EXECUTIVE SUMMARY

The 2020 update to the Fulton 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 and 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 Fulton 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, Fulton County and inclusive jurisdictions actively participated in updating the Fulton County HMP. Extensive outreach efforts by Fulton County's Planning & Mapping Department resulted in participation from 12 of its municipalities. Valley-Hi Borough was the only jurisdiction that did not participate. Upon completion and approval of the HMP, participating jurisdictions will continue to address and implement findings and recommendations of this plan update. This 2020 version is the third update of the County HMP, with the original HMP developed in 2004.

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

Table ES-1. Participating Jurisdictions in the 2020 Fulton County HMP Update

Jurisdictions				
• Fulton County	• Bethel Township	• Licking Creek Township	• Thompson Township	• Wells Township
• Ayr Township	• Brush Creek Township	• McConnellsburg Borough	• Todd Township	
• Belfast Township	• Dublin Township	• Taylor Township	• Union Township	

During the plan update process, Fulton County and its 12 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 vulnerabilities of the county and each municipality 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 two Steering Committee meetings that were open to the public, during which residents could provide input on the HMP.

The following hazards were identified by the Steering Committee as presenting the highest risk to the county and its municipalities:

- Flood, Flash Flood, and Ice Jam
- Winter Storm

- Transportation Accidents
- Environmental Hazards
- Drought

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

- Dam Failure
- Earthquake
- Tornado, Windstorm
- Subsidence and Sinkholes
- Radon Exposure
- Wildfire
- Hailstorm
- Landslide

To mitigate the effects of the above hazards, the Steering Committee identified the following goals for hazard mitigation over the next 5 years:

1. **Goal 1:** Protect the people, property, and environment in hazard areas.
2. **Goal 2:** Prevent hazards from impacting the community.
3. **Goal 3:** Enhance awareness, understanding, and preparedness among local, county, state, and federal emergency management personnel to protect public health and safety.
4. **Goal 4:** Ensure that stakeholder groups have necessary information to mitigate against hazard impacts.

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

Additionally, Steering Committee 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 Fulton County Hazard Mitigation Plan 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 the Fulton County Planning & Mapping Department. Contact information is provided below:

Mailing Address:	Hazard Mitigation Plan Steering Committee c/o Fulton County Planning Commission 219 North 2nd Street, Suite 102 McConnellsburg, PA 17233
Contact Name:	Mary K. Seville, Planning & Mapping Director
E-mail Address:	mkseville@co.fulton.pa.us
Telephone:	(717) 485-3717

CERTIFICATION OF ANNUAL REVIEW MEETINGS

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

Year	Date of Meeting	Public Outreach Addressed?*	Signature
2015	N/A	N/A	To the best of the knowledge of the Fulton County Steering Committee, no HMP progress reports were submitted from municipalities for 2015
2016	December 5, 2016	N/A	
2017	December 4, 2017	N/A	
2018	December 3, 2018	N/A	
2019	Fulton County engaged in a full update of the HMP during 2019-2020.		
2020			
2021			
2022			
2023			
2024			

** 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)
2015	To the best of the knowledge of the Fulton County Steering Committee, no HMP progress reports were submitted from municipalities for 2015	N/A	N/A
2016	Updated hazard events. Added a mitigation action. Updated the status of mitigation actions.	N/A	N/A
2017	Updated hazard events. Updated the status of mitigation actions.	N/A	N/A
2018	Updated hazard events. Updated the status and wording of mitigation actions.	N/A	N/A

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

Section **Page**

APPENDICES

SECTION 1 INTRODUCTION

This section presents background information, describes the purpose, and defines the scope of the 2020 update of the Fulton County Hazard Mitigation Plan (HMP).

1.1 BACKGROUND

Across the United States, natural and human-caused disasters have led to increasing levels 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.

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

"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 measures taken to reduce the risk of loss.

The Fulton County Hazard Mitigation Steering Committee (composed of Fulton County officials, municipal representatives, and emergency responders) has updated this HMP. Fulton County contracted Tetra Tech, Inc. (Tetra Tech) to prepare the 2020 HMP update.

The HMP update is the result of several months of collaboration between the citizens and officials of the 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 each 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 Fulton County. This document exists to provide the background information and rationale for the mitigation actions that the Steering Committee 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 the 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 outlined within this HMP apply to Fulton County and any municipalities within the county that adopt this plan. Only those municipalities that have participated in the plan update process may adopt this plan and will be eligible for state and federal hazard mitigation funding. Municipal participation was defined as providing information (e.g., via completion and submission of an Evaluation of Identified Hazards Worksheet, Capability Assessment Survey, NFIP Survey, Mitigation Strategy 5-Year Plan Review Worksheet, and/or Municipal Risk Factor Analysis) and participation by an official municipal representative at a planning meeting or in individual outreach.

1.4 AUTHORITY AND REFERENCE

This HMP was prepared in accordance with the following regulations and guidance:

- 44 CFR Parts 201 and 206 (including February. 26, 2002; October. 1, 2002; October. 28, 2003; and Sept. 13, 2004 Interim Final Rules)
- DMA 2000 (Public Law 106-390), October 30, 2000
- FEMA "Plan Integration: Linking Local Planning Efforts," July 2015
- FEMA "Local Mitigation Planning Handbook," March 2013
- FEMA "Integrating Hazard Mitigation into Local Planning," March 1, 2013
- FEMA "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards," January 2013
- FEMA "Local Mitigation Plan Review Guide," October 1, 2011
- FEMA "How-To Guide for Using HAZUS-MH for Risk Assessment" (Document No. 433), February 2004
- FEMA Mitigation Planning How-To Series (FEMA 386-1 through 4), 2002
  Available on-line at: http://www.fema.gov/fima/planhowto.shtm.
- Commonwealth of Pennsylvania's All-Hazard Mitigation Planning Standard Operating Guide, October 18, 2013

A full set of references used in updating the HMP is included in Appendix A.

SECTION 2 COUNTY PROFILE

Section 2 of the Fulton County Hazard Mitigation Plan (HMP) discusses the geography and environment, community facts, population and demographics, and land use and development in Fulton County.

2.1 GEOGRAPHY AND ENVIRONMENT

Fulton County is located in south-central Pennsylvania (The County has a rich historical background dating back to pre-Revolutionary days. Because of its Mason-Dixon Line location, Fulton County played a significant role during the Civil War. According to the U.S. Census Bureau's 2016 County Business Patterns, key industries in Fulton County include: other services (except public administration), retail trade, construction, health care and social assistance, transportation and warehousing, and accommodation and food services (U.S. Census Bureau 2018). Agriculture is also a main industry within Fulton County.

Figure 2-1) and encompasses approximately 438 square miles. The County is bordered to the north by Huntingdon County, to the east by Franklin County, to the south by Allegany and Washington Counties (Maryland), and to the west by Bedford County. It is one of the smallest counties in the Commonwealth of Pennsylvania.

Fulton County has a scenic landscape characterized by numerous high ridges separating narrow valleys. These valleys are fertile and productive enough to support the primarily rural lifestyle of the county's residents. Over 68 percent of the land area is forestland. Several of the large streams within the county flow southward into Maryland and drain into the Potomac River. The streams in the western and northern parts of the county are tributaries of the Juniata River.

2.2 COMMUNITY FACTS

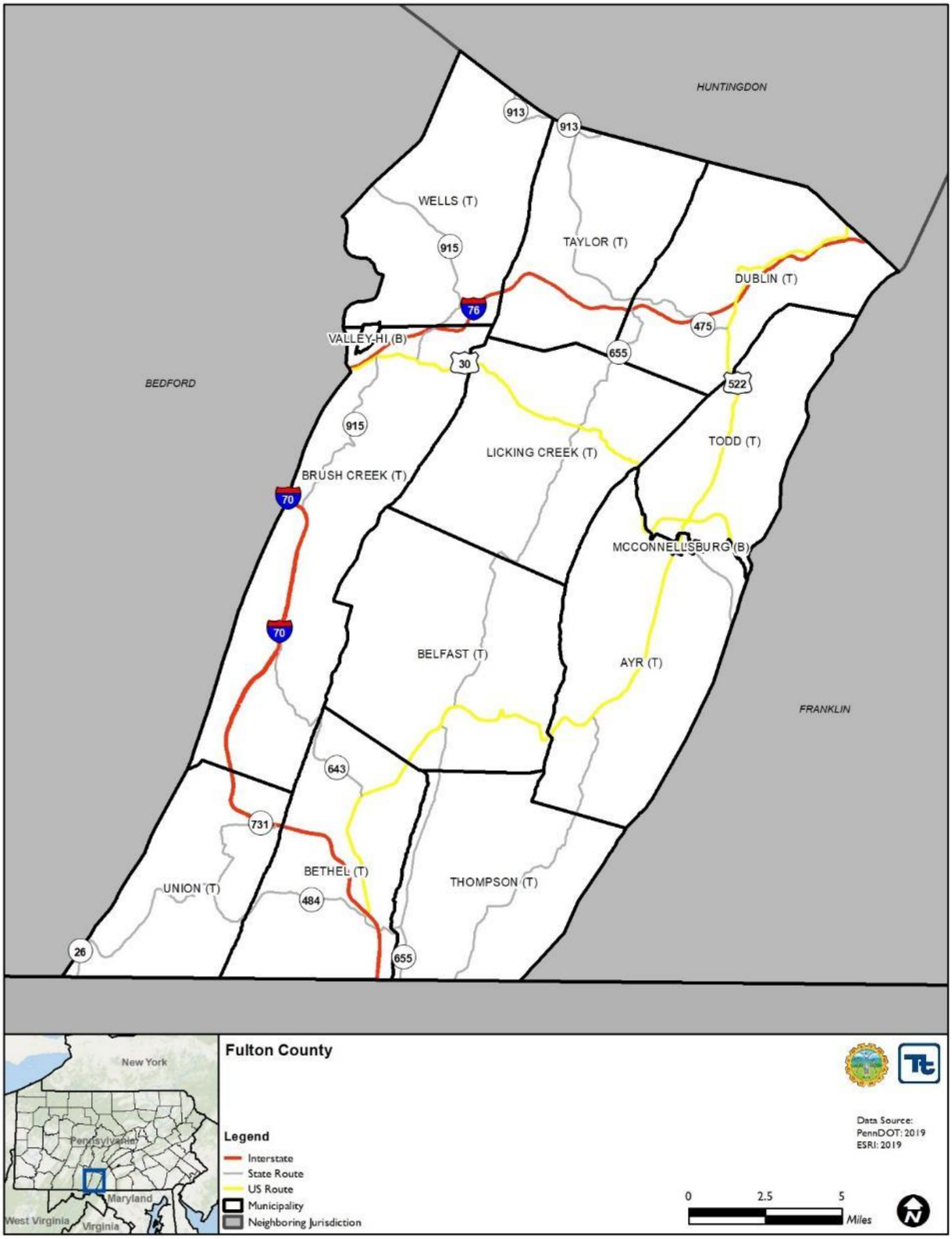
Fulton County was created on April 19, 1850, from a portion of Bedford County. It is named after Robert Fulton, the inventor who pioneered the use of the steamboat. It consists of 13 municipalities; specifically, 11 townships and 2 boroughs. The County seat is McConnellsburg. The County has an estimated population of 14,631 (U.S. Census Bureau 2018).

Fulton County has an extensive transportation network of roads, with 20 miles each of turnpike and interstate highways, 368.4 miles of State and federal highways, and 231.5 miles of secondary and municipal roads. The major routes are US-522, US-30, PA-16, Interstate (I)-70, and the Pennsylvania Turnpike (I-76).

McConnellsburg Borough has remained the population center and the industrial and commercial nucleus of Fulton County. Several larger population centers are located just outside of Fulton County: the City of Altoona, located approximately 70 miles north; the City of Harrisburg, located approximately 90 miles northeast; the City of Hagerstown (Maryland), located approximately 45 miles southeast; Pittsburgh, located approximately 135 miles to the west; and Johnstown, located approximately 75 miles northwest.

The County has a rich historical background dating back to pre-Revolutionary days. Because of its Mason-Dixon Line location, Fulton County played a significant role during the Civil War. According to the U.S. Census Bureau's 2016 County Business Patterns, key industries in Fulton County include: other services (except public administration), retail trade, construction, health care and social assistance, transportation and warehousing, and accommodation and food services (U.S. Census Bureau 2018). Agriculture is also a main industry within Fulton County.

Figure 2-1. Base Map of Fulton County



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. According to the 2010 U.S. Census, Fulton County had a population of 14,845, which represents a 4 percent increase from the 2000 U.S. Census population of 14,261. Table 2-1 presents the population statistics for Fulton County based on the 2000 and 2010 U.S. Census, and 2013-2017 American Community Survey 5-Year estimates (the most current available) data. Table 2-2 provides details regarding the demographics for Fulton County.

Table 2-1. Fulton County Population Statistics

Municipality	2000 Census	2010 Census	2013-2017 5-Year ACS Estimate	Population Change 2000-2017	Population Change 2000-2017 (%)	Population Density Per Square Mile
Ayr Township	1,982	1,942	2,151	169	8.53%	42.00
Belfast Township	1,341	1,448	1,347	6	0.45%	28.90
Bethel Township	1,420	1,508	1,570	150	10.56%	40.7
Brush Creek Township	730	819	748	18	2.47%	15.1
Dublin Township	1,277	1,264	1,317	40	3.13%	34.2
Licking Creek Township	1,532	1,703	1,557	25	1.63%	38.10
McConnellsburg Borough	1,073	1,220	1,037	-36	-3.36%	3,393.90
Taylor Township	1,237	1,118	907	-330	-26.68%	34.3
Thompson Township	998	1,098	1,094	96	9.62%	29.00
Todd Township	1,488	1,527	1,728	240	16.13%	52.8
Union Township	634	706	722	88	13.88%	23.1
Valley-Hi Borough*	20	15	0	-20	-100.00%	29.80
Wells Township	529	477	453	-76	-14.37%	12.8
Fulton County	**14,261**	**14,845**	**14,631**	**370**	**2.59%**	**33.9**

Sources: U.S. Census Bureau 2000, 2010, and 2018

* *Valley-Hi has a low population and therefore American Community Survey (ACS) data may be skewed because of the sampling techniques used for ACS data collection.*

Table 2-2. Demographics for Fulton County

Demographics	2000 Census	2010 Census	2013-2017 5-Year ACS Estimate
Total population	14,261	14,845	14,631
Male	7,133	7,471	7,376
Female	7,128	7,374	7,255
Median age (years)	38.2	41.8	44.6
Under 5 years	898	916	759
18 years and over	10,754	11,414	3,075
65 years and over	2,068	2,544	2,945
Total Households	5,660	6,014	6,014
Group quarters population	102	122	38

Source: U.S. Census Bureau 2000, 2010, and 2018

As shown in the tables above, Fulton County's 2010 Census population was 14,845. Based on these data, the population density of Fulton County is 33.9 persons per square mile, which is considerably lower than the Pennsylvania statewide average of 284 persons per square mile. The Borough of McConnellsburg has the highest population density all the municipalities in the county (3,393.90persons per square mile of land area) (U.S. Census 2010). A majority of the municipalities in Fulton County have population densities below the statewide average. However, many municipalities in the county have low population density, meaning that people are spread throughout the county rather than clustered in groups. Dispersing information, instructions, and resources during a disaster response effort to residents in low-density areas is more difficult than in more densely populated areas because individuals are not centralized. Fulton County 2010 population density data is illustrated on Figure 2-2.

While low-density areas provide challenges to disseminating hazard mitigation information, a low population density also means that hazards will not affect 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.

The Disaster Mitigation Act of 2000 (DMA 2000) requires that HMPs consider socially vulnerable populations. These populations can be more susceptible to hazard events 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. For the purposes of this study, vulnerable populations shall include (1) the elderly and younger populations (persons aged 65 and over; persons aged 5 and younger) and (2) those living in low-income households.

Approximately 17.1 percent of the county's total population is aged 65 and older. Older residents may have access and functional needs. For example, many may be unable to drive; therefore, special evacuation plans may be necessary. They may also have hearing or vision impairments that could make receiving emergency instructions difficult. Additionally, 6.1 percent of the county's total population is under the age of 5 years. Both older and younger populations have higher risks for contracting certain diseases. The County's combined population under 5 years of age and over 65 years represent approximately 23.2 percent of its total population.

Figure 2-3 and Figure 2-4 show the number of these populations by municipality. It should be noted that these two population figures are reported by municipality because American Community Survey data is not available at the Census Block level; therefore, for more concise reporting of population, the municipal level of data was used to report Population Over 65 Years of Age and Population Under 5 Years of Age.

Figure 2-2. Fulton County 2010 Population Distribution

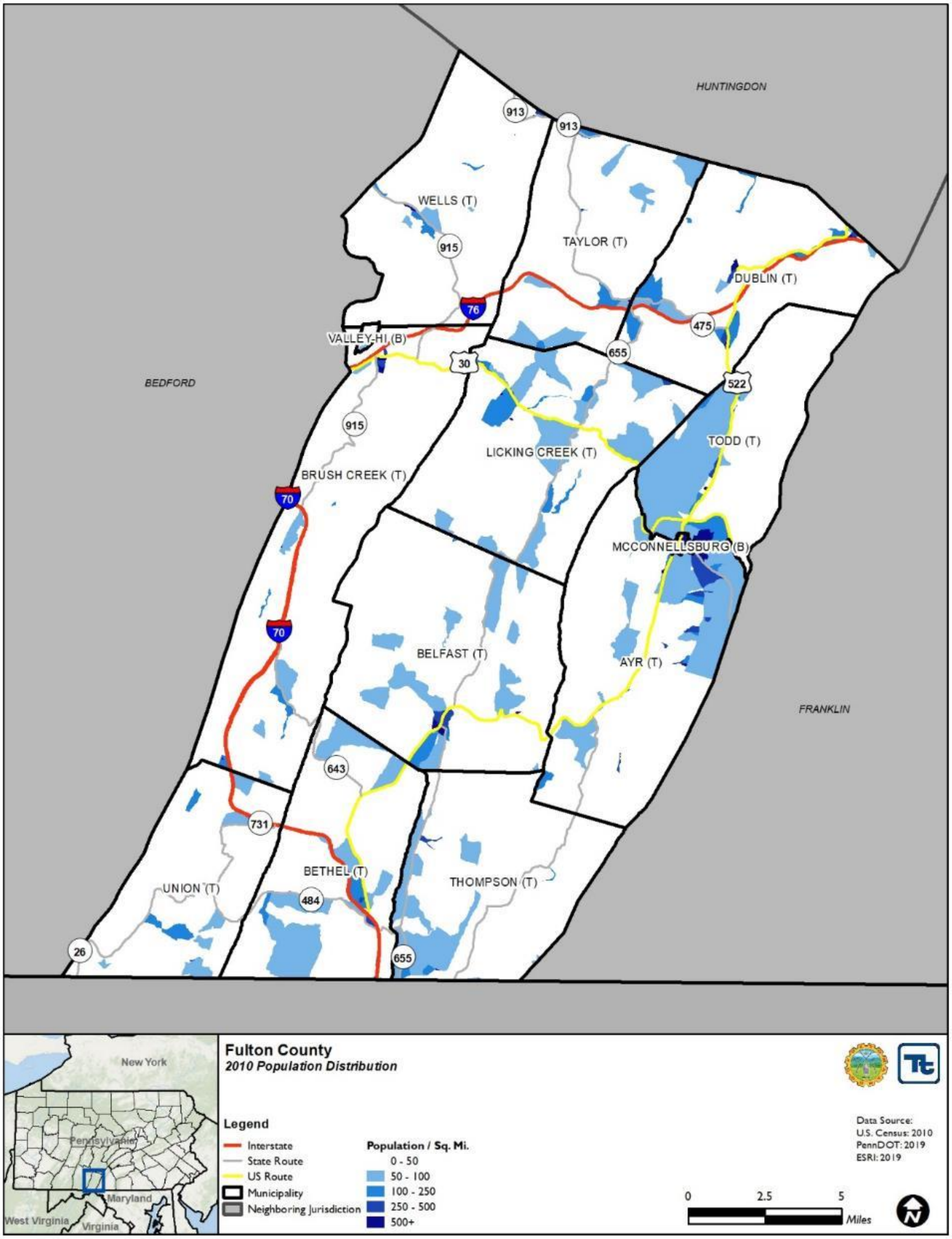


Figure 2-3. Fulton County Population Over 65 Years of Age

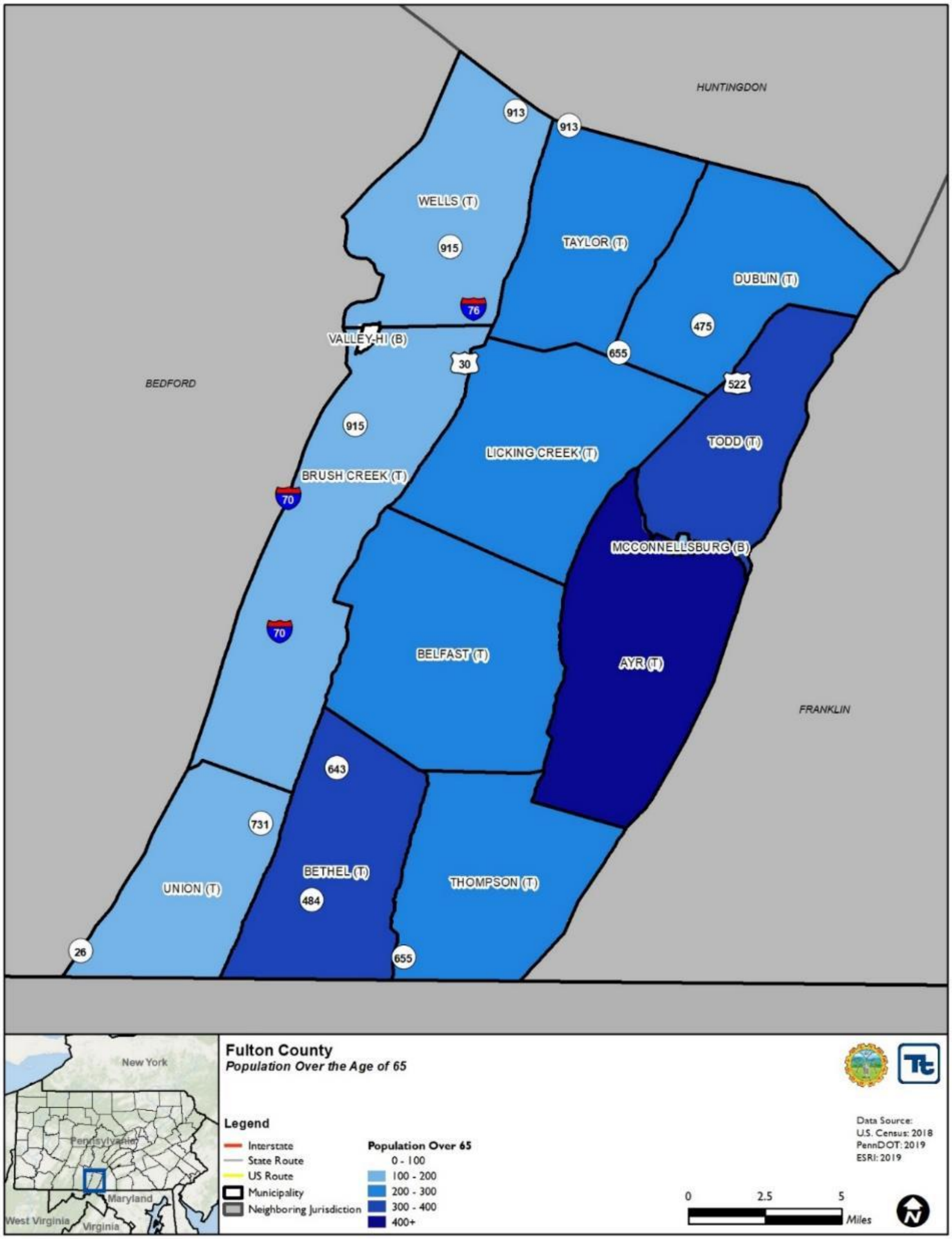
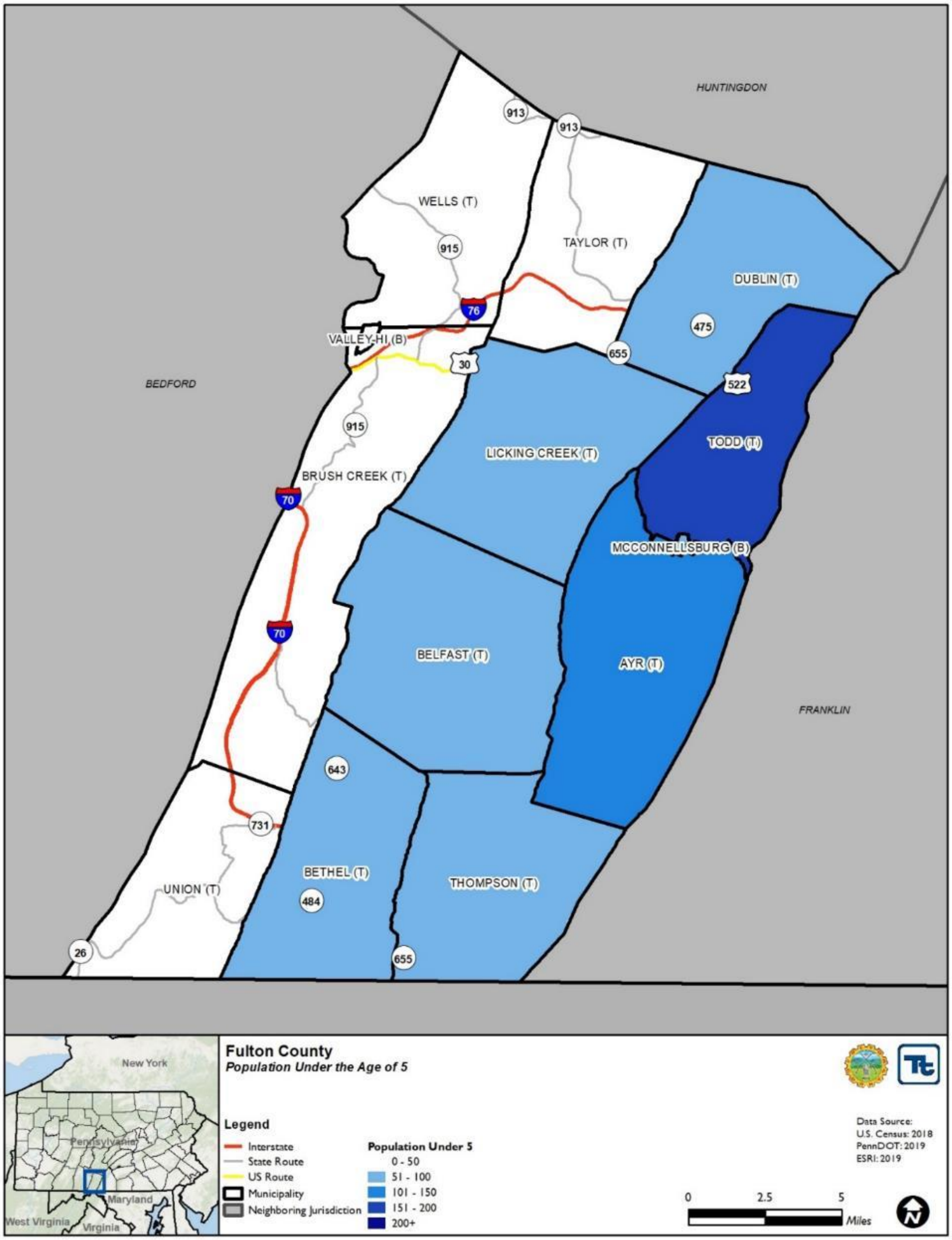


Figure 2-4. Fulton County Population Under 5 Years of Age



Only 0.8 percent of Fulton County's population lives in group quarters. 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 quarter facility has its own emergency plan to account for the unique needs of its residents during a hazard event.

Table 2-3 provides population estimates and projections for each municipality in Fulton County and for the county as a whole. The population of the entire County is estimated to be 16,573 by the year 2040, which represents a net population increase of 1,728 people in a 30-year period. As shown in the table below, approximately half of the municipalities in Fulton County are projected to see an increase in population. The table also shows that four municipalities are projected to see a decrease in population. It should be noted that changes in population or demographics may be used to identify higher-risk populations. Maintaining up-to-date data on demographics will allow Fulton County to better assess magnitudes of hazards and develop more specific mitigation plans and strategies.

Table 2-3. Fulton County Population Projections by Municipality

Municipality	2000 Census	2010 Census	Population Change 2000-2010 (%)	2020 Projection	2030 Projection	2040 Projection	Projected Population Change 2010-2040 (%)
Ayr Township	1,982	1,942	-2.02%	1,819	1,744	1,641	-15.50%
Belfast Township	1,341	1,448	7.98%	1,570	1,683	1,801	24.38%
Bethel Township	1,420	1,508	6.20%	1,605	1,696	1,791	18.77%
Brush Creek Township	730	819	12.19%	907	995	1,084	32.36%
Dublin Township	1,277	1,264	-1.02%	1,333	1,356	1,405	11.16%
Licking Creek Township	1,532	1,703	11.16%	1,846	2,005	2,155	26.54%
McConnellsburg Borough	1,073	1,220	13.70%	1,264	1,367	1,436	17.70%
Taylor Township	1,237	1,118	-9.62%	1,104	1,030	991	-11.36%
Thompson Township	998	1,098	10.02%	1,112	1,176	1,211	10.29%
Todd Township	1,488	1,527	2.62%	1,575	1,853	1,830	19.84%
Union Township	634	706	11.36%	743	800	846	19.83%
Valley-Hi Borough*	20	15	-25.00%	14	12	11	-26.67%
Wells Township	529	477	-9.83%	446	406	371	-22.22%
Fulton County	**14,261**	**14,845**	**4.10%**	**15,338**	**16,123**	**16,573**	**11.64%**

Sources: U.S. Census 2000, 2010, and 2018

According to the 2013-2017 American Community Survey, 1.8 percent of the county's population speaks a language other than English with 0.3 percent of the population speaking 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 2-4 summarizes race and ethnicity population information for Fulton County.

Table 2-4. Race and Ethnicity in Fulton County

Race and Ethnicity	2010	% of Population	2016	% of Population
One race	14,691	99%	14,523	99.3%
White	14,450	97.3%	14,191	97.0%
Black or African American	151	1.0%	234	1.6%

Race and Ethnicity	2010	% of Population	2016	% of Population
American Indian and Alaska Native	28	0.2%	37	0.3%
Asian	19	0.1%	34	0.2%
Native Hawaiian and Other Pacific Islander	1	0.0%	24	0.0%
Some other race	42	0.3%	11	0.1%
Two or more races	154	1.0%	108	0.7%
Foreign born	N/A	N/A	N/A	N/A
Speak a language other than English	166	1.2%	208	1.5%
Hispanic or Latino	110	0.7%	174	1.2%

Source: U.S. Census Bureau 2010, 2018

Fulton County has 7,208 housing units. These properties may be vulnerable to various natural hazards, particularly those located in defined hazard areas. Damage to residential properties is not only costly to repair or rebuild, but devastating to the displaced residents.

According to the U.S. Census, approximately 17.5 percent of the county's residential properties are vacant and most of these units are available for rent. Vacant buildings are particularly vulnerable to arson and criminal activity. Because vacant properties are not inhabited year-round or may not be adequately maintained, many are structurally deficient and at risk of collapse.

Approximately 21.5 percent of the county's population live in rented homes. Because renters are more transient than homeowners, communicating with renters may be more difficult than communicating with homeowners. Similarly, communications with tourists would be harder during an emergency event. Communication strategies should be developed to ensure that these populations receive proper notifications.

Table 2-5 summarizes characteristics of the residential properties in Fulton County.

Table 2-5. Housing Characteristics in Fulton County

Housing Characteristics	2010	2017
Total housing units	7,122	7,208
Owner-occupied housing units	4,617	4,670
Renter-occupied housing units	1,397	1,277
Vacant housing units	1,102	1,261
Median value (dollars)	$157,500	$156,000
Housing units with a mortgage	2,457	2,305
Housing units without a mortgage	2,160	2,365

Source: U.S. Census Bureau 2010, 2011, 2018

In 2017 (the most current data available), the median household income in the county was $50,007, which was lower than the Commonwealth of Pennsylvania's estimated median household income ($56,951). The County's 2017 estimated per capita income of $25,273 was lower than the Commonwealth's 2017 estimated per capita income of $31,476. Approximately 8.3 percent of family incomes in Fulton County were below poverty level, and 11.5 percent of individual incomes were below poverty level. Emergency responders may have difficulty connecting with individuals within this economic bracket for several reasons, including less access to the Internet. Additionally, some low-income families and individuals may not own vehicles, and therefore could be more vulnerable during an evacuation. Table 2-6 summarizes economic characteristics of Fulton County's population.

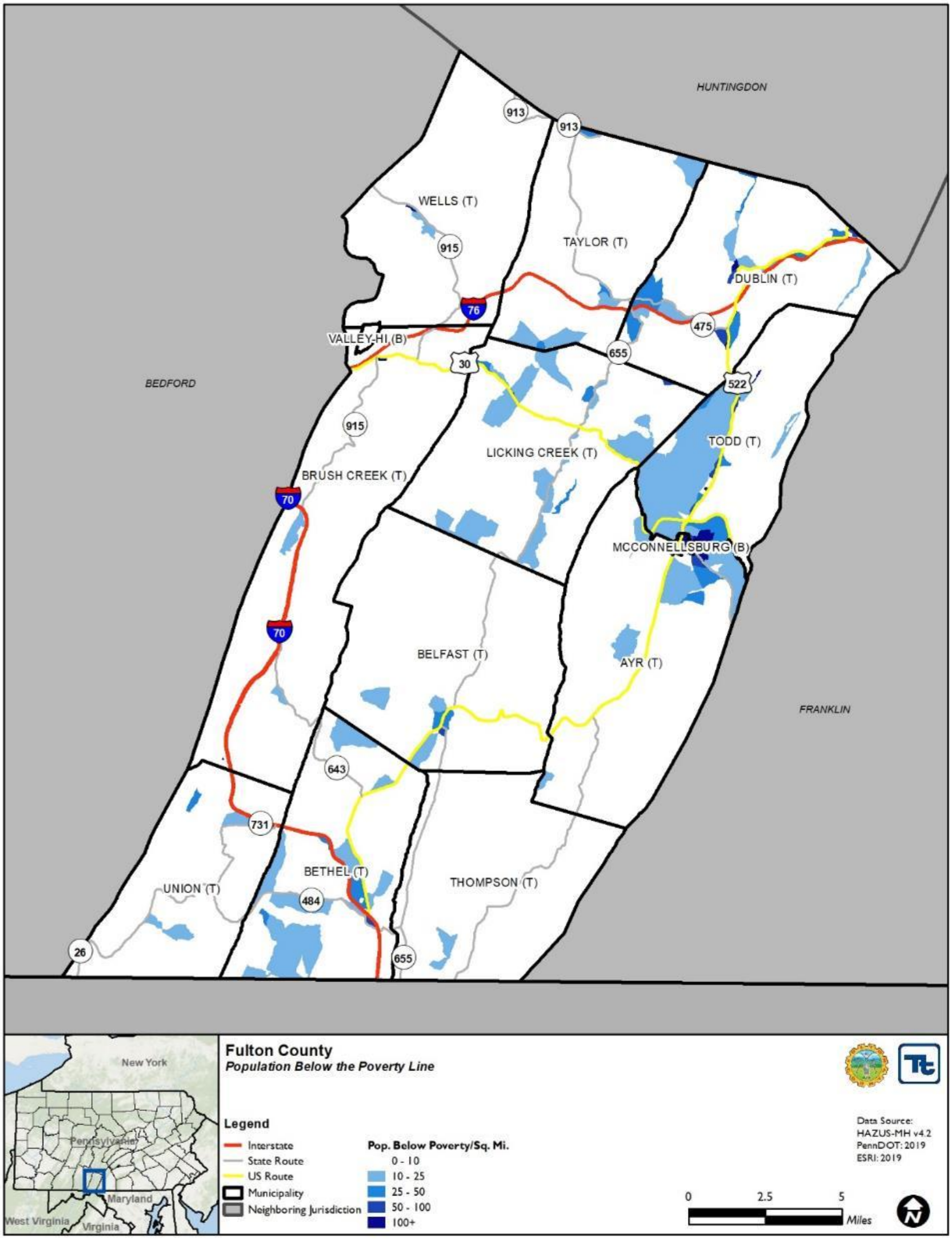
Table 2-6. Economic Characteristics in Fulton County

Economic Characteristics	2010 Census	2017 Estimates
Median household income	$45,240	$50,007
Median family income	$54,946	$61,448
Per capita income	$21,729	$25,373
Families with income below the poverty level	8.8%	8.3%
Individuals with income below the poverty level	13.3%	11.5%

Source: U.S. Census Bureau 2011, 2018

Figure 2-5 illustrates population distribution for residents with incomes below the poverty level.

Figure 2-5. Fulton County Population Below the Poverty Level



2.4 LAND USE AND DEVELOPMENT

Fulton 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 Fulton County. These systems include the Pennsylvania Turnpike, I-70, US Route 30, and US Route 522. In addition, Fulton County is in proximity to the juncture of I-70 and I-68 in Maryland. These transportation systems have greatly contributed to Fulton County's accessibility and land development patterns. Of the county's total land area of 438 square miles, approximately 95 percent is classified as agricultural or forested land and approximately 5 percent is considered developed.

McConnellsburg Borough has remained the population center and the industrial and commercial nucleus of Fulton County. Consequently, a natural pattern of development has occurred as a concentric ring of growth has expanded outward from the Borough into the neighboring rural townships.

Fulton County's commercial and industrial land development patterns are largely influenced by the transportation network and availability of public sewer services. As a result, future growth in the county is expected to occur in five distinct geographic areas: (1) McConnellsburg, (2) Warfordsburg, (3) Hustontown, (4) Fort Littleton, and (5) Crystal Spring.

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

Fulton County residents have expressed concern that the county's rural character is being jeopardized as its agricultural lands are slowly being converted to areas of low-density, scattered residential development. While still a concern, residential development growth has slowed since this trend has been noted. From 2010 to 2017, U.S. Census records showed an increase in housing units (1.2 percent) that was slightly outpaced by the county's population growth (2.59 percent). This contrasts from the 2000 to 2010 comparison, which showed a housing unit growth of 4.9 percent, compared to a County population growth of only 4.1 percent.

Land use regulations are not prevalent in Fulton County. For example, Fulton County does not have a County zoning ordinance nor a subdivision and land development ordinance. In addition, of the 13 municipalities, only McConnellsburg Borough has adopted a zoning ordinance. Moreover, municipal subdivision and land development ordinances lack the regulations necessary to support the preservation of the county's existing rural character.

Agricultural use of land is in long-term decline. According to the U.S. Department of Agriculture, 63 farms and 3,051 farmland acres were lost between 2007 and 2017. Approximately 145 acres of farmland from 2 farms are enrolled in the agricultural easement program within Fulton County (Pennsylvania Land Trust Association no date). Fulton County identified actions to increase the agriculture industry, including increasing representation of agriculture on the county economic development agency, actively recruiting additional businesses or facilities to the county, increasing public awareness of the role agriculture plays in the county's economy, and collaborating with lenders to offer low-interest loans to farmers (Southern Alleghenies Regional Planning Commission 2018)

Access management is an increasing concern as residential land development patterns continue to develop in a linear fashion along local roadways (e.g., US-522) and each property obtains an individual highway occupancy permit from the Pennsylvania Department of Transportation (PennDOT). Fulton County has developed a growth management survey to help monitor and guide County growth and development in a way to ensure compliance with overall County land use goals. Figure 2-6 provides visual representations of current County land use and predicted growth patterns.

Figure 2-6. Fulton County Land Use and Land Cover

As displayed in Figure 2-7 through Figure 2-12, the county has identified six geographic hazards and growth areas inside its borders. All six of the identified growth areas are located within the Federal Emergency Management Agency (FEMA) flood hazard zone, the subsidence hazard area, and the environmental hazard area. Growth Area A, however, is the only area located within both the 0.25-mile buffer of a major road and 0.10-mile buffer of a Superfund Amendments and Reauthorization Act (SARA) Title III facility. Growth Areas A, B, and F are located above limestone formations in the subsidence and sinkhole hazard area. The County has noted the location of these hazards in relation to the growth areas to ensure that the planning and development officials considers these factors. Additionally, the county intends to discourage development within (1) vulnerable areas, areas with high population density, and the Special Flood Hazard Area (SFHA); or (2) encourage higher regulatory standards at the local level.

Figure 2-7. Fulton County Growth Area A and Hazard Areas

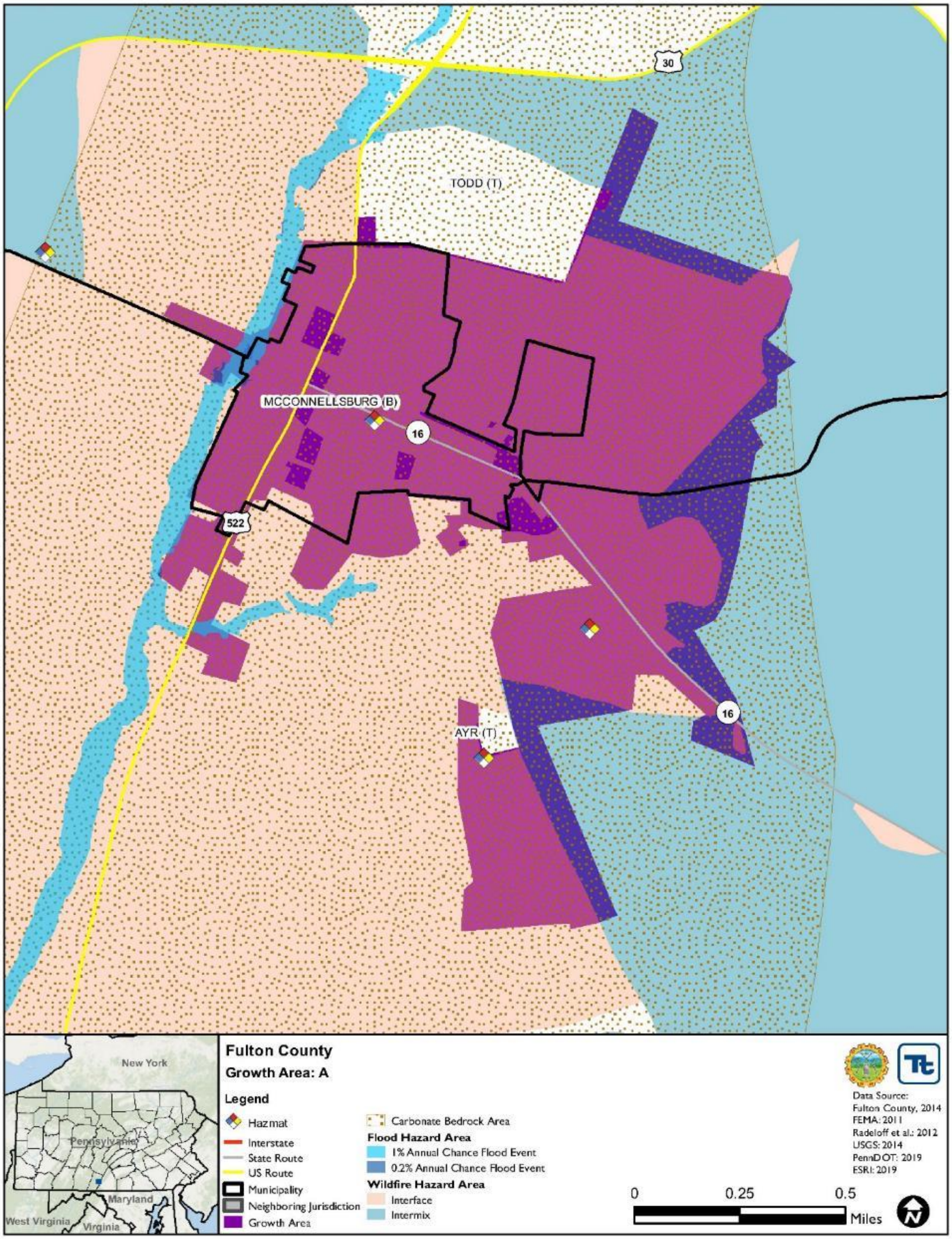


Figure 2-8. Fulton County Growth Area B and Hazard Areas

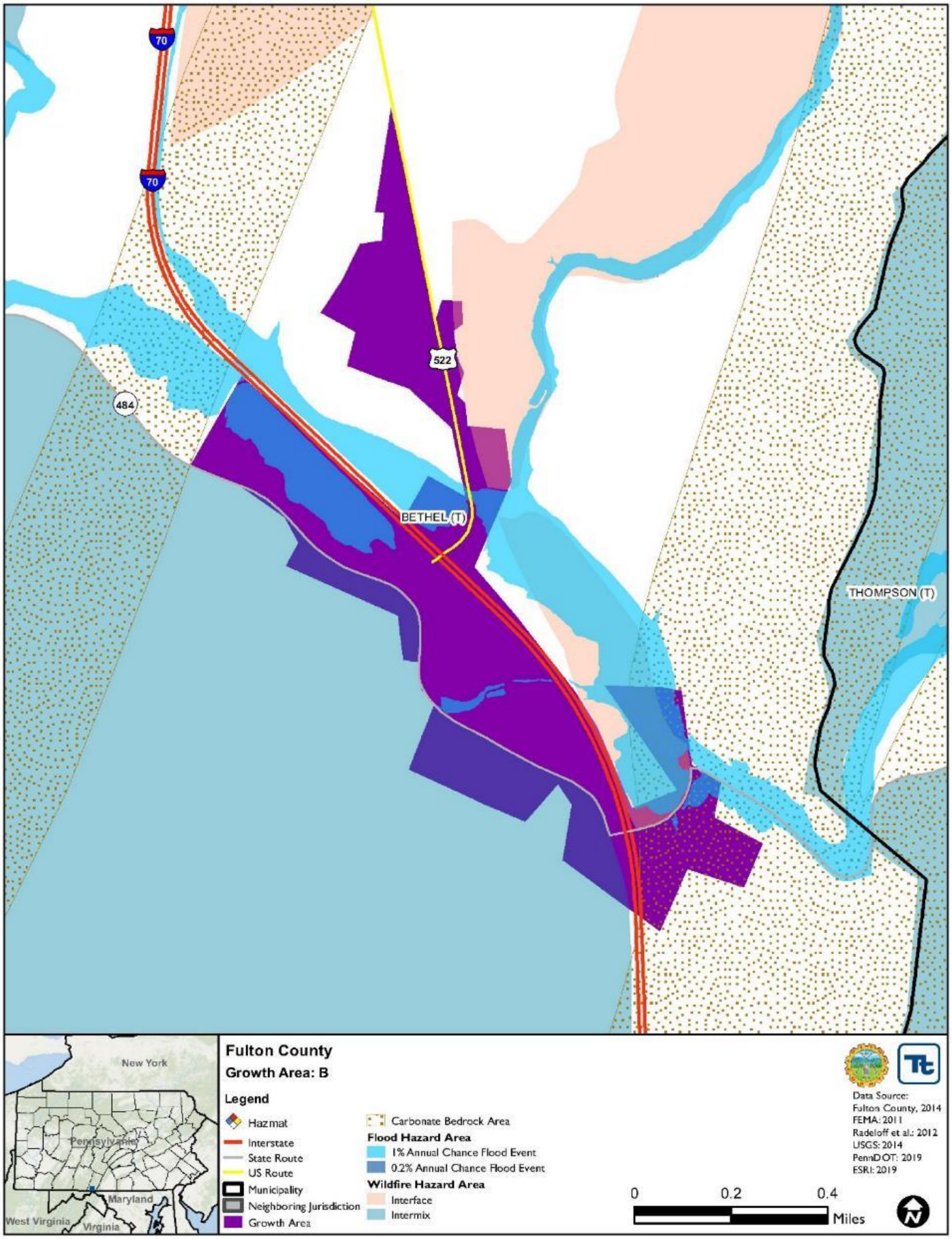


Figure 2-9. Fulton County Growth Area C and Hazard Areas

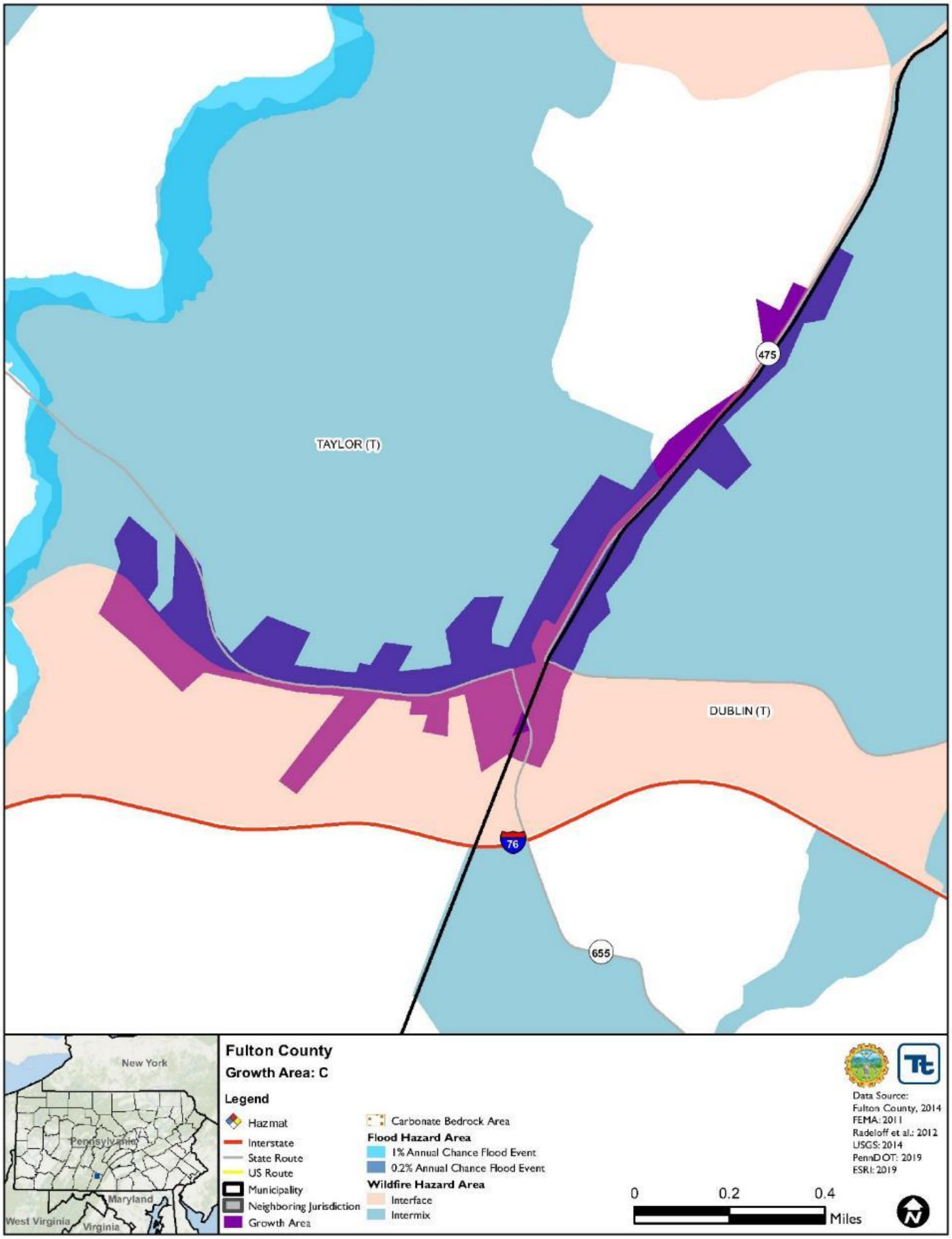


Figure 2-10. Fulton County Growth Area D and Hazard Areas

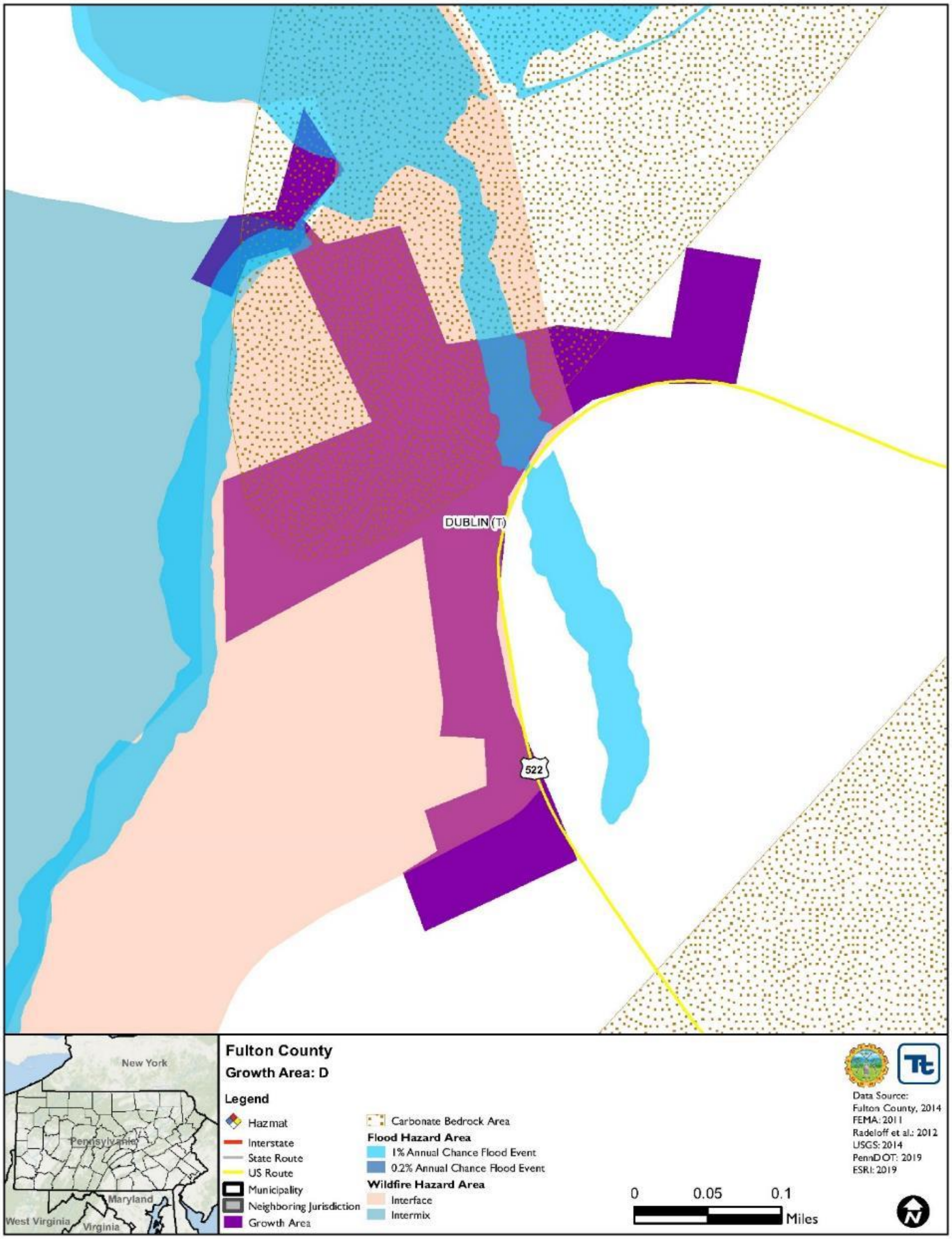


Figure 2-11. Fulton County Growth Area E and Hazard Areas

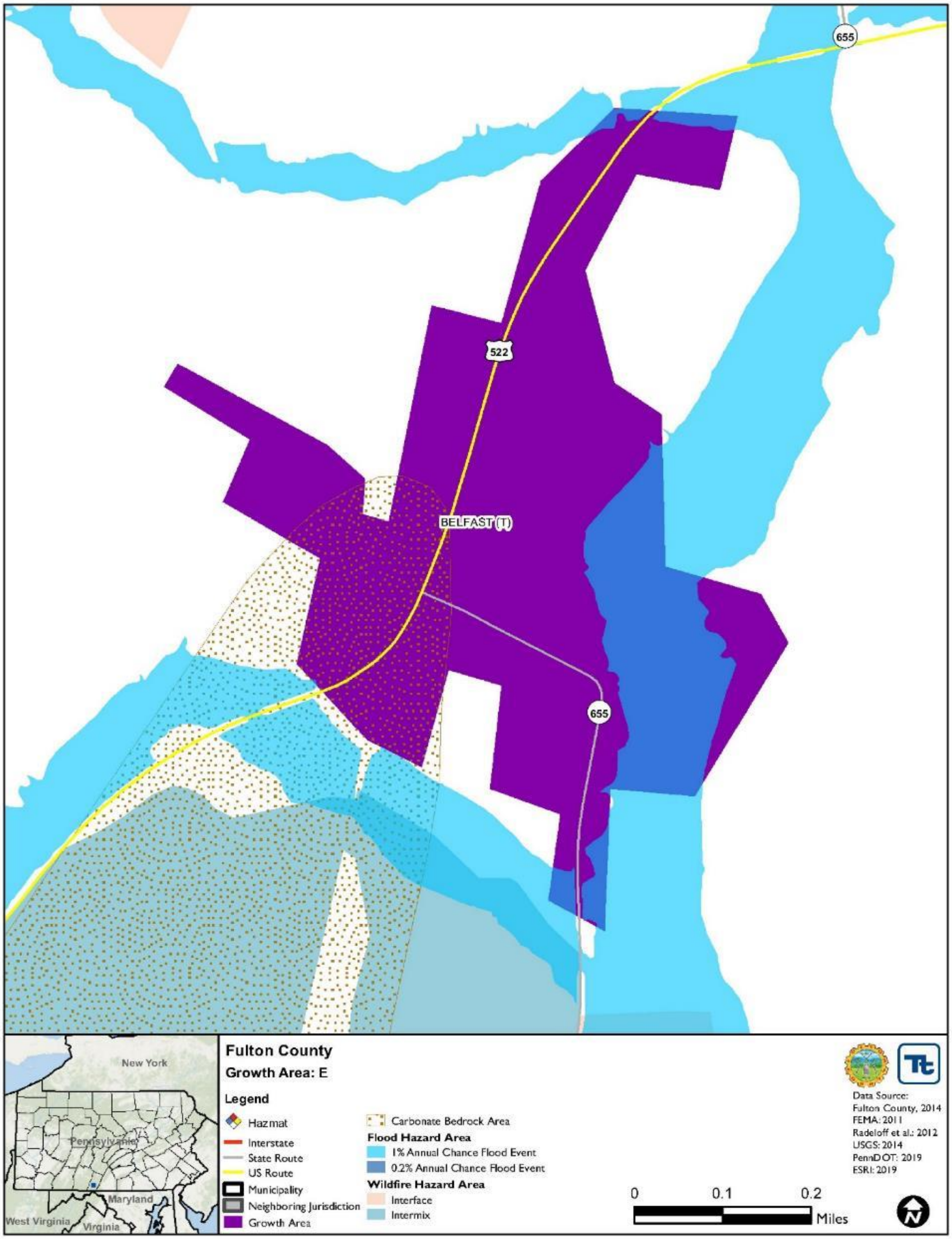
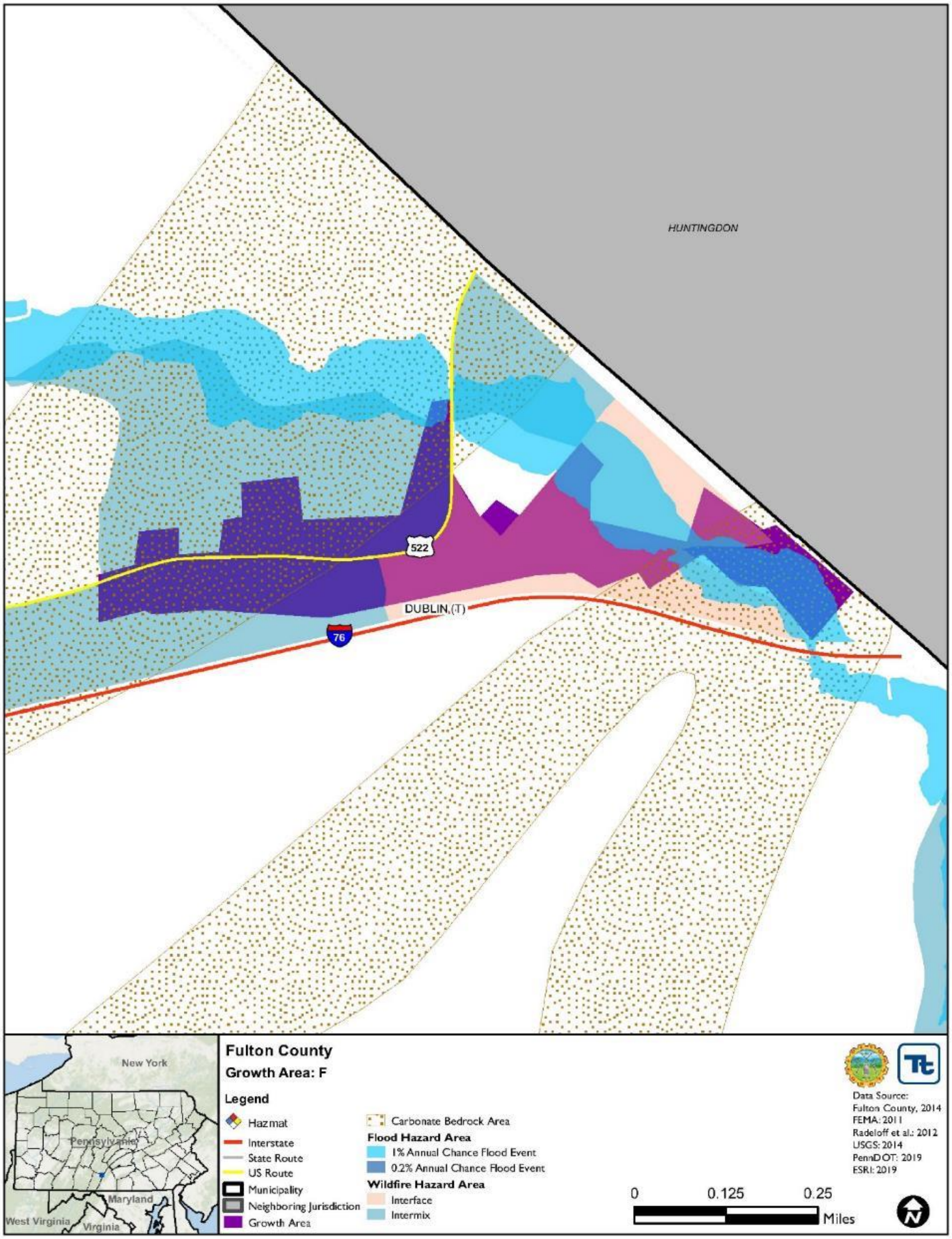


Figure 2-12. Fulton County Growth Area F and Hazard Areas



2.5 DATA SOURCES AND LIMITATIONS

The County Profile section of this HMP was developed with information from the following sources:

1. Comprehensive Plan for the Southern Alleghenies Region (Southern Alleghenies Regional Planning Commission, 2018).
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8. United States Department of Agriculture. 2019. 2017 Census of Agriculture: Fulton County, Pennsylvania County Profile.
9. Pennsylvania Land Trust Association. Accessed 2019. "Fulton County Agricultural Land Preservation Board."

Data sources used to develop the HMP in general are listed in Section 1.4. Data sources used to perform geographic information system (GIS) analysis for the risk assessment are listed in Section 4.1. These sources were key in understanding the current demographic makeup of the C as well as in framing the foundation of the Plan. The sources listed provided the underlying context of the HMP and allowed the Steering Committee to understand critical vulnerabilities in the county. Throughout the course of the planning process, the Steering Committee continually sought additional data sources to augment the information included in the Plan.

SECTION 2 COUNTY PROFILE

Section 2 of the Fulton County Hazard Mitigation Plan (HMP) discusses the geography and environment, community facts, population and demographics, and land use and development in Fulton County.

2.1 GEOGRAPHY AND ENVIRONMENT

Fulton County is located in south-central Pennsylvania (The County has a rich historical background dating back to pre-Revolutionary days. Because of its Mason-Dixon Line location, Fulton County played a significant role during the Civil War. According to the U.S. Census Bureau's 2016 County Business Patterns, key industries in Fulton County include: other services (except public administration), retail trade, construction, health care and social assistance, transportation and warehousing, and accommodation and food services (U.S. Census Bureau 2018). Agriculture is also a main industry within Fulton County.

Figure 2-1) and encompasses approximately 438 square miles. The County is bordered to the north by Huntingdon County, to the east by Franklin County, to the south by Allegany and Washington Counties (Maryland), and to the west by Bedford County. It is one of the smallest counties in the Commonwealth of Pennsylvania.

Fulton County has a scenic landscape characterized by numerous high ridges separating narrow valleys. These valleys are fertile and productive enough to support the primarily rural lifestyle of the county's residents. Over 68 percent of the land area is forestland. Several of the large streams within the county flow southward into Maryland and drain into the Potomac River. The streams in the western and northern parts of the county are tributaries of the Juniata River.

2.2 COMMUNITY FACTS

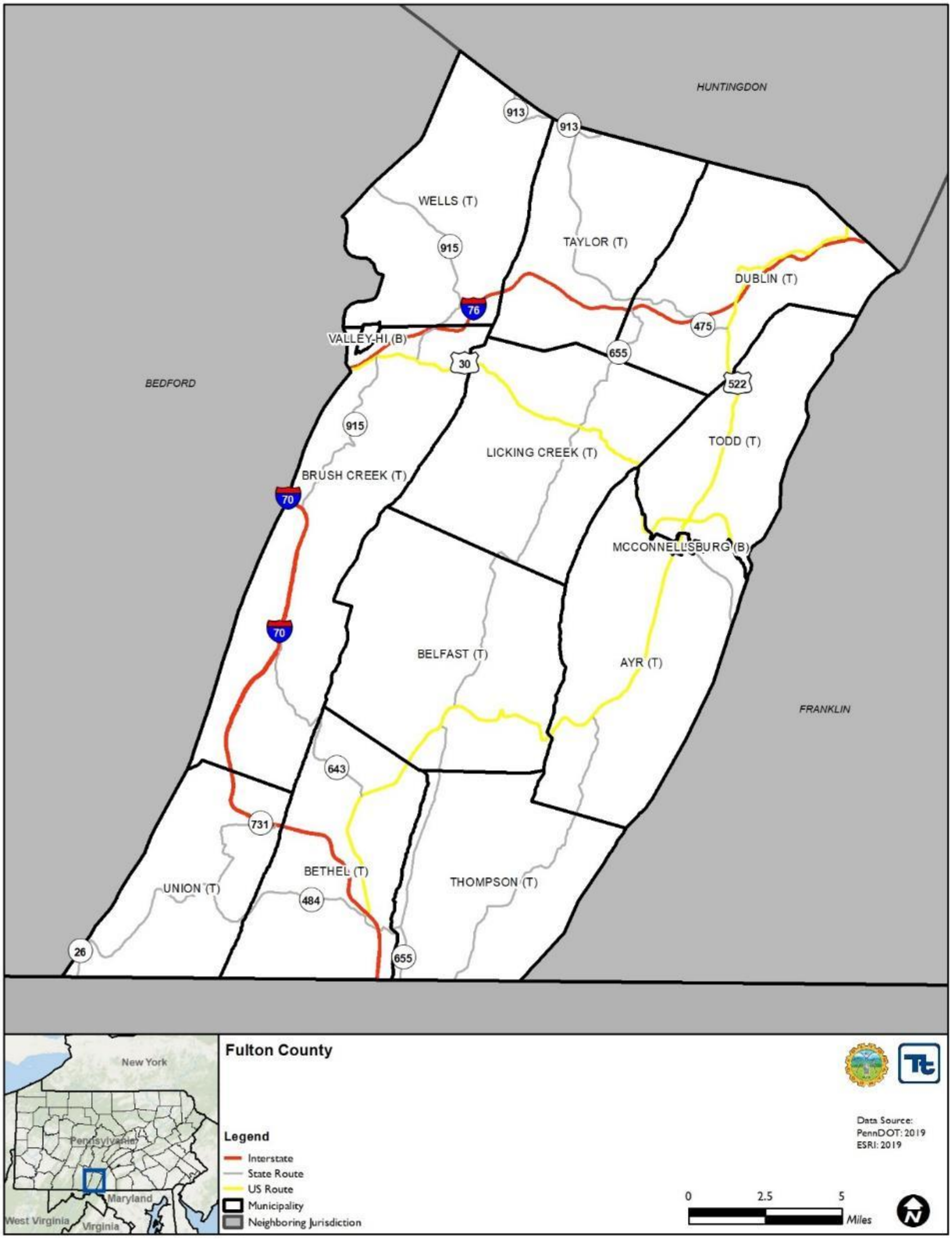
Fulton County was created on April 19, 1850, from a portion of Bedford County. It is named after Robert Fulton, the inventor who pioneered the use of the steamboat. It consists of 13 municipalities; specifically, 11 townships and 2 boroughs. The County seat is McConnellsburg. The County has an estimated population of 14,631 (U.S. Census Bureau 2018).

Fulton County has an extensive transportation network of roads, with 20 miles each of turnpike and interstate highways, 368.4 miles of State and federal highways, and 231.5 miles of secondary and municipal roads. The major routes are US-522, US-30, PA-16, Interstate (I)-70, and the Pennsylvania Turnpike (I-76).

McConnellsburg Borough has remained the population center and the industrial and commercial nucleus of Fulton County. Several larger population centers are located just outside of Fulton County: the City of Altoona, located approximately 70 miles north; the City of Harrisburg, located approximately 90 miles northeast; the City of Hagerstown (Maryland), located approximately 45 miles southeast; Pittsburgh, located approximately 135 miles to the west; and Johnstown, located approximately 75 miles northwest.

The County has a rich historical background dating back to pre-Revolutionary days. Because of its Mason-Dixon Line location, Fulton County played a significant role during the Civil War. According to the U.S. Census Bureau's 2016 County Business Patterns, key industries in Fulton County include: other services (except public administration), retail trade, construction, health care and social assistance, transportation and warehousing, and accommodation and food services (U.S. Census Bureau 2018). Agriculture is also a main industry within Fulton County.

Figure 2-1. Base Map of Fulton County



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. According to the 2010 U.S. Census, Fulton County had a population of 14,845, which represents a 4 percent increase from the 2000 U.S. Census population of 14,261. Table 2-1 presents the population statistics for Fulton County based on the 2000 and 2010 U.S. Census, and 2013-2017 American Community Survey 5-Year estimates (the most current available) data. Table 2-2 provides details regarding the demographics for Fulton County.

Table 2-1. Fulton County Population Statistics

Municipality	2000 Census	2010 Census	2013-2017 5-Year ACS Estimate	Population Change 2000-2017	Population Change 2000-2017 (%)	Population Density Per Square Mile
Ayr Township	1,982	1,942	2,151	169	8.53%	42.00
Belfast Township	1,341	1,448	1,347	6	0.45%	28.90
Bethel Township	1,420	1,508	1,570	150	10.56%	40.7
Brush Creek Township	730	819	748	18	2.47%	15.1
Dublin Township	1,277	1,264	1,317	40	3.13%	34.2
Licking Creek Township	1,532	1,703	1,557	25	1.63%	38.10
McConnellsburg Borough	1,073	1,220	1,037	-36	-3.36%	3,393.90
Taylor Township	1,237	1,118	907	-330	-26.68%	34.3
Thompson Township	998	1,098	1,094	96	9.62%	29.00
Todd Township	1,488	1,527	1,728	240	16.13%	52.8
Union Township	634	706	722	88	13.88%	23.1
Valley-Hi Borough*	20	15	0	-20	-100.00%	29.80
Wells Township	529	477	453	-76	-14.37%	12.8
Fulton County	**14,261**	**14,845**	**14,631**	**370**	**2.59%**	**33.9**

Sources: U.S. Census Bureau 2000, 2010, and 2018
* *Valley-Hi has a low population and therefore American Community Survey (ACS) data may be skewed because of the sampling techniques used for ACS data collection.*

Table 2-2. Demographics for Fulton County

Demographics	2000 Census	2010 Census	2013-2017 5-Year ACS Estimate
Total population	14,261	14,845	14,631
Male	7,133	7,471	7,376
Female	7,128	7,374	7,255
Median age (years)	38.2	41.8	44.6
Under 5 years	898	916	759
18 years and over	10,754	11,414	3,075
65 years and over	2,068	2,544	2,945
Total Households	5,660	6,014	6,014
Group quarters population	102	122	38

Source: U.S. Census Bureau 2000, 2010, and 2018

As shown in the tables above, Fulton County's 2010 Census population was 14,845. Based on these data, the population density of Fulton County is 33.9 persons per square mile, which is considerably lower than the Pennsylvania statewide average of 284 persons per square mile. The Borough of McConnellsburg has the highest population density all the municipalities in the county (3,393.90persons per square mile of land area) (U.S. Census 2010). A majority of the municipalities in Fulton County have population densities below the statewide average. However, many municipalities in the county have low population density, meaning that people are spread throughout the county rather than clustered in groups. Dispersing information, instructions, and resources during a disaster response effort to residents in low-density areas is more difficult than in more densely populated areas because individuals are not centralized. Fulton County 2010 population density data is illustrated on Figure 2-2.

While low-density areas provide challenges to disseminating hazard mitigation information, a low population density also means that hazards will not affect 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.

The Disaster Mitigation Act of 2000 (DMA 2000) requires that HMPs consider socially vulnerable populations. These populations can be more susceptible to hazard events 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. For the purposes of this study, vulnerable populations shall include (1) the elderly and younger populations (persons aged 65 and over; persons aged 5 and younger) and (2) those living in low-income households.

Approximately 17.1 percent of the county's total population is aged 65 and older. Older residents may have access and functional needs. For example, many may be unable to drive; therefore, special evacuation plans may be necessary. They may also have hearing or vision impairments that could make receiving emergency instructions difficult. Additionally, 6.1 percent of the county's total population is under the age of 5 years. Both older and younger populations have higher risks for contracting certain diseases. The County's combined population under 5 years of age and over 65 years represent approximately 23.2 percent of its total population.

Figure 2-3 and Figure 2-4 show the number of these populations by municipality. It should be noted that these two population figures are reported by municipality because American Community Survey data is not available at the Census Block level; therefore, for more concise reporting of population, the municipal level of data was used to report Population Over 65 Years of Age and Population Under 5 Years of Age.

Figure 2-2. Fulton County 2010 Population Distribution

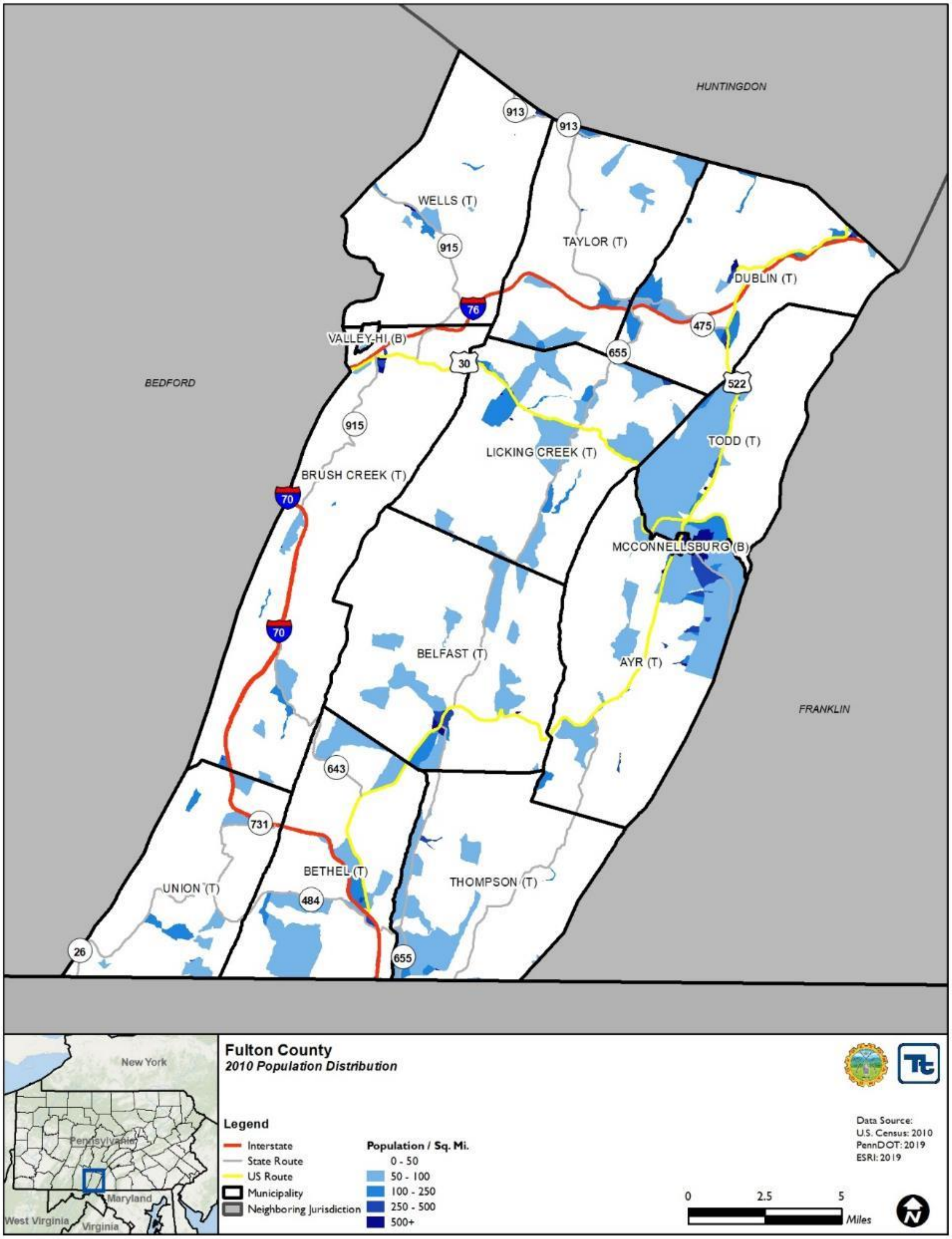


Figure 2-3. Fulton County Population Over 65 Years of Age

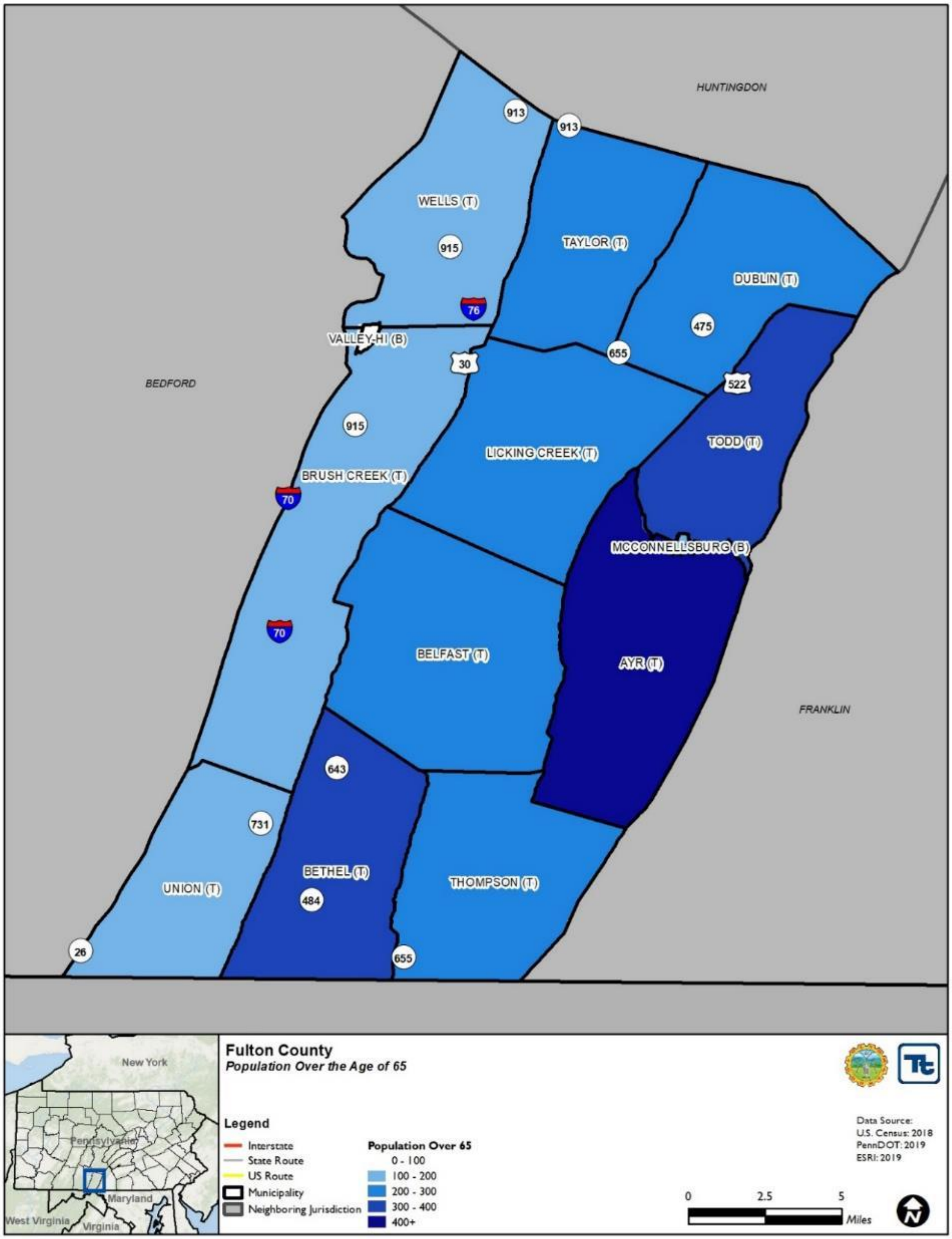
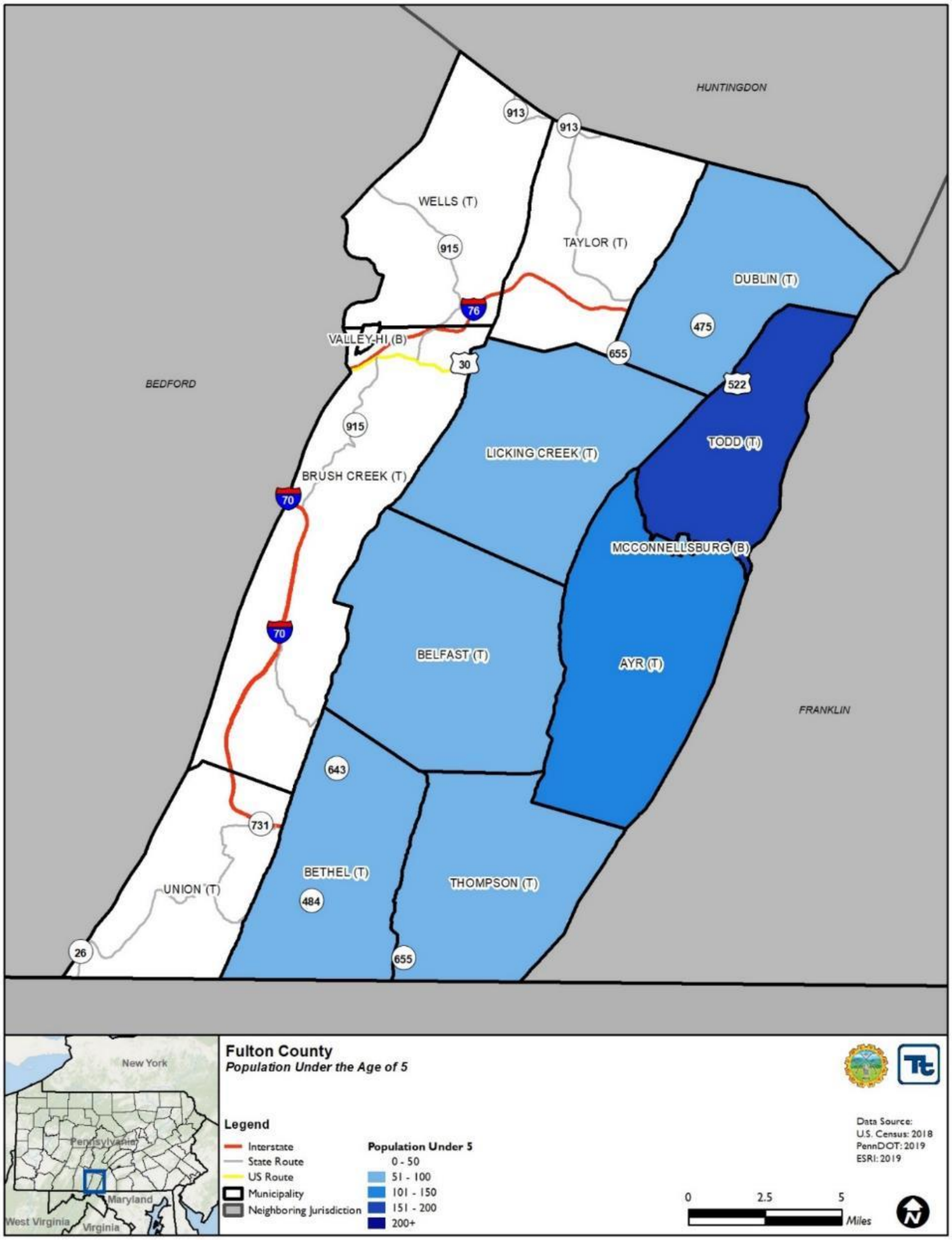


Figure 2-4. Fulton County Population Under 5 Years of Age



Only 0.8 percent of Fulton County's population lives in group quarters. 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 quarter facility has its own emergency plan to account for the unique needs of its residents during a hazard event.

Table 2-3 provides population estimates and projections for each municipality in Fulton County and for the county as a whole. The population of the entire County is estimated to be 16,573 by the year 2040, which represents a net population increase of 1,728 people in a 30-year period. As shown in the table below, approximately half of the municipalities in Fulton County are projected to see an increase in population. The table also shows that four municipalities are projected to see a decrease in population. It should be noted that changes in population or demographics may be used to identify higher-risk populations. Maintaining up-to-date data on demographics will allow Fulton County to better assess magnitudes of hazards and develop more specific mitigation plans and strategies.

Table 2-3. Fulton County Population Projections by Municipality

Municipality	2000 Census	2010 Census	Population Change 2000-2010 (%)	2020 Projection	2030 Projection	2040 Projection	Projected Population Change 2010-2040 (%)
Ayr Township	1,982	1,942	-2.02%	1,819	1,744	1,641	-15.50%
Belfast Township	1,341	1,448	7.98%	1,570	1,683	1,801	24.38%
Bethel Township	1,420	1,508	6.20%	1,605	1,696	1,791	18.77%
Brush Creek Township	730	819	12.19%	907	995	1,084	32.36%
Dublin Township	1,277	1,264	-1.02%	1,333	1,356	1,405	11.16%
Licking Creek Township	1,532	1,703	11.16%	1,846	2,005	2,155	26.54%
McConnellsburg Borough	1,073	1,220	13.70%	1,264	1,367	1,436	17.70%
Taylor Township	1,237	1,118	-9.62%	1,104	1,030	991	-11.36%
Thompson Township	998	1,098	10.02%	1,112	1,176	1,211	10.29%
Todd Township	1,488	1,527	2.62%	1,575	1,853	1,830	19.84%
Union Township	634	706	11.36%	743	800	846	19.83%
Valley-Hi Borough*	20	15	-25.00%	14	12	11	-26.67%
Wells Township	529	477	-9.83%	446	406	371	-22.22%
Fulton County	**14,261**	**14,845**	**4.10%**	**15,338**	**16,123**	**16,573**	**11.64%**

Sources: U.S. Census 2000, 2010, and 2018

According to the 2013-2017 American Community Survey, 1.8 percent of the county's population speaks a language other than English with 0.3 percent of the population speaking 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 2-4 summarizes race and ethnicity population information for Fulton County.

Table 2-4. Race and Ethnicity in Fulton County

Race and Ethnicity	2010	% of Population	2016	% of Population
One race	14,691	99%	14,523	99.3%
White	14,450	97.3%	14,191	97.0%
Black or African American	151	1.0%	234	1.6%

Race and Ethnicity	2010	% of Population	2016	% of Population
American Indian and Alaska Native	28	0.2%	37	0.3%
Asian	19	0.1%	34	0.2%
Native Hawaiian and Other Pacific Islander	1	0.0%	24	0.0%
Some other race	42	0.3%	11	0.1%
Two or more races	154	1.0%	108	0.7%
Foreign born	N/A	N/A	N/A	N/A
Speak a language other than English	166	1.2%	208	1.5%
Hispanic or Latino	110	0.7%	174	1.2%

Source: U.S. Census Bureau 2010, 2018

Fulton County has 7,208 housing units. These properties may be vulnerable to various natural hazards, particularly those located in defined hazard areas. Damage to residential properties is not only costly to repair or rebuild, but devastating to the displaced residents.

According to the U.S. Census, approximately 17.5 percent of the county's residential properties are vacant and most of these units are available for rent. Vacant buildings are particularly vulnerable to arson and criminal activity. Because vacant properties are not inhabited year-round or may not be adequately maintained, many are structurally deficient and at risk of collapse.

Approximately 21.5 percent of the county's population live in rented homes. Because renters are more transient than homeowners, communicating with renters may be more difficult than communicating with homeowners. Similarly, communications with tourists would be harder during an emergency event. Communication strategies should be developed to ensure that these populations receive proper notifications.

Table 2-5 summarizes characteristics of the residential properties in Fulton County.

Table 2-5. Housing Characteristics in Fulton County

Housing Characteristics	2010	2017
Total housing units	7,122	7,208
Owner-occupied housing units	4,617	4,670
Renter-occupied housing units	1,397	1,277
Vacant housing units	1,102	1,261
Median value (dollars)	$157,500	$156,000
Housing units with a mortgage	2,457	2,305
Housing units without a mortgage	2,160	2,365

Source: U.S. Census Bureau 2010, 2011, 2018

In 2017 (the most current data available), the median household income in the county was $50,007, which was lower than the Commonwealth of Pennsylvania's estimated median household income ($56,951). The County's 2017 estimated per capita income of $25,273 was lower than the Commonwealth's 2017 estimated per capita income of $31,476. Approximately 8.3 percent of family incomes in Fulton County were below poverty level, and 11.5 percent of individual incomes were below poverty level. Emergency responders may have difficulty connecting with individuals within this economic bracket for several reasons, including less access to the Internet. Additionally, some low-income families and individuals may not own vehicles, and therefore could be more vulnerable during an evacuation. Table 2-6 summarizes economic characteristics of Fulton County's population.

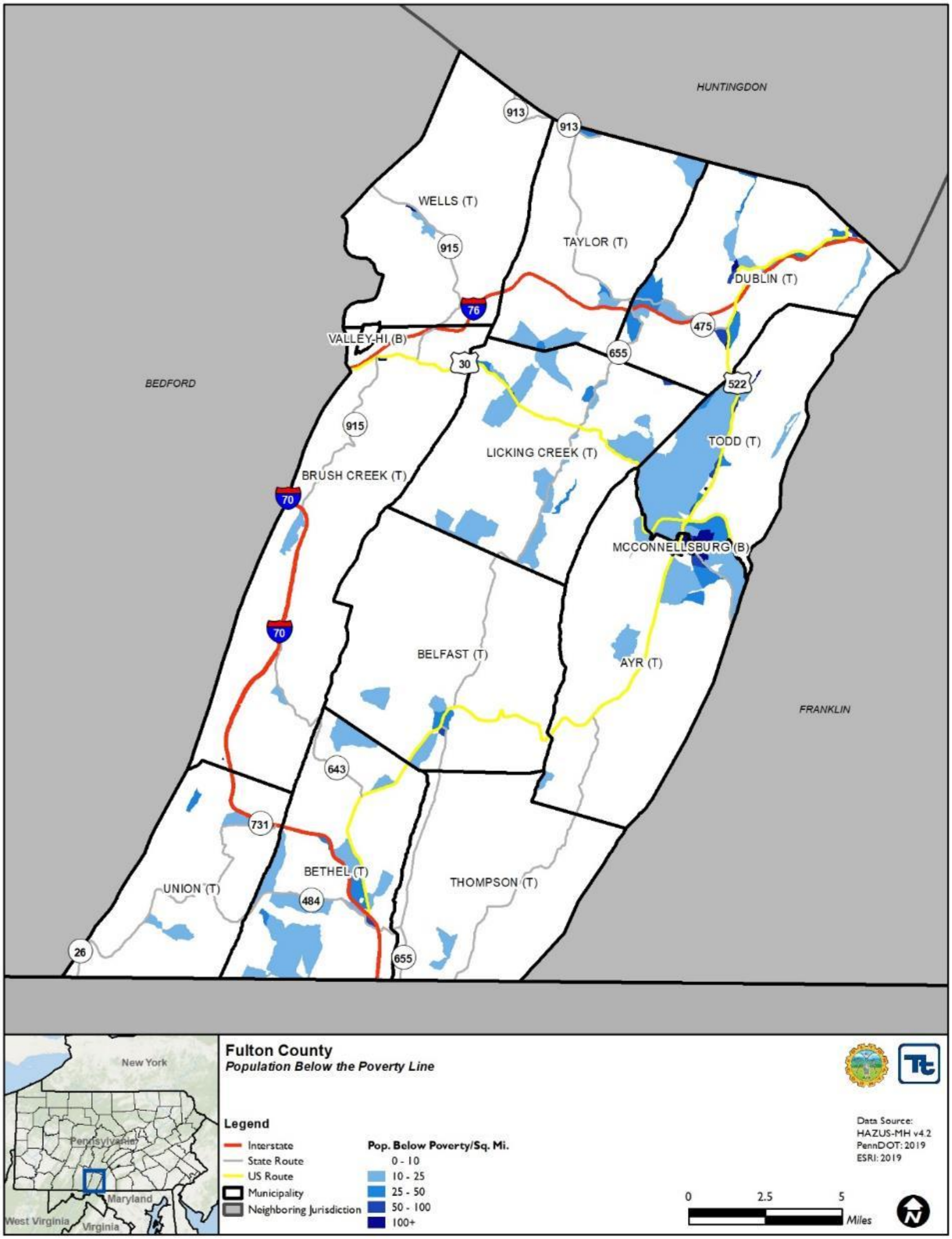
Table 2-6. Economic Characteristics in Fulton County

Economic Characteristics	2010 Census	2017 Estimates
Median household income	$45,240	$50,007
Median family income	$54,946	$61,448
Per capita income	$21,729	$25,373
Families with income below the poverty level	8.8%	8.3%
Individuals with income below the poverty level	13.3%	11.5%

Source: U.S. Census Bureau 2011, 2018

Figure 2-5 illustrates population distribution for residents with incomes below the poverty level.

Figure 2-5. Fulton County Population Below the Poverty Level



2.4 LAND USE AND DEVELOPMENT

Fulton 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 Fulton County. These systems include the Pennsylvania Turnpike, I-70, US Route 30, and US Route 522. In addition, Fulton County is in proximity to the juncture of I-70 and I-68 in Maryland. These transportation systems have greatly contributed to Fulton County’s accessibility and land development patterns. Of the county’s total land area of 438 square miles, approximately 95 percent is classified as agricultural or forested land and approximately 5 percent is considered developed.

McConnellsburg Borough has remained the population center and the industrial and commercial nucleus of Fulton County. Consequently, a natural pattern of development has occurred as a concentric ring of growth has expanded outward from the Borough into the neighboring rural townships.

Fulton County’s commercial and industrial land development patterns are largely influenced by the transportation network and availability of public sewer services. As a result, future growth in the county is expected to occur in five distinct geographic areas: (1) McConnellsburg, (2) Warfordsburg, (3) Hustontown, (4) Fort Littleton, and (5) Crystal Spring.

Fulton County’s future population growth and land use development patterns will be largely influenced by in-migration patterns of people from the east and south. Data gathered from the Internal Revenue Service reveal that Fulton County’s greatest population inflows originated in Franklin County, Pennsylvania; and Washington County, Maryland.

Fulton County residents have expressed concern that the county’s rural character is being jeopardized as its agricultural lands are slowly being converted to areas of low-density, scattered residential development. While still a concern, residential development growth has slowed since this trend has been noted. From 2010 to 2017, U.S. Census records showed an increase in housing units (1.2 percent) that was slightly outpaced by the county’s population growth (2.59 percent). This contrasts from the 2000 to 2010 comparison, which showed a housing unit growth of 4.9 percent, compared to a County population growth of only 4.1 percent.

Land use regulations are not prevalent in Fulton County. For example, Fulton County does not have a County zoning ordinance nor a subdivision and land development ordinance. In addition, of the 13 municipalities, only McConnellsburg Borough has adopted a zoning ordinance. Moreover, municipal subdivision and land development ordinances lack the regulations necessary to support the preservation of the county’s existing rural character.

Agricultural use of land is in long-term decline. According to the U.S. Department of Agriculture, 63 farms and 3,051 farmland acres were lost between 2007 and 2017. Approximately 145 acres of farmland from 2 farms are enrolled in the agricultural easement program within Fulton County (Pennsylvania Land Trust Association no date). Fulton County identified actions to increase the agriculture industry, including increasing representation of agriculture on the county economic development agency, actively recruiting additional businesses or facilities to the county, increasing public awareness of the role agriculture plays in the county’s economy, and collaborating with lenders to offer low-interest loans to farmers (Southern Alleghenies Regional Planning Commission 2018)

Access management is an increasing concern as residential land development patterns continue to develop in a linear fashion along local roadways (e.g., US-522) and each property obtains an individual highway occupancy permit from the Pennsylvania Department of Transportation (PennDOT). Fulton County has developed a growth management survey to help monitor and guide County growth and development in a way to ensure compliance with overall County land use goals. Figure 2-6 provides visual representations of current County land use and predicted growth patterns.

Figure 2-6. Fulton County Land Use and Land Cover

As displayed in Figure 2-7 through Figure 2-12, the county has identified six geographic hazards and growth areas inside its borders. All six of the identified growth areas are located within the Federal Emergency Management Agency (FEMA) flood hazard zone, the subsidence hazard area, and the environmental hazard area. Growth Area A, however, is the only area located within both the 0.25-mile buffer of a major road and 0.10-mile buffer of a Superfund Amendments and Reauthorization Act (SARA) Title III facility. Growth Areas A, B, and F are located above limestone formations in the subsidence and sinkhole hazard area. The County has noted the location of these hazards in relation to the growth areas to ensure that the planning and development officials considers these factors. Additionally, the county intends to discourage development within (1) vulnerable areas, areas with high population density, and the Special Flood Hazard Area (SFHA); or (2) encourage higher regulatory standards at the local level.

Figure 2-7. Fulton County Growth Area A and Hazard Areas

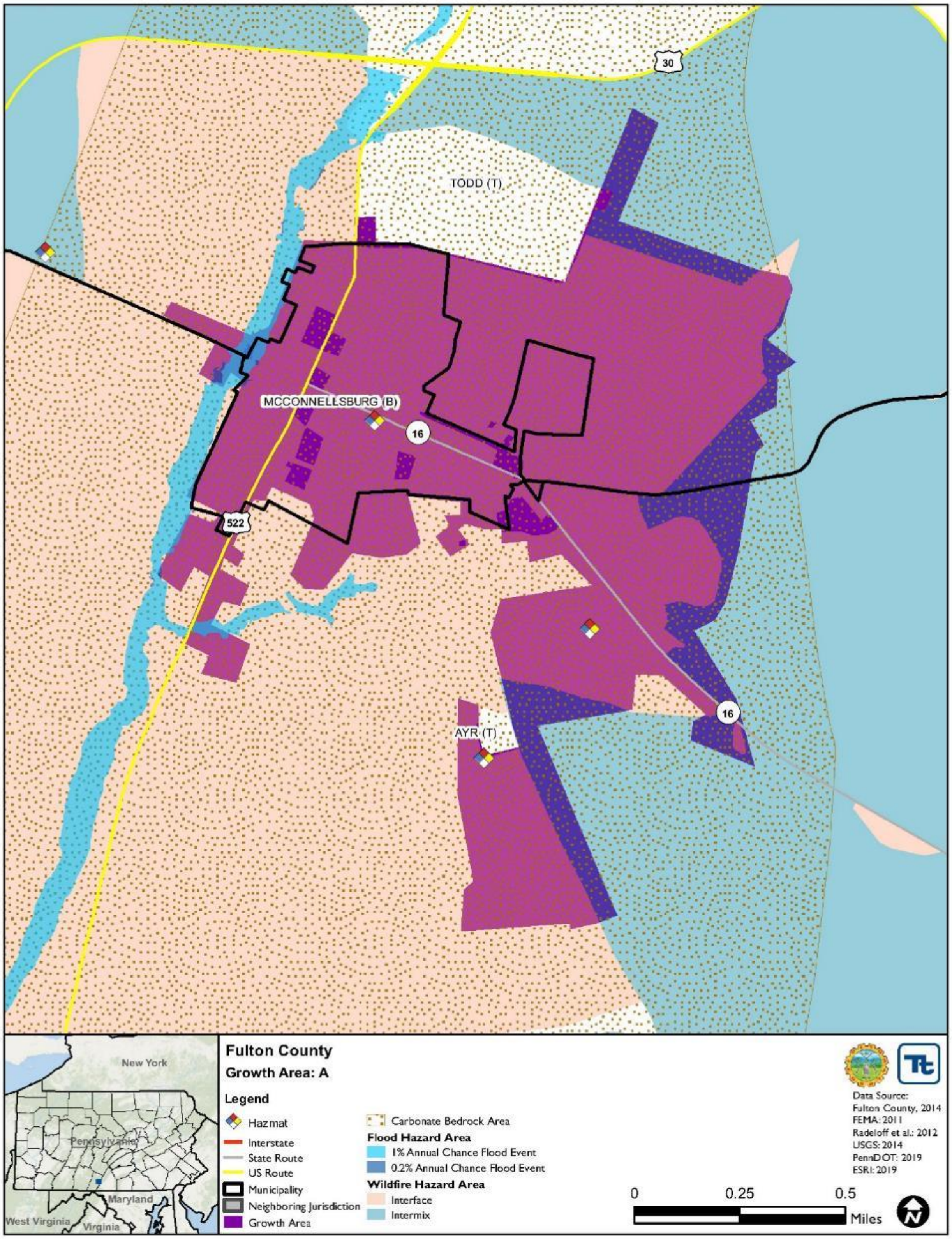


Figure 2-8. Fulton County Growth Area B and Hazard Areas

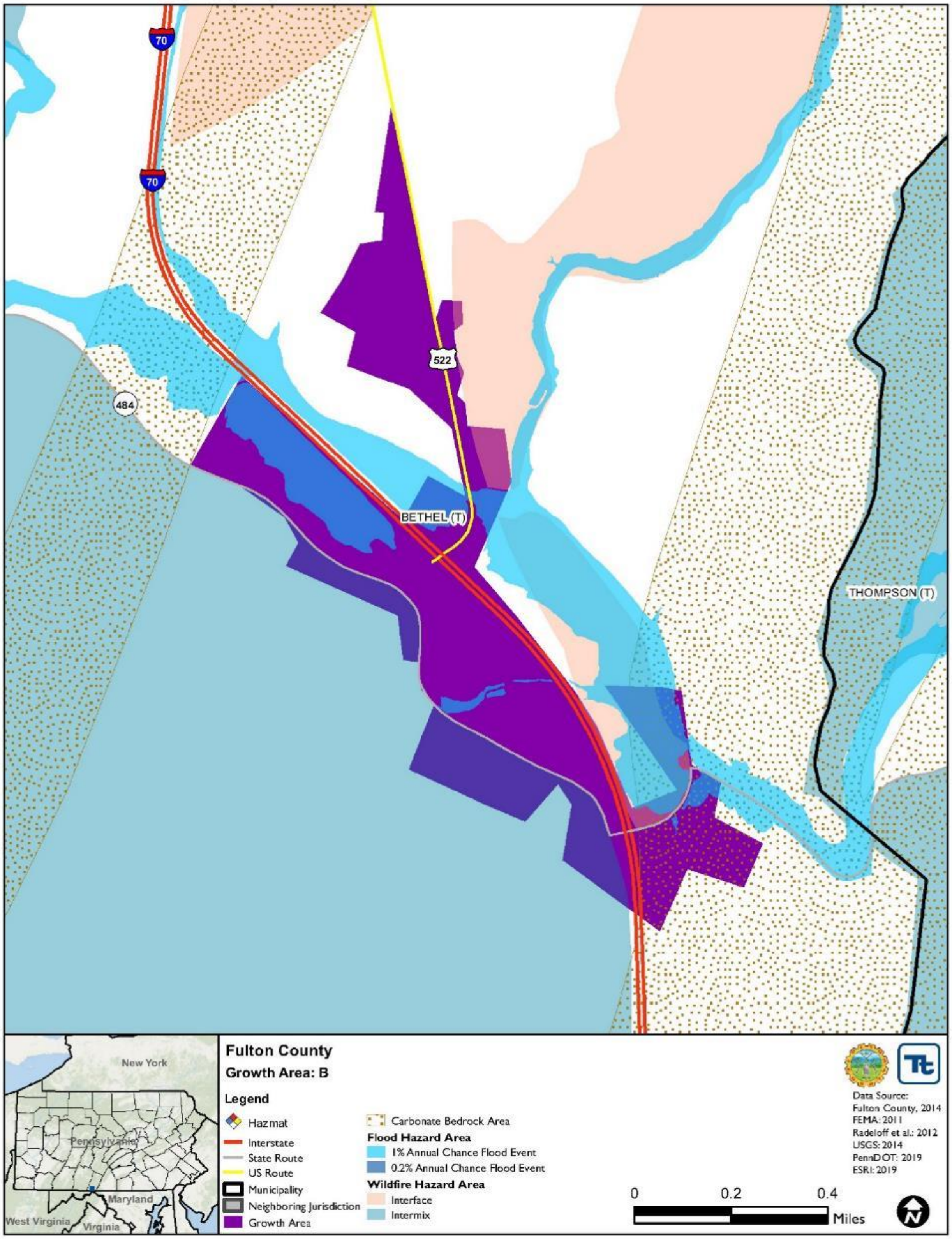


Figure 2-9. Fulton County Growth Area C and Hazard Areas

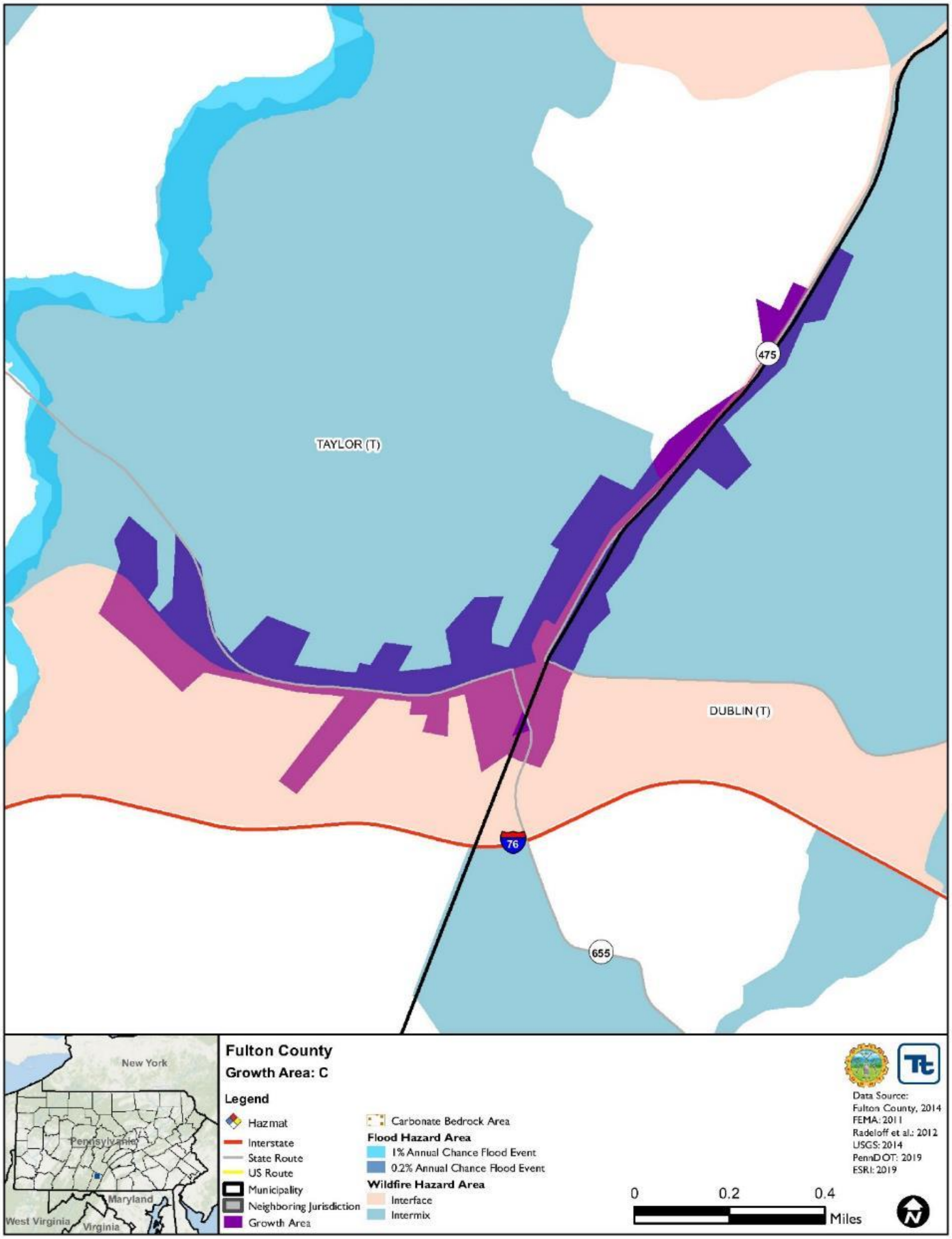


Figure 2-10. Fulton County Growth Area D and Hazard Areas

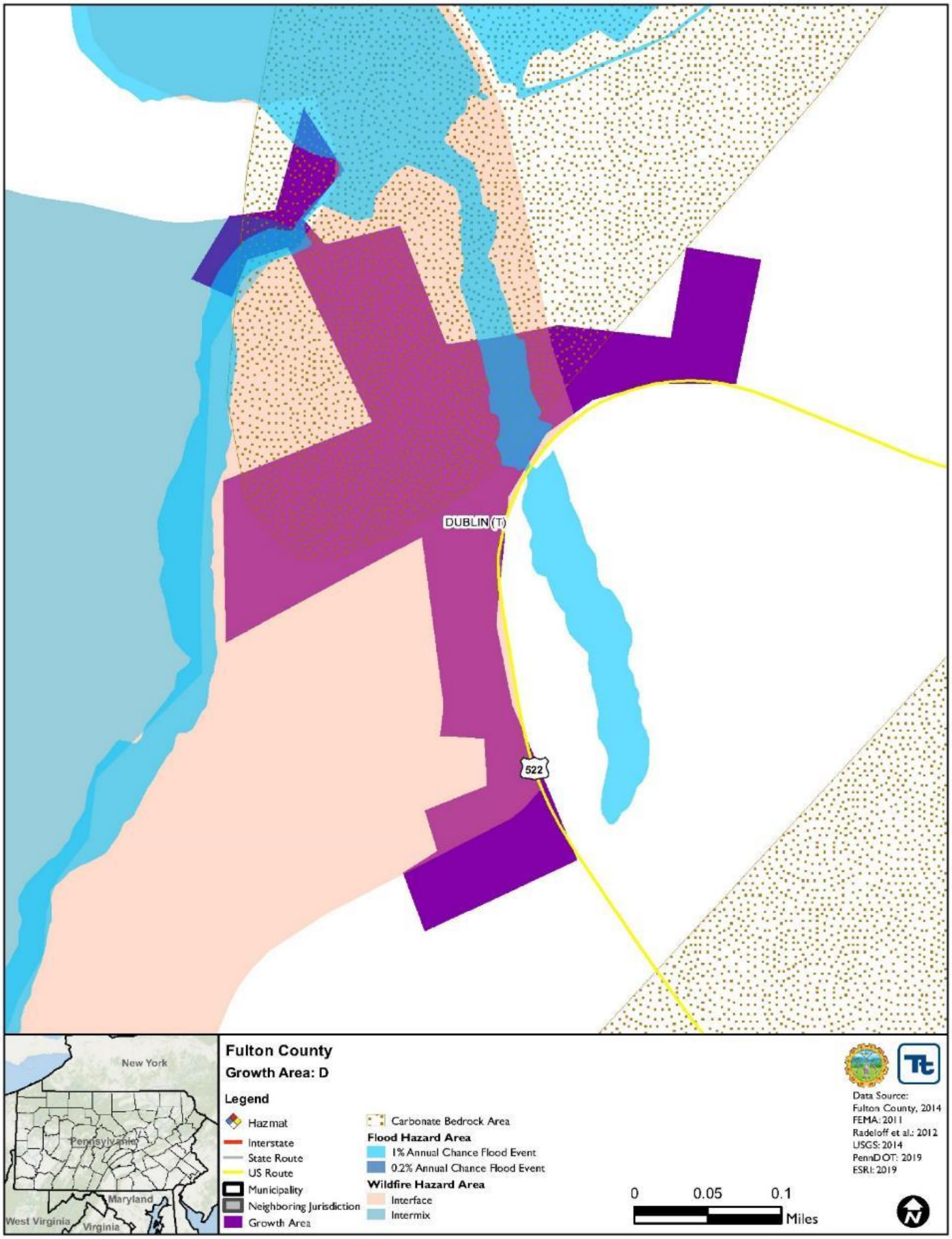


Figure 2-11. Fulton County Growth Area E and Hazard Areas

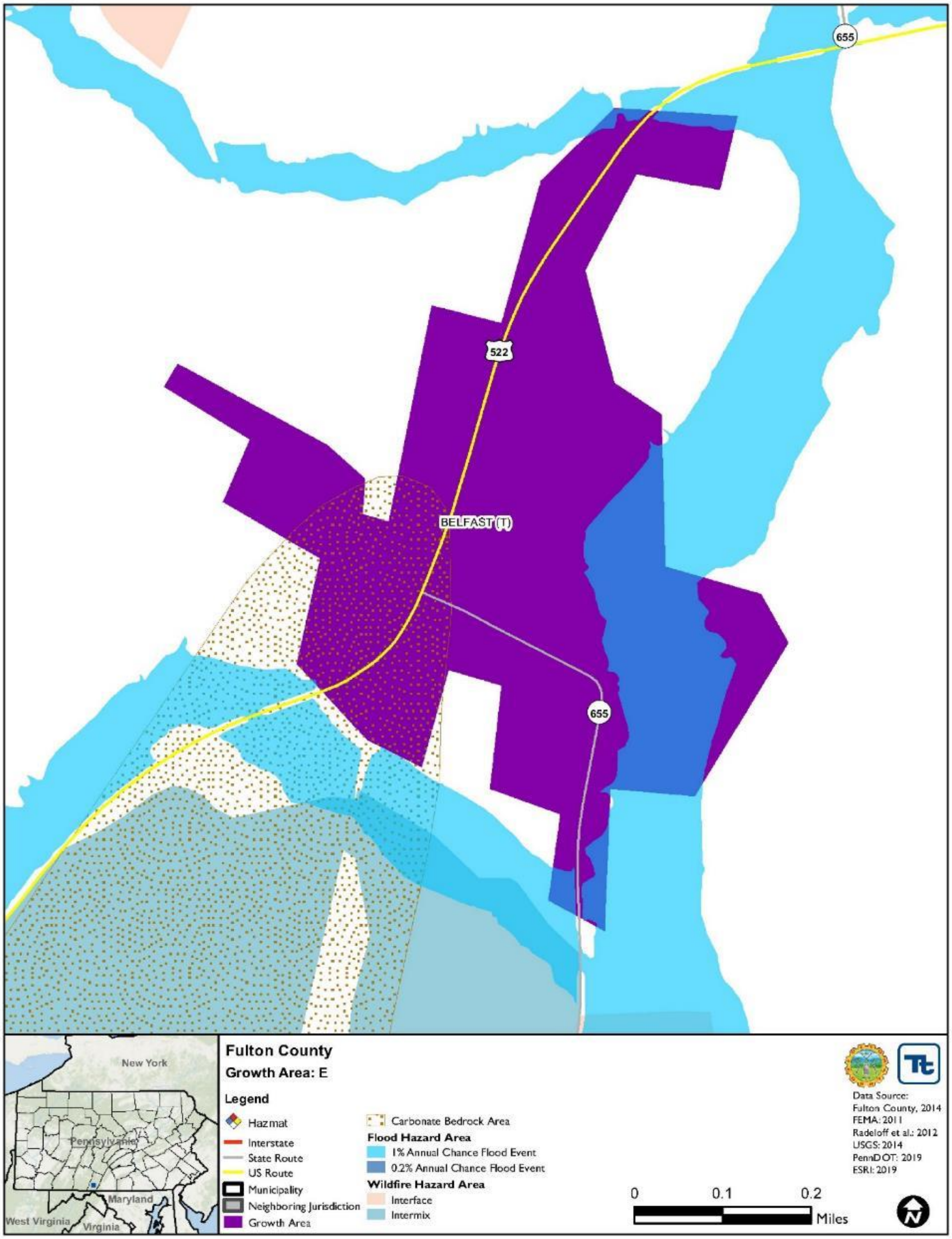
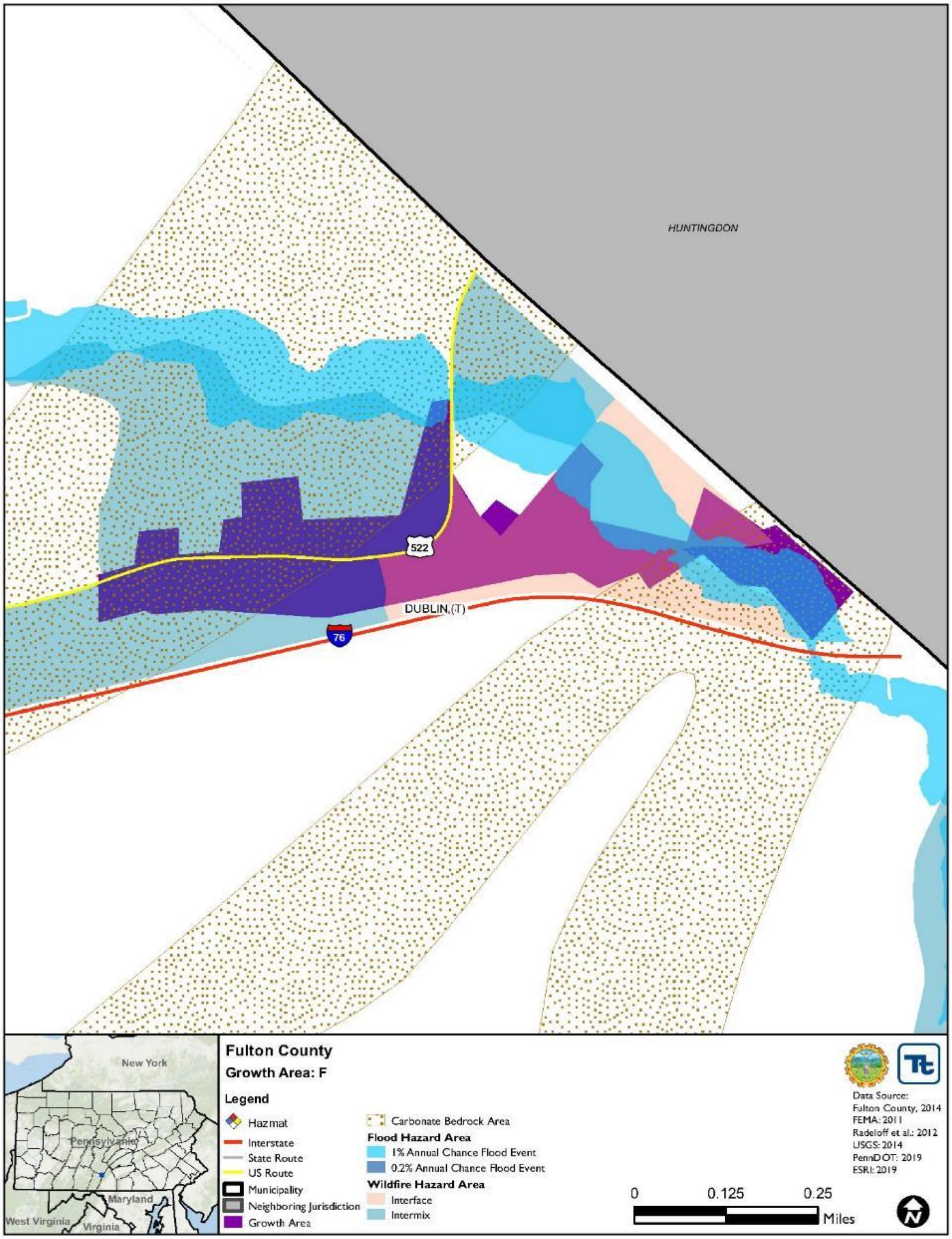


Figure 2-12. Fulton County Growth Area F and Hazard Areas



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8. United States Department of Agriculture. 2019. 2017 Census of Agriculture: Fulton County, Pennsylvania County Profile.
9. Pennsylvania Land Trust Association. Accessed 2019. “Fulton County Agricultural Land Preservation Board.”

Data sources used to develop the HMP in general are listed in Section 1.4. Data sources used to perform geographic information system (GIS) analysis for the risk assessment are listed in Section 4.1. These sources were key in understanding the current demographic makeup of the C as well as in framing the foundation of the Plan. The sources listed provided the underlying context of the HMP and allowed the Steering Committee to understand critical vulnerabilities in the county. Throughout the course of the planning process, the Steering Committee continually sought additional data sources to augment the information included in the Plan.

SECTION 3 PLANNING PROCESS

The Fulton County hazard mitigation planning process has been an integral part of the update of the Fulton County Hazard Mitigation Plan (HMP). This section describes the elements of planning process, which included participation from 12 of the county's 13 municipalities and the Steering Committee; work performed by the planning team; meetings and documentation; public and stakeholder participation; and multi-jurisdictional planning. Additional details regarding the update process for each section of this HMP are included at the beginning of those sections.

A successful hazard mitigation planning process builds partnerships and brings together representatives from government agencies, the public, and other stakeholders to reach consensus on ways the community will prepare for and respond to the hazards most likely to affect them. In addition, applying a comprehensive and transparent process adds validity to the HMP. Throughout the Fulton County HMP update process, participants gained a 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 the agreed-upon actions.

3.1 UPDATE PROCESS AND PARTICIPATION SUMMARY

In accordance with the requirements set forth in the Disaster Mitigation Act of 2000 (DMA 2000), 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 2013 PEMA All-Hazard Mitigation Planning Standard Operating Guide (PEMA 2013) lays out Pennsylvania's standard planning process 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 forum for gathering information to update the HMP. The Steering Committee was afforded access to information in relevant and approved plans, policies, and procedures for Fulton County. Opportunities for public participation included public meetings, distribution of information at municipal meetings and via social media, and occasions to the review and comment on the draft HMP update. To develop all sections of the HMP, the Steering Committee used meetings, e-mail correspondence, and teleconferences to solicit input from county, municipal, and other stakeholders, including members of the general public. Most information received for this update came from Fulton County, its municipalities, and the Steering Committee. Through this planning process, the county established a comprehensive approach to reduce the effects of hazards on the county and its municipalities.

3.2 THE PLANNING TEAM

Recognizing the need to manage risk within the county and to meet the requirements of the DMA 2000, the Planning and Mapping Department and the Fulton County Steering Committee led the update to the 2020 HMP. Mary K. Seville, Planning and Mapping Director, led the Steering Committee Meeting, providing guidance and direction to the planning effort and ensuring the resulting document will be embraced both politically and by the constituency within the county. She also served as the lead planner and point of contact for the planning process. The Fulton County Steering Committee meets each year. Membership of the Steering Committee is maintained on an ongoing basis and includes representatives from the Fulton County Planning and Mapping Department, municipalities, major industries, community organizations, and other stakeholders.

The Steering Committee was charged with the following tasks:

- Providing guidance and oversight of the planning process
- Attending and participating in Steering Committee meetings
- Assisting with the development and completion of certain planning elements, including:
    - Reviewing and updating the hazards of concern
    - Developing a public and stakeholder outreach program
    - Verifying the data and information used in the plan update process are best available
    - Reviewing and updating the hazard mitigation planning goals and objectives
    - Identifying and screening appropriate mitigation strategies and activities
    - Reviewing and updating plan maintenance procedures
- Reviewing and commenting on plan documents prior to submission to PEMA and FEMA

The Steering Committee was assembled to include representatives from each of the municipalities participating in the HMP update as well as invited stakeholders. The organizations listed in Table 3-1 were invited to participate on the Steering Committee.

Table 3-1. Organizations Invited to Participate in the Planning Process

Fulton County				
• County Commissioners	• Fulton County Conservation District	• Fulton County EMA	• Fulton County Planning & Mapping Department	Fulton County Local Emergency Planning Committee
Fulton County Municipalities				
• Ayr Township	• Brush Creek Township	• McConnellsburg Borough	• Todd Township	• Wells Township
• Belfast Township	• Dublin Township	• Taylor Township	• Union Township	
• Bethel Township	• Licking Creek Township	• Thompson Township	• Valley-Hi Borough	
Educational Institutions				
• Central Fulton School District	• Forbes Road School District	• Fulton County Community Christian School	• Southern Fulton School District	
Fire Departments				
• Hustontown Vol. Fire. Co.	• McConnellsburg Vol. Fire Co.	• Needmore Vol. Fire Co.		
Chambers of Commerce				
• Fulton Co. Chamber of Commerce & Tourism	• County Commissioners	• Pennsylvania State Police		
State Agencies				
• Pennsylvania Department of Transportation	• Pennsylvania Emergency Management Agency			

Neighboring Jurisdictions				
• Allegany County Planning	• Bedford County Planning	• Franklin County Municipal Court	• Huntingdon County EMA	• Washington County EMA
• Allegany County EMA	• Franklin County EMA	• Franklin County Planning	• Huntingdon County Planning	• Washington County Planning
• Bedford County EMA				
Other Stakeholders				
• American Red Cross	• Fulton County Medical Center	• JLG Industries	• Mellott Company	• Southern Alleghenies Planning and Development Commission (SAPDC)
• Fulton Co. Chamber of Commerce & Tourism				

Complete lists of individual invitees, participants, attendance at meetings, completion of worksheets, and comments submitted on the HMP are included in Appendices C through E.

The Steering Committee acknowledged the following important steps in developing a comprehensive risk assessment:

- Identify hazards that specifically affect Fulton County
- Assess their likelihood of occurrence, along with potential damage to the people, property, and environment of the county

The Steering Committee chose to focus on an all-hazards approach rather than to narrow the focus to natural disasters only.

As the contract consultant, Tetra Tech, Inc. (Tetra Tech) guided the Steering Committee through the HMP update planning process. More specifically, Tetra Tech was tasked to carry out the following tasks:

- Assist with the organization of the Steering Committee
- Assist with the development and implementation of a public and stakeholder outreach program
- Collect data
- Facilitate and record attendance at meetings
- Assist with the review, update, and ranking of the hazards of concern, hazard profiling, and the risk assessment
- Assist with the review and update of mitigation planning goals and objectives
- Assist with the review of progress of past mitigation strategy
- Assist with the screening of mitigation actions and the identification of appropriate actions
- Assist with the prioritization of mitigation actions
- Author the draft and final HMP documents

3.3 MEETINGS AND DOCUMENTATION

Tetra Tech supported the county in drafting planning documents and preparing for meetings. The Steering Committee reviewed documentation, provided validation, and acted as an advocate for the HMP update.

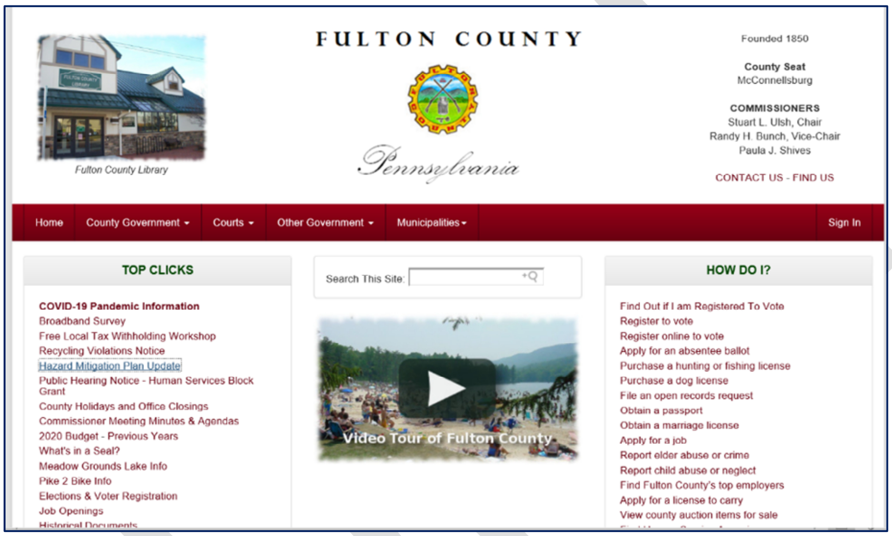
Table 3-2 lists dates and descriptions of meetings held by the Fulton County Steering Committee as part of the process of updating the Fulton County HMP.

Table 3-2. Public and Planning Meetings

Date	Description of Meeting
April 10, 2019	Project Kickoff Meeting
May 30, 2019	Steering Committee Kickoff Meeting
December 9, 2019	Risk Assessment Review Meeting
January 15, 2020	Mitigation Strategy Workshop
TBD	Draft Review Meeting

The Steering Committee provided notes that documented all agenda topics, decisions, and action items identified during the meeting and posted the meeting minutes on the HMP website. Documentation from all meetings is provided in Appendix C.

Fulton County residents were informed of the planning process through various sources, including newspaper-announced public notices and announcements on the Fulton County HMP website (https://www.co.fulton.pa.us/planning-hmp-update.php). The website is linked from the county's home page.



The Risk Assessment Review Meeting and Draft Review Meeting were advertised as public meetings. Press releases were sent to the major media outlets serving Fulton County, and invitations were posted to the county's website and social media network. One member of the general public attended. Any subsequent supporting documentation provided by county residents will be included in Appendix E (Public and Stakeholder Participation).

3.4 PUBLIC AND STAKEHOLDER PARTICIPATION

To maximize effectiveness of the HMP, the Steering Committee fostered continual public and stakeholder engagement. Input was encouraged and collected through a variety of methods. Five worksheets and surveys—the Hazard Identification and Risk Evaluation, Hazard/Risk Identification Survey, Capabilities Assessment Survey, NFIP Survey, and Mitigation Strategy 5-Year Plan Review Worksheet (Mitigation Review Worksheet)—were given to representatives from each municipality in Fulton County. Of the county and the 13 municipalities within Fulton County surveyed, 13 jurisdictions (the county and 12 municipalities) provided information so that their input could be reviewed and 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 Steering Committee or public meeting, or by offering comments on the project website:

- local, state, and federal agencies
- neighboring jurisdictions (e.g., Franklin)
- community leaders and educators
- healthcare facilities
- other relevant private and nonprofit groups

Invitations to participate in meetings were sent to the stakeholders listed. Appendix E includes a copy of the Steering Committee meeting invitation list and copies of invitation letters sent. Meeting invitations were also sent to all municipalities, including elected officials and Emergency Management Coordinators. Twelve of the 13 municipalities in Fulton County had representatives attending at least one meeting. Additionally, direct outreach 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. This additional outreach was conducted by phone or in one-on-one meetings.

Through public notices published in the local newspapers, the groups listed in Section 3.2 and the general public were invited to visit the project website, review the draft County HMP update, and send comments to Fulton County Planning and Mapping Department. In addition, two general public meetings were held during the planning process, as listed in Table 3-2. Copies of the public notices and other forms of public and stakeholder outreach are presented in Appendix E.

Throughout the course of the entire planning process, two members of the general public attended a meeting, and a representative from the following stakeholder organizations participated:

- American Red Cross
- Mellott Company

Section 3.5, Multi-jurisdictional Planning, includes Table 3-3, which indicates overall municipal participation in the planning process.

3.5 MULTI-JURISDICTIONAL PLANNING

Fulton County led a multi-jurisdictional effort to prepare and update the HMP, which will apply to the county and all participating municipalities. The county provided resources (e.g., demographic data, geographic information system [GIS] data, etc.) to municipalities to augment locally available information. Fulton County undertook an intensive effort to involve all 13 municipalities in the update process. However, Fulton County depended on municipal buy-in for plan participation, as municipalities in the Commonwealth of Pennsylvania have the legal authority to enforce compliance with land use planning and development directives, and thus determine whether to participate in the planning process.

Each municipality was given the opportunity to join the process. The county invited municipal officials and representatives to attend Steering Committee and public meetings; provided worksheets to update the hazards of concern, capabilities, and mitigation strategy; and tasked municipalities to review and prioritize the mitigation actions. Municipal participation culminated in formal adoption of the HMP; copies of municipal adoption resolutions are provided in Appendix F. Table 3-3 indicates the ways each municipality participated in the planning process.

Table 3-3. Worksheet Completion and Planning Meetings

Jurisdiction	Worksheets					Meetings		
	Hazard Identification and Risk Evaluation Worksheet Received	Municipal Risk Factor Analysis Received	Capabilities Assessment Survey Received	Mitigation Review Worksheet Received	NFIP Survey	Steering Committee Kickoff 05/30/19	RA and CA Review Meeting 12/09/19	Mitigation Strategy Workshop 01/15/20
Fulton County	X	N/A	X	X	X	X	X	X
Ayr Township	X	X	X	X	X	X	X	X
Belfast Township	X	X	X	X	X	X	-	X
Bethel Township	X	X	X	X	X	X	-	X
Brush Creek Township	X	X	X	X	X	-	X	-
Dublin Township	X	X	X	X	X	-	X	X
Licking Creek Township	X	-	X	X	X	X	-	-
McConnellsburg Borough	X	X	X	X	X	X	X	-
Taylor Township	X	X	X	X	X	X	X	-
Thompson Township	X	X	X	X	X	X	X	X
Todd Township	X	X	X	X	X	-	-	X
Union Township	X	X	X	X	X	X	X	X
Valley-Hi Borough	-	-	-	-	-	-	-	-
Wells Township	X	-	X	X	X	-	-	-

SECTION 4 RISK ASSESSMENT

4.1 UPDATE PROCESS SUMMARY

In accordance with the Federal Emergency Management Agency (FEMA) Local Mitigation Planning Handbook, risk is the potential for damage, loss, or other impacts created by the interaction of natural hazards with community assets. Fulton County's risk assessment is organized into the following sections:

- Section 4.2 outlines the hazard identification process for both natural and human-caused hazards of concern for further profiling and evaluation.
- Section 4.3 profiles the hazards of concern (location and extent, range of magnitude, past occurrence, and future occurrence) and assesses vulnerability.
- Section 4.4 summarizes the risk assessment methodology, ranking results, potential losses, and future development and vulnerability.

The Steering Committee evaluated the 2015 Hazard Mitigation Plan (HMP) hazards of concern by examining the historic events that have taken place in the county since the last plan update and reviewing the Commonwealth's 2013 HMP and 2018 HMP. In addition, the Steering Committee completed the risk assessment worksheet (Evaluation of Identified Hazards and Risk Worksheet). The worksheet listed hazards profiled in the 2015 HMP and requested that participants identify whether the frequency of occurrence, magnitude of impact, and/or geographic extent of each hazard increased, decreased, or did not change since the preparation of the 2015 HMP. The worksheet also provided the opportunity to assess hazards not profiled in the HMP to determine if those hazards should be included as part of the update. Responses from the worksheets were reviewed by the Steering Committee to identify a list of hazards to profile in the 2020 HMP, keeping all hazards of concern. Each hazard profile in section 4.3 includes an additional subsection that discusses the effect of climate change on vulnerability. Refer to copies of the completed worksheets in Appendix D.

4.2 HAZARD IDENTIFICATION

This section summarizes previous disaster declarations and hazards affecting Fulton County

4.2.1 Disaster Declarations

In reviewing and updating Fulton County's hazards of concern, the Steering Committee reviewed additional information and historical records from a wide range of sources. This section discusses the Presidential Disaster and Emergency Declarations, Gubernatorial Disaster Declarations or Proclamations, and Small Business Administration Disaster Declarations that have affected Fulton County.

Presidential Disaster and Emergency Declarations are issued when state and local governments are determined to be in need of assistance in responding to a disaster event. Since 1955, Presidential Declarations have been issued for various hazard events, including hurricanes or tropical storms, severe winter storms, and flooding. A unique Presidential Emergency Declaration, Emergency Declaration 3235, was issued in September 2005. Through this declaration, President George W. Bush declared a state of emergency for the Commonwealth of Pennsylvania and ordered federal aid to supplement Commonwealth and local response efforts to help people evacuate from their homes due to Hurricane Katrina. A summary of declarations affecting the county is provided in the tables below.

Table 4.2-1 lists Presidential Disaster and Emergency Declarations issued from 1972 through October 2019 that have affected Fulton County. Additional declarations beyond March 2016 can be found on the Federal Emergency Management Agency (FEMA) website at https://www.fema.gov/disasters.

Table 4.2-1. Presidential Disaster and Emergency Declarations Affecting Fulton County

Declaration Number	Date	Event
DR-4267	March 23, 2016	Severe Winter Storm and Snowstorm
DR-4099	January 10, 2013	Hurricane Sandy
EM-3356	October 29, 2012	Hurricane Sandy
EM-3340	September 8, 2011	Remnants of Tropical Storm Lee
DR-1898	April 16, 2010	Severe Winter Storms and Snowstorms
EM-3235	September 10, 2005	Hurricane Katrina Evacuation
DR-1557	September 19, 2004	Tropical Depression Ivan
DR-1555	September 19, 2004	Severe Storms and Flooding associated with Tropical Depression Frances
EM-3180	March 14, 2003	Snowstorm
DR-1093	January 21, 1996	Flooding
DR-1085	January 13, 1996	Blizzard
EM-3105	March 16, 1993	Severe Snowfall and Winter Storm
DR-485	September 26, 1975	Severe Storms, Heavy Rain, Flooding
DR-340	June 23, 1972	Tropical Storm Agnes

Source: FEMA 2020

In addition to these Presidentially-declared events, 26 events warranted Gubernatorial Disaster Declarations or Proclamations that included Fulton County (Pennsylvania Emergency Management Agency [PEMA] 2019). These events are summarized in Table 4.2-2

Table 4.2-2. Gubernatorial Disaster Declarations or Proclamations Affecting Fulton County

Date	Event
August 2018	Proclamation of Disaster Emergency – Rapid, Heavy Rainfall Resulting in Flash Floods
January 2018	Proclamation of Disaster Emergency – Opioid Crisis
March 2017	Proclamation of Emergency – Severe Winter Storm
January 2016	Proclamation of Disaster Emergency – Severe Winter Storm
August 2015	Proclamation of Disaster Emergency – Severe Storms
January 2015	Proclamation of Disaster Emergency – Severe Winter Storms
February 2014	Proclamation of Emergency – Severe Winter Storms
January 2014	Proclamation of Disaster Emergency – Extreme Weather, Utility Interruption
June 2013	Proclamation of Emergency – High Winds, Thunderstorms, Heavy Rain, Tornado, Flooding
October 2012	Proclamation of Emergency – Hurricane Sandy
April 2012	Proclamation of Emergency – Spring Winter Storms
August 2011	Proclamation of Emergency - Severe Storms and Flooding (Lee/Irene)
January 2011	Proclamation of Emergency – Severe Winter Storm
February 2010	Proclamation of Emergency – Severe Winter Storm
April 2007	Proclamation of Emergency – Severe Winter Storm
February 2007	Proclamation of Emergency – Severe Winter Storm
February 2007	Proclamation of Emergency – Regulations
September 2006	Proclamation of Emergency – Tropical Depression Ernesto
September 2005	Proclamation of Emergency – Hurricane Katrina
February 2002	Drought and Water Shortage
June 1999	Drought
February 1978	Blizzard
January 1978	Heavy Snow
February 1974	Truckers’ Strike
February 1972	Heavy Snow
January 1966	Heavy Snow

Source: PEMA 2019

Fulton County has also received Small Business Administration Disaster Assistance for a number of disaster events. A Small Business Administration Disaster Declaration qualifies communities for access to affordable, timely, and accessible financial assistance. Table 4.2-3 lists Small Business Administration Disaster Declarations issued for Fulton County from 1991 through July 2016 (PEMA 2019), including those declarations for which Fulton County was declared as an adjacent county.

Table 4.2-3. Small Business Administration Disaster Declarations Affecting Fulton County

Date	Event
July 2016	Flash Flooding
January 2007	Fire
July 1991	Drought

Source: PEMA 2019

4.2.2 Summary of Hazards

As part of the plan update process, the Steering Committee reviewed the hazards of concern detailed in the 2015 version of the plan, as well as those identified in the State Hazard Mitigation Plan (HMP). They also considered the history of hazard events occurring in Fulton County as well as events occurring after the completion of the 2015 version of the plan. This review of historical events included an evaluation of all emergency and disaster declarations in the Commonwealth, with a focus on those in which Fulton 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 Fulton County, including any that may not have been considered in either the 2015 version of the plan or the State HMP. Completed worksheets submitted by the municipalities are included in Appendix D of this plan. Based on the review of the 2015 hazards list and the completed the Hazard Identification/ Evaluation of Risk worksheets, no additional hazards were considered in need of a risk assessment. The Steering Committee decided not to remove any of the hazards that were addressed in the 2015 version of the HMP.

Based on all available information and input from the municipalities, the Steering Committee selected the following natural and non-natural hazards for consideration in this plan:

Natural Hazards

- Drought
- Earthquake
- Flood, Flash Flood, Ice Jam
- Hailstorm
- Landslides
- Radon Exposure
- Subsidence and Sinkholes
- Tornado and Windstorm
- Wildfire
- Winter Storm

Non-Natural Hazards

- Dam Failure
- Environmental Hazards
- Transportation Accidents

Individual profiles for each of these hazards are included in Section 4.3 of this plan.

4.3.1 Dam Failure

This section provides a profile and vulnerability assessment of the dam failure hazard in Fulton 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] 2015b).

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 2015b)

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 (PA DEP) 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" (PA DEP 2009a). 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). Fulton County receives copies of EAPs and inundation maps for high-hazard dams whose failure could impact local residents.

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 2017b). The USACE National Inventory of Dams (NID) provides the most recent dates of inspection of the following Fulton County dams:

- Camp Sinoquipe Lake Dam: June 1, 2018
- Cowans Gap Dam: December 18, 2017
- Meadow Grounds Dam: June 22, 2017
- Valley-Hi Eagle Lake Dam: December 18, 2017

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. 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 2017)

Every five 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 2017).

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 2017).

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 2017).

4.3.1.1 Location and Extent

Seven (7) dams are present throughout Fulton County, as shown on Figure 4.3.1-1. The vast majority of these dams pose little risk; however, nine Hazard Category 1 "high-hazard" dams require EAPs. Table 4.3.1-1 lists dam classification definitions. Table 4.3.1-2 is a complete list of dams in Fulton County with "high-hazard" dams listed first. According to the U.S. Army Corps of Engineers, there are four dams located in Fulton

County, two of which are publicly owned, and two of which are privately owned (USACE 2019, NPDP 2015). Table 4.3.1-2 below reflects the list of dams maintained by PA DEP.

Figure 4.3.1-1. Dams in Fulton County

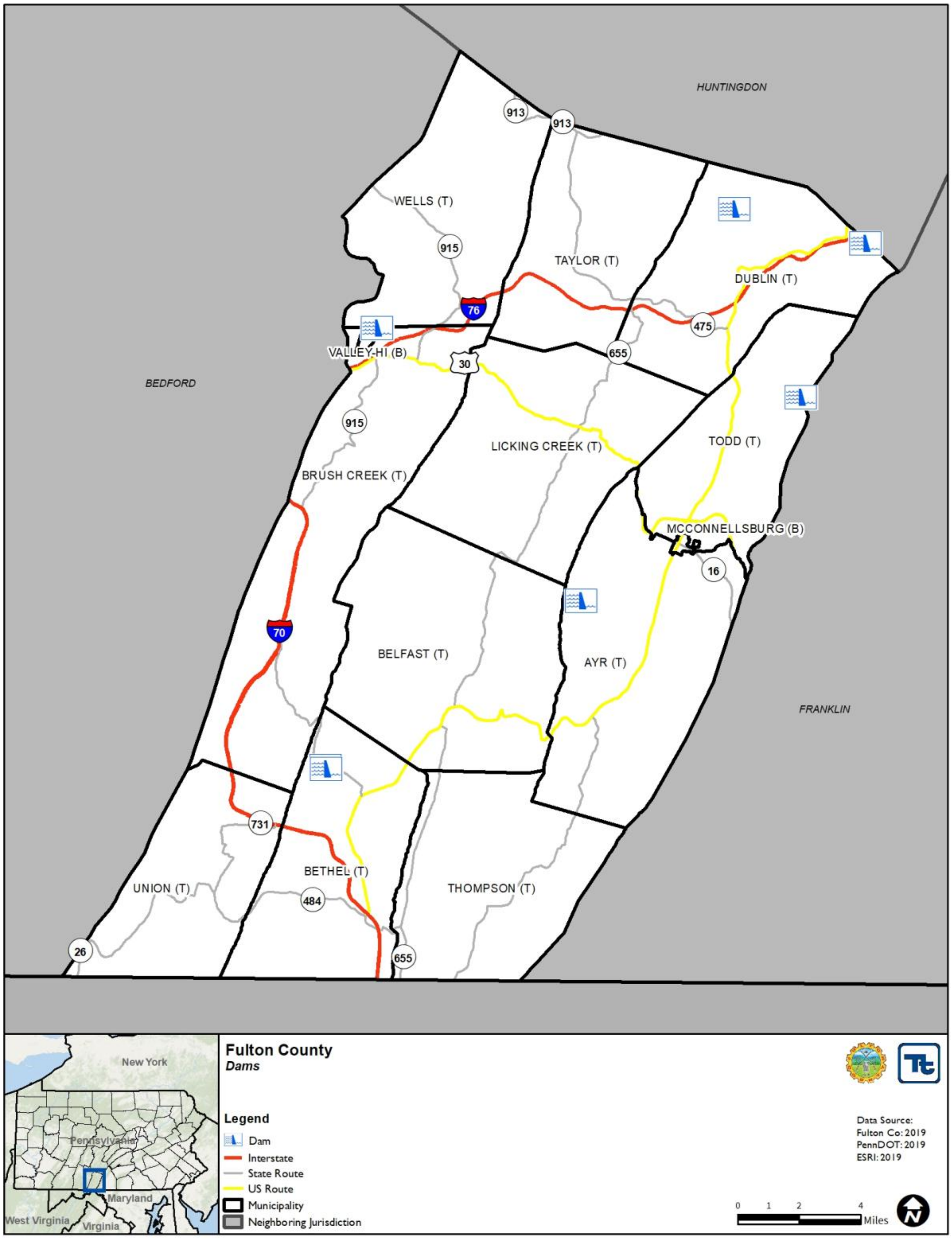


Table 4.3.1-1. Dam Classification Definitions

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 4.3.1-2. Dams in Fulton County

Dam Name	Municipality	Stream	Type	Class	Permittee
High-Hazard Dams					
Meadow Grounds	Ayr Township	Roaring Run	Earth	B-1	PA Fish and Boat Commission
Cowan’s Gap	Todd Township	Little Aughwick Creek	Earth	B-1	DNCR – Bureau of State Parks
Valley-Hi Eagle Lake	Valley-Hi Borough	Oregon Creek	Earth	C-1	Valley-Hi Development Association, Inc.
Other Dams					
Camp Sinoquipe Lake	Dublin Township	Plum Run	Earth	C-4	Boy Scouts of America
Grewe Upper	Bethel Township	Mellot Run	Earth	C-4	Josef Grewe
Grewe Lower	Bethel Township	Mellot Run	Earth	C-4	Josef Grewe
Burnt Cabins Mill Pond	Dublin Township	S Br Little Aughwick Creek	Earth	C-4	Greg and Dawn Harnish

Source: PA DEP 2017a

4.3.1.2 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 4.3.1-3 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 4.3.1-3. 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

The worst-case scenario dam failure would be the sudden catastrophic failure of the Cowan's Gap dam, which could threaten the population in the inundation zone as well as any individuals using the lake for recreation. The Meadow Grounds dam has been drained and is currently waiting for structural improvements and repairs.

Once the surrounding waterways have been refilled, the sudden catastrophic failure of the Meadow Grounds dam would also be considered a worst-case scenario. The most likely dam failure would be the failure of a small earthen dam along a minor stream and would not threaten any lives or property.

4.3.1.3 Past Occurrence

There have been two significant dam failures in Pennsylvania. The worst dam failure to occur in the U.S. took place in Johnstown, PA, in 1889 and claimed 2,209 lives. Another dam failure took place in Austin, PA, (Potter County) in 1911 and claimed 78 lives. To date, there have not been any dam failures in Fulton County's recent history.

4.3.1.4 Future Occurrence

Likelihood of a dam failure in Fulton 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 Fulton County, dam failures are considered *unlikely* in the county.

4.3.1.5 Vulnerability Assessment

The dam failure hazard is of significance to Fulton County because three of the county's seven dams are classified as high-hazard by PA DEP. 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.

Impact on Life, Health, and Safety; General Building Stock; Critical Facilities; and the Economy

The entire population residing within a dam failure inundation zone is considered exposed and vulnerable. 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 net economic impact to their family. The population over the age of 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.

The EAPs associated with the Fulton County high-hazard dams provide information concerning the estimated number of homes and residents vulnerable to a dam failure. Dam failure 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.

Table 4.3.1-4. Fulton County High-Hazard Dam EAP Impacts

Dam Name	Vulnerable Structures/Homes	Vulnerable Residents
Meadow Grounds Dam	65 Homes	163 Residents
Cowans Gap Dam	57 Permanent Inhabited Structures	N/A
Valley-Hi Dam	7 Homes	20 Residents

Source: Meadow Grounds EAP 2012, Cowans Gap EAP 2008, Valley-Hi EAP 2010
Note: The Cowans Gap Dam inundation area does not impact any hospitals, schools, or nursing homes. Fort Littleton Bible Church is located in the inundation area for Fort Littleton.
The Valley-Hi Dam inundation area does not impact any businesses, hospitals, nursing homes, or daycares.

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

All buildings and infrastructure located in the dam failure inundation zone are considered exposed and vulnerable. Property located closest to the dam inundation zone has the greatest potential to experience the largest, most destructive surge of water. All transportation infrastructures within the dam failure inundation zone are vulnerable to damage. Damage to these infrastructures 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.

Impact on the Environment

The environment is vulnerable to several risks in the event of a dam failure. Water releases from dams usually contain very little suspended sediment; this can lead to scouring of river beds and banks. The inundation may introduce foreign elements into local waterways, resulting in destruction of downstream habitat and impacting many animal and plant species, especially endangered species. The subsequent rush of water downstream can rapidly increase flow rate and turbidity of streams and rivers in minor dam failures or overwhelm terrestrial habitat with floodwaters in severe dam failure events.

Dam failures can often result in the release of hazardous materials, either swept up in floodwaters or in sediment that is contained behind the dam as is often the case in areas that have had mining activities take place upstream. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed. Contaminated sediment must be removed from buildings, yards, and properties.

Dam failures may result in significant water quality and debris disposal issues. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooding waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals get added to flood waters. Water supplies and wastewater treatment could be off-line for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be disposed of properly.

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 dam failure hazard if within the identified hazard areas. The county intends to discourage development within vulnerable areas and to encourage higher regulatory standards on the local level.

While existing floodplain development regulations in place may offer some protection for new development located in these areas, such protections would likely not be sufficient in many instances in the event of a catastrophic dam failure. This results from a number of factors, such as the extent of the dam inundation areas may be larger than the regulated floodplain, and water depths and velocities may be stronger and higher than the 1% annual chance flood event.

Effect of Climate Change on Vulnerability

The climate of Pennsylvania is already changing and will continue to change over the course of this century. Precipitation is expected to increase over the next several decades. Future climate change may impact storm patterns, increasing the probability of more frequent, intense storms with varying duration. Since dam overtopping is often caused by excessive rainfall, it is appropriate to relate the future vulnerability of dams directly with the potential for increased rainfall in Fulton County.

Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs (flow over time). Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hydrograph changes, it is conceivable that the structure can lose some or all of its designed margin of safety, also known as freeboard. Loss of designed margins of safety may cause floodwaters to more readily overtop the dam or create unintended loads. Such situations could lead to a dam failure.

Climate change may increase the probability of dam failures, as indicated above. Changes in climate may lead to higher intensity rainfall events. As a result, the failure probability of low, significant, and under-designed high-hazard dams may increase.

Additional Data and Next Steps

This vulnerability assessment was based on the most current and best available data, including updated building and critical facilities inventories. For future Hazard Mitigation Plan (HMP updates), additional dam failure inundation areas can be delineated and used to spatially assess the asset exposure. A custom-general building stock could be generated for future plans to assess impacts at the structural level versus the census block level. Depth grids could be generated for the inundation areas and used in HAZUS-MH to estimate potential losses similar to Flood (Section 4.3.5).

4.3.2 Drought

This section provides a profile and vulnerability assessment of the drought hazard in Fulton 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] 2017).

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 cause 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.

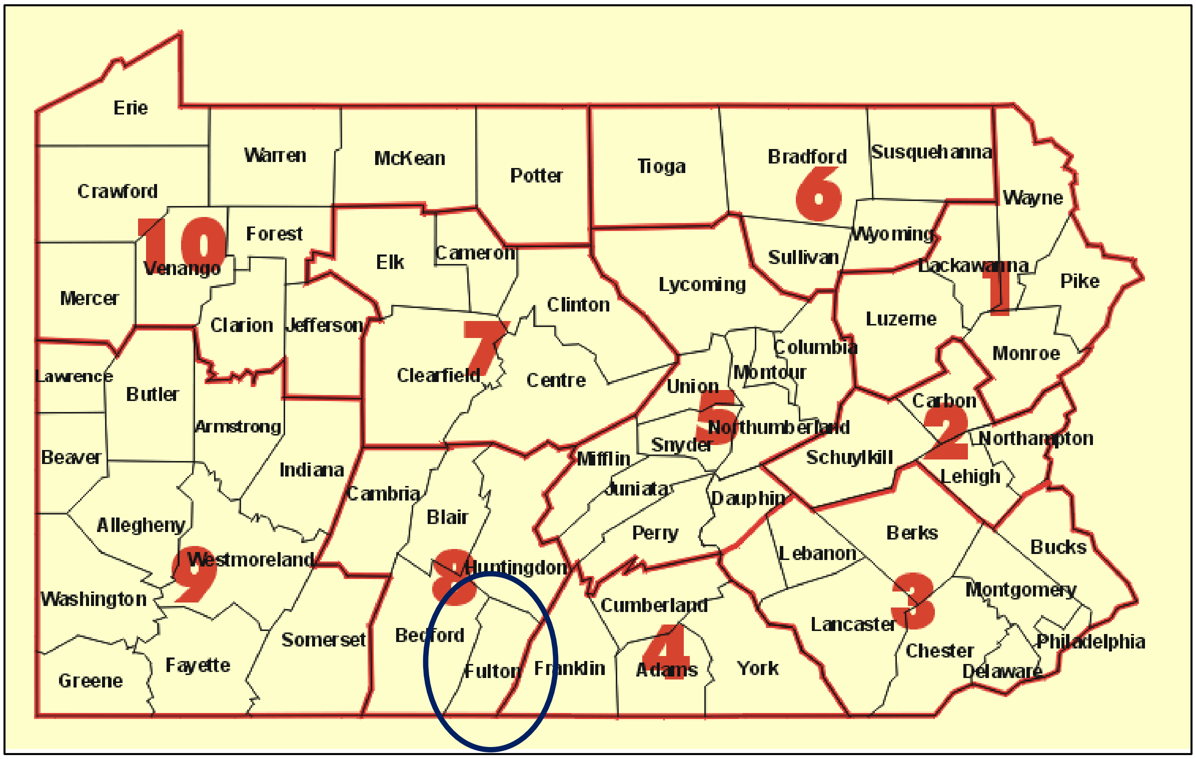
4.3.2.1 Location and Extent

Droughts are regional in scope and may affect the entirety of Fulton County rather than only individual municipalities within the county. Droughts may also concurrently affect counties near Fulton 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. NOAA has a map of these climate divisions nationally across the country (NOAA 2019). The boundaries of these divisions typically coincide with County boundaries, except in the western United States where they are based largely on drainage basins (National Weather Service [NWS] 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 4.3.2-1 shows the climate divisions of Pennsylvania. Fulton County is within the South Central Mountains climate division.

Figure 4.3.2-1 Climate Divisions of Pennsylvania



Source: *NWS 2005*

Notes: 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. Fulton County residents who depend on private domestic wells have this greater "hidden vulnerability" to droughts. According to the U.S. Geological Survey (USGS) National Water Information System, the average daily domestic self-supplied groundwater withdrawals of fresh water in Fulton County was 0.73 million gallons (Mgal) per day in 2015, serving roughly 12,176 residents for a total of roughly 65 gallons per person (dependent on well water) per day (USGS 2019).

Table 4.3.2-1 lists the number of reported domestic wells within each municipality of Fulton County. The well data were obtained from the Pennsylvania Groundwater Information System (PaGWIS). PaGWIS is maintained by Pennsylvania Department of Conservation and Natural Resources (PA DCNR) and relies on voluntary submissions of well data recorded 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 4.3.2-1. Domestic Wells in Fulton County

Municipality	Number of Reported Domestic Wells	Municipality	Number of Reported Domestic Wells
Ayr Township	223	Taylor Township	151
Belfast Township	145	Thompson Township	112
Bethel Township	212	Todd Township	107
Brush Creek Township	133	Union Township	131
Dublin Township	152	Valley-Hi Borough	3
Licking Creek Township	189	Wells Township	101
McConnellsburg Borough	0	**Fulton County**	**1,685**

Source: PA DCNR 2019

In addition to domestic wells in the county, residents may also receive their water from municipal water providers. According to the Pennsylvania Department of Environmental Protection (PA DEP) Drinking Water Reporting System, Fulton County has four community water systems for potable water: the Wells Tanner Water System, Belfast Township Municipal Authority, McConnellsburg Borough Municipal Authority, and the Leisure Living Retirement Home. Table 4.3.2-2 summarizes information for each community water system in Fulton County.

Table 4.3.2-2. Community Water Systems in Fulton County

Facility Name	Service Area	Population Served	Water Sources	Source Pumping Capacity (gpd)
McConnellsburg Borough Municipal Water Authority	McConnellsburg Borough, Ayr Township, Todd Township	2,000	Wells, Springs, Reservoirs	36,000-576,000
Belfast Township Municipal Authority	Belfast Township	276	Groundwater – one spring	340,000
Wells Tannery Water Authority	Village of Wells Tannery (Wells Township)	95	Groundwater - two wells	10,080-14,400
Leisure Living Retirement Home	Leisure Living Retirement Home (Fort Littleton)	40	Groundwater – one well	14,000

Source: PA DEP 2019

4.3.2.2 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 water resources 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

PA DEP and Pennsylvania Emergency Management Agency (PEMA) manage and describe water supply droughts according to the following three conditions of drought, as defined in the Commonwealth of Pennsylvania 2018 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. Drought watches are invoked when three or more drought indicators are present for a county or group of counties. 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. Due to 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: This stage is a phase of concerted management operations to marshal all available resources to respond to actual emergency conditions, to avoid depletion of water sources, to assure at least minimum water supplies to protect public health and safety, to support essential and high propriety water uses and to avoid unnecessary economic dislocations. It is possible during this phase to impose mandatory restrictions on It is possible during this phase to impose mandatory restrictions on non-essential water uses that are provided in the Pennsylvania Code (Chapter 119), if deemed necessary and if ordered by the Governor of Pennsylvania. The objective of water use restrictions (mandatory or voluntary) and other conservation measures during this phase is to reduce consumptive water use in the affected area by 15 percent, and to reduce total use to the extent necessary to preserve public water system supplies, to avoid or mitigate local or area shortages and to assure equitable sharing of limited supplies.
- Local Water Rationing: Although not a drought phase, local municipalities may, with the approval of the PA Emergency Management Council, implement local water rationing to share a rapidly dwindling or severely depleted water supply in designated water supply service areas. These individual water rationing plans, authorized through provisions of the Pennsylvania Code (Chapter 120), will require specific limits on individual water consumption to achieve significant reductions in use. Under both mandatory restrictions imposed by the Commonwealth and local water rationing, procedures are provided for granting of variances to consider individual hardships and economic dislocations (PEMA 2018).

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: Because rainfall provides the basis for ground and surface water resources, measuring the difference in precipitation from the normal (30-year average) tends to be the earliest indicator that a drought is possible in an area. PA DEP will compare the cumulative precipitation for varying time periods (minimum of 3 months, maximum of 12 months) each month against the normal, 30-year average value for each same timer-period. Any duration that has less than the normal is considered to have a deficit, represented by a percentage less than the normal precipitation. Table 4.3.2-3 lists the drought conditions (defined in the PA HMP and noted above) that are indicated by various precipitation deficit percentages (PEMA 2018).

Table 4.3.2-3. 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 2018

Table 4.3.2-4 lists normal monthly and annual precipitation from 1981 to 2010 (the most current three-decade data available) at the two NOAA weather stations in Fulton County. Data from the NOAA weather stations are available through the National Centers for Environmental Information (NCEI), which compiles monthly and annual normal total precipitation (inches) data retrieved from both NWS Cooperative Network (COOP) and Principal Observation (First-Order) locations throughout the United States.

Table 4.3.2-4. Normal Monthly and Annual Precipitation (total in inches) from 1981 to 2010 at NOAA Weather Stations in Fulton 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: NCEI 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. PA DEP uses 61 USGS-maintained stream gauges throughout the Commonwealth 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. The USGS 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 percent, 90 percent, and 95 percent exceedances of 30-day average flows (PEMA 2018). The National Weather Service tracks stream gages throughout the Commonwealth and provides real time information.
- Groundwater Levels: Groundwater levels for each day are used to calculate the average level of the preceding 30 days. This 30-day value is compared to the values derived from historical records yielding

a percentile indicating how much time the groundwater levels have been below the historical average levels. The USGS also maintains a network of groundwater monitoring wells, just recently upgraded to at least one well in each county. Groundwater is used to indicate drought status in a manner similar to stream flows. Groundwater level exceedances of 75, 90 and 95 percent are used to indicate watch, warning and emergency status. In this case, it is the 30-day average depth to groundwater that is measured and monitored, again in relation to long-term 30-day averages based on the period of record for each county well (PEMA 2018).

- Soil Moisture: Soil moisture is measured using an algorithm calibrated for relatively homogeneous regions that measures dryness based on temperature and precipitation in the area, which is information provided by the National Oceanic and Atmospheric Administration (NOAA). This generates a value called the Palmer Drought Severity Index (PDSI), which is compiled by the Climate Prediction Center of the National Weather Service on a weekly basis. A PDSI of -4.00 or less indicates a drought emergency; a value between -3.00 and -3.99 indicates a drought warning, and a value between -2.00 and -2.99 indicates a drought watch (PEMA 2018).
- Reservoir Storage Levels: Water level storage in several large public water supply reservoirs (especially three New York City reservoirs in the Upper Delaware River Basin) is the fifth indicator that the PA DEP uses for drought monitoring. Depending on the total quantity of storage and the length of the refill period for the various reservoirs, PA DEP uses varying percentages of storage draw down to indicate the three drought stages for each of the reservoirs (PEMA 2018).

Table 4.3.2-5 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 4.3.2-5. 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 (PA DEP 2009b), a joint effort by the Statewide Water Resources Committee and PA DEP. In 2009, the PA DEP 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 State Water 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 (PA DEP 2009b).

4.3.2.3 Past Occurrence

Historical information has been drawn from many sources regarding previous occurrences and losses associated with drought events throughout Pennsylvania and Fulton 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 NCEI storm events database, Fulton County underwent four drought events between January 1, 1950, and October 19, 2017: October 1997, December 1998, July 1999, and August 1999. No Commonwealth-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. Fulton County was included in one of these events, and full details are available in PEMA's Pennsylvania Disaster History list. In addition to these events, between 1980 and 2016, PA DEP indicated that Fulton County has undergone 28 drought watch declarations, 11 drought warning declarations, and 12 drought emergency declarations (PEMA 2018).

According to FEMA, between 1954 and 2017, 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 Fulton County has not been declared a disaster area as a result of a drought-related event (FEMA 2017).

Based on all sources researched, drought events between 1895 and 2017 that have affected Fulton County are identified in Table 4.3.2-6. However, not all sources have been identified or researched, and therefore Table 4.3.2-6 may not include all events that have occurred throughout the county.

Table 4.3.2-6. Past Occurrences of Drought Events from 1895 to 2017

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts / PDSI Value
September 1895 – May 1896	Drought	N/A	N/A	-4.81 in January 1896
November 1908 – March 1909	Drought	N/A	N/A	-4.38 in January 1909
November 1909 – December 1909	Drought	N/A	N/A	-3.99 in November 1909
November 1910 – December 1910	Drought	N/A	N/A	-3.53 in December 1910
November 1922 – April 1923	Drought	N/A	N/A	-4.29 in December 1922
July 1930 – July 1931	Drought	N/A	N/A	-7.13 in January 1931
November 1931 – February 1932	Drought	N/A	N/A	-3.95 in December 1931
November 1953 – February 1954	Drought	N/A	N/A	-4.1 in February 1954
October 1963 – December 1963	Drought	N/A	N/A	-4.12 in December 1963
October 1964 – December 1964	Drought	N/A	N/A	-3.77 in December 1964
June 1965 – February 1967	Drought	N/A	N/A	-5.32 in August 1966
July – September 1965	Drought	DR-206	N/A	-3.68 in August 1965
April 1969 – June 1969	Drought	N/A	N/A	-3.74 in May 1969
November 1980 – April 1982	Drought Emergency	N/A	N/A	Not listed
April – December 1985	Drought Watch	N/A	N/A	Not listed
July – August 1988	Drought Watch	N/A	N/A	Not listed
August – December 1988	Drought Warning	N/A	N/A	Not listed
March – May 1989	Drought Watch	N/A	N/A	Not listed
June – July 1991	Drought Warning	N/A	N/A	Not listed
July 1991	Drought	N/A	Yes	Governor Robert P. Casey – Governor's Proclamation

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts / PDSI Value
July 1991 – April 1992	Drought Emergency	N/A	N/A	Not listed
April – September 1992	Drought Warning	N/A	N/A	Not listed
September – December 1995	Drought Watch	N/A	N/A	Not listed
July – November 1997	Drought Watch	N/A	N/A	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 Watch	N/A	N/A	Not listed
January – March 1999	Drought Warning	N/A	N/A	Not listed
March – June 1999	Drought Watch	N/A	N/A	Not listed
June – July 1999	Drought Warning	N/A	N/A	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	N/A	Not listed
July 1999	Drought	N/A	N/A	No losses identified
August 1999	Drought	N/A	N/A	No losses identified
September 1999 – May 2000	Drought Watch	N/A	N/A	Not listed
August – December 2001	Drought Watch	N/A	N/A	Not listed
December 2001 – February 2002	Drought Warning	N/A	N/A	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	N/A	Not listed
November – December 2002	Drought Watch	N/A	N/A	Not listed
April – June 2006	Drought Watch	N/A	N/A	Not listed
August 2007 – January 2008	Drought Watch	N/A	N/A	Not listed
September – November 2010	Drought Warning	N/A	N/A	Not listed
August – September 2011	Drought Watch	N/A	N/A	Not listed
June – July 2015	Drought Watch	N/A	N/A	Not listed
August 2016 – February 2017	Drought Watch	N/A	N/A	Not listed

Sources: NRCC 2019; PEMA 2013; NCEI 2017; PA DEP 2017b

Notes:
FEMA Federal Emergency Management Agency
N/A Not applicable
PDSI Palmer Drought Severity Index

Table 4.3.2-7 lists the crop loss insurance payments on claims from Fulton County caused by drought events since 1948.

Table 4.3.2-7. Crop Loss Insurance Claims Due to Drought, 1948 to 2016

Crop Year	Total Claims	Crop Year	Total Claims
1948 - 1988	$0	2003	$0
1989	$0	2004	$3,515.00
1990	$0	2005	$110,145,90
1991	$0	2006	$142,677.50
1992	$0	2007	$277,016.26
1993	$174,284.75	2008	$150,567.70
1994	$20,030.60	2009	$91,795.80
1995	$30,481.25	2010	$540,299.22

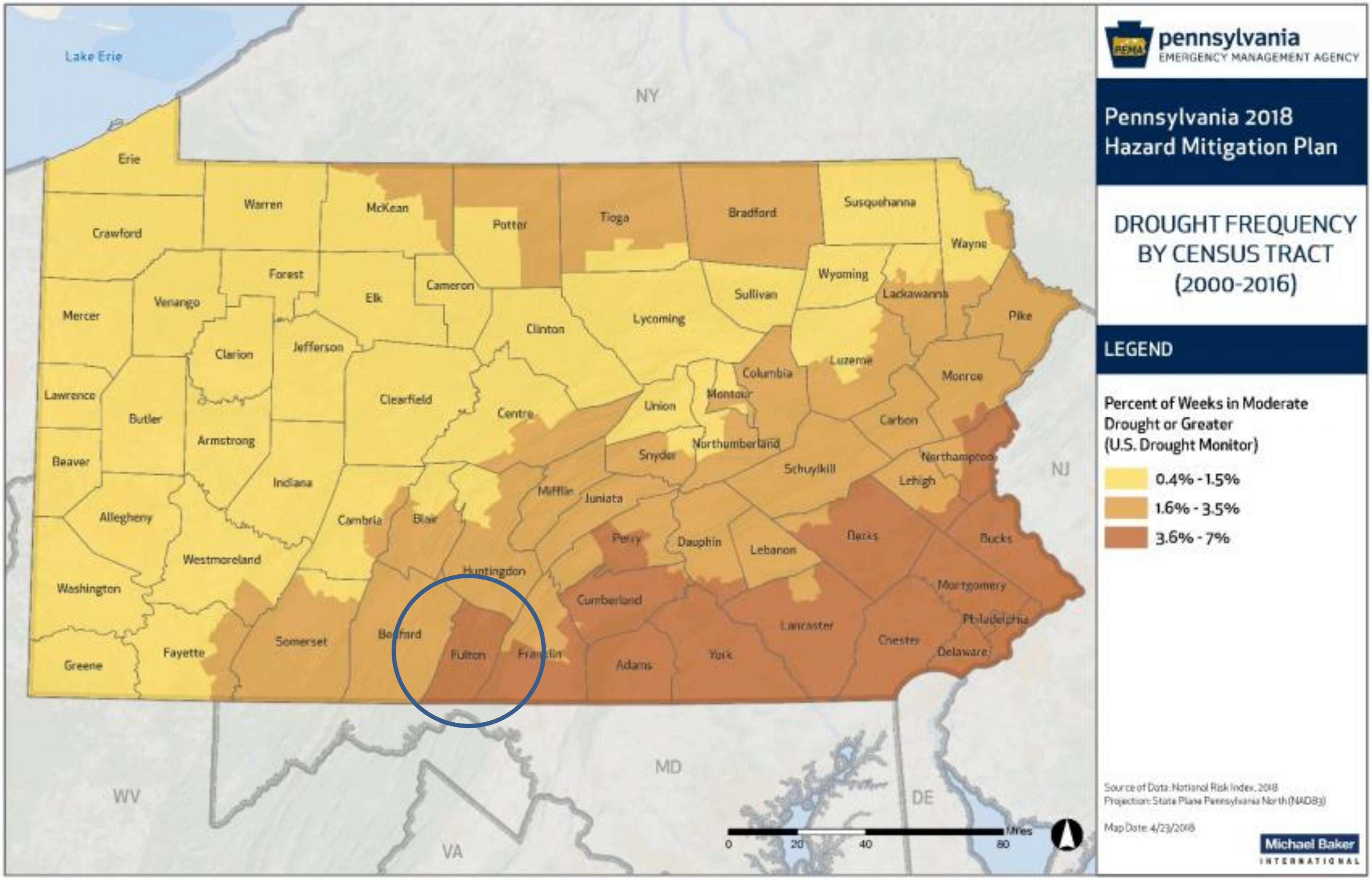
Crop Year	Total Claims	Crop Year	Total Claims
1996	$0	2011	$780,798.00
1997	$181,766.60	2012	$70,962.50
1998	$58,165.00	2013	$24,512.60
1999	$378,377.50	2014	$226,101.15
2000	$0	2015	$75,156.45
2001	$126,945.14	2016	$506,787.24
2002	$496,344,87	**Total**	**$4,466,732.44**

Source: U.S. Department of Agriculture (USDA) 2019a

4.3.2.4 Future Occurrence

Frequency of droughts is difficult to forecast. Based on data from a 16 year period, Fulton County underwent severe or extreme drought conditions less than 7 percent of the time (illustrated on Figure 4.3.2-2). Based on the drought conditions listed in Table 4.3.2-6, future occurrences of drought events are considered *likely*, as defined by the Risk Factor Methodology probability criteria (described in Section 4.4).

Figure 4.3.2-2. Percent of weeks that areas have been in moderate drought or greater



Source: PEMA 2018 (highlight added)

4.3.2.5 Vulnerability Assessment

To understand risk, a community must evaluate assets exposed and vulnerable within the identified hazard area. For the drought hazard, all of Fulton 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 Fulton 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 and critical facilities; (4) economy; (5) environment; and (6) future growth and development
- Effects of climate change on vulnerability

Overview of Vulnerability

Fulton 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.

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 4.3.12 of this HMP addresses the wildfire hazard in Fulton County.

Impact on the Economy

Drought events impact the economy, including loss of business function and damage and loss of inventory. Industries that rely on water for business may be impacted the hardest (e.g., agriculture). Even though a majority of businesses will still be operational, they may be impacted aesthetically. A prolonged drought can exert serious direct and indirect economic impacts on a community or across the county. Economic impacts may include:

- Losses from crop, livestock, timber, and aquaculture production and associated businesses.
- Losses from recreation providers and associated businesses.
- Losses related to the increased costs resulting from increased energy demand and from shortages caused by reduced hydroelectric generation capacity.

- Revenue losses for federal, state, and local governments from a reduced tax base and for financial institutions from defaults and postponed payments.
- Long-term loss of economic growth and development.

Loss estimates are based on lost agricultural revenues statewide. Table 4.3.2-8 below 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 over $12 million.

Table 4.3.2-9 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 $63 million (USDA 2017).

Table 4.3.2-8. Estimated County Losses Relating to Agricultural Crop Production

Crops	Inventory	Market Value of Agricultural Products
Grains, oilseeds, dry beans, dry peas	$5,065,000	**$12,253,000**
Vegetables, melons, potatoes, sweet potatoes	$337,000	
Fruits, tree nuts, berries	$197,000	
Nursery, greenhouse, floriculture, sod	$138,000	
Cultivated Christmas trees, short rotation woody crops	$137,000	
Other crops and hay	$6,380,000	

Source: USDA 2017

Table 4.3.2-9. Estimated County Losses Relating to Agricultural Livestock Production

Livestock and Poultry	Inventory	Market Value of All Livestock, Poultry, and Their Products
Poultry and eggs	$3,161,000	**$63,562,000**
Cattle and calves	$7,337,000	
Milk from cows	$24,872,000	
Hogs and pigs	$27,744,000	
Sheep, goats, wool, mohair, milk	$147,000	

Source: USDA 2017

Impact on the Environment

As summarized in the PA HMP (2018), the National Drought Mitigation Center at the University of Nebraska-Lincoln identified the following as environmental impacts from droughts:

- Damage to animal species in the form of reduced water and feed availability, degradation of fish and wildfire habitat, migration and concentration issues (too many or too few animals in a given area), stress to endangered species, and loss of biodiversity
- Lower water levels in reservoirs, lakes, and ponds
- Reduced stream flow
- Loss of wetlands
- Increased groundwater depletion, land subsidence, and reduced groundwater recharge
- Water quality impacts like salinity, water temperature increases, pH changes, dissolved oxygen, or turbidity
- Loss of biodiversity
- Loss of trees
- Increased number and severity of fires
- Reduced soil quality and erosion issues

- Increased dust or pollutants

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).

According to the Pennsylvania Climate Impacts Assessment 2015 Update, the likelihood for drought will decrease by the middle of the 21st century as months with above-normal precipitation increase but drying of surface soil across the coterminous United States in all seasons is still projected due to enhanced evapotranspiration. Soil moisture at root depth of crops is more useful for estimating agricultural drought. Resolution constraints and lack of detailed evapotranspiration process representation lead to lower confidence in projections with the soil moisture budget being less constrained (Wehner et al. 2017).

4.3.3 Earthquake

An earthquake is sudden movement of the Earth's surface caused by release of stress accumulated within or along the edge of the Earth's tectonic plates, a volcanic eruption, or a man-made explosion (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. Commonly occurs with shallow earthquakes—those with an epicenter of less than 20 kilometers (km).
- Ground motion (shaking): Movement of the Earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves 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: 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: Change in the original shape of a 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: Sloshing of a closed body of water, such as a lake or bay, from earthquake shaking (USGS 2012).

Ground shaking is the primary cause of earthquake damage to man-made structures. Damage can be increased when soft soils amplify ground shaking. Soils influence damage in different ways. Soft soils can amplify the motion of earthquake waves, producing greater ground shaking and increasing stresses on built structures on the land surface. Loose, wet, sandy soils also can cause damage when they 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 (A to E) distinguished by soil shear-wave velocity that alters severity of an earthquake; each classification is listed in Table 4.3.3-1. Class A soils (hard rock) reduce ground motion from an earthquake, and Class E soils (soft soils) amplify and magnify ground shaking, and increase building damage and losses.

Table 4.3.3-1. 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: Federal Emergency Management Agency (FEMA) 2013

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

4.3.3.1 Location and Extent

Focal depth and geographic position of the epicenter of an earthquake commonly determine its location. 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, events that occur in the Commonwealth involve very small impact areas (less than 100 kilometers in diameter). The most seismically active region in the Commonwealth is in southeastern Pennsylvania in the area of Lancaster County (PEMA 2018). Areas of Pennsylvania, including Fulton County, may be subject to the effects of earthquakes with epicenters outside the Commonwealth.

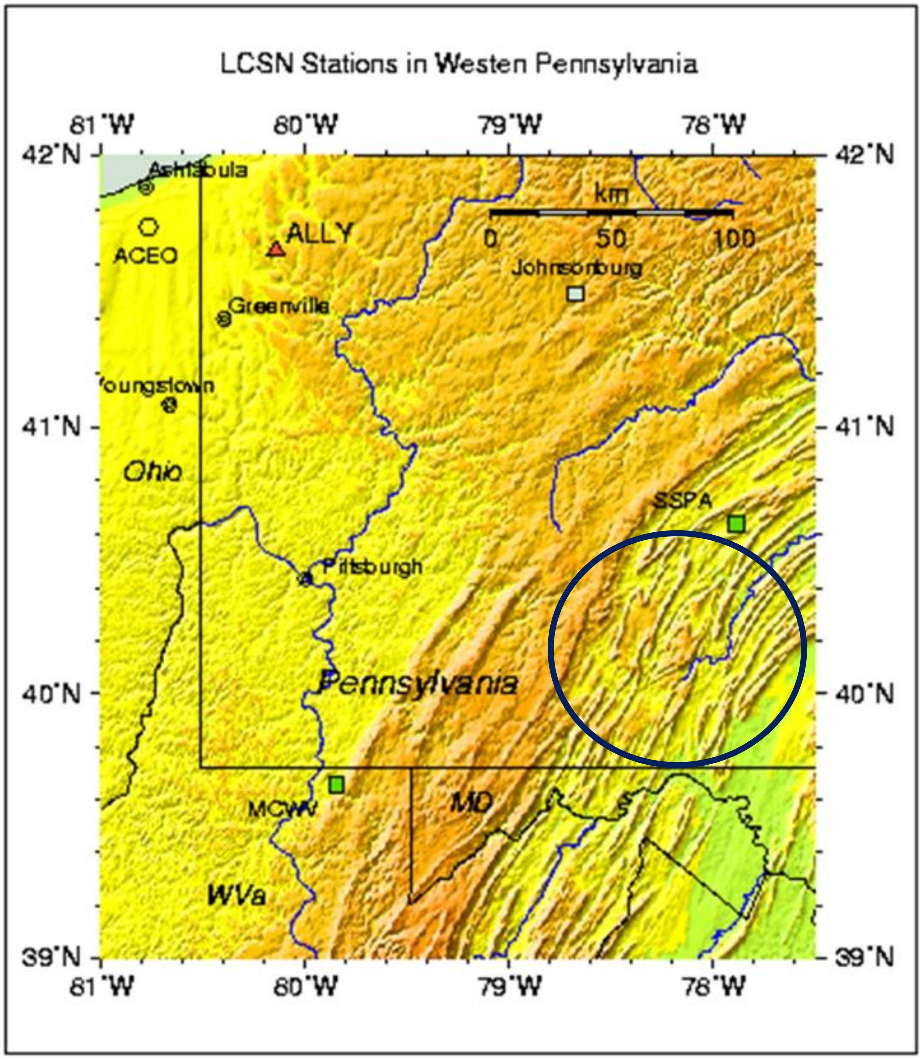
The Pennsylvania State Hazard Mitigation Plan includes a map of earthquake hazard zones throughout the Commonwealth (shown on Figure 4.3.3-1) (PEMA 2018). Fulton County falls within the lowest hazard zone with a 4-percent Peak Ground Acceleration (PGA) (USGS 2014).

Figure 4.3.3-1. Relative earthquake hazard zones of Pennsylvania

Source: PEMA 2018
Note: Fulton County is within the blue oval on the map.

The Lamont-Doherty Cooperative Seismographic Network (LCSN) monitors earthquakes that occur primarily in the northeastern United States. Goals of the project are to compile a complete earthquake catalog for this region, assess earthquake hazards, and study causes of earthquakes in the region. LCSN operates 40 seismographic stations in the following seven states: Connecticut, Delaware, Maryland, New Jersey, New York, Pennsylvania, and Vermont. Figure 4.3.3-2 shows locations of seismographic stations in eastern Pennsylvania. The figure shows three stations in Huntingdon, Pennsylvania; Meadville, Pennsylvania; and northern West Virginia. The network is composed of broadband and short-period seismographic stations (LCSN 2012).

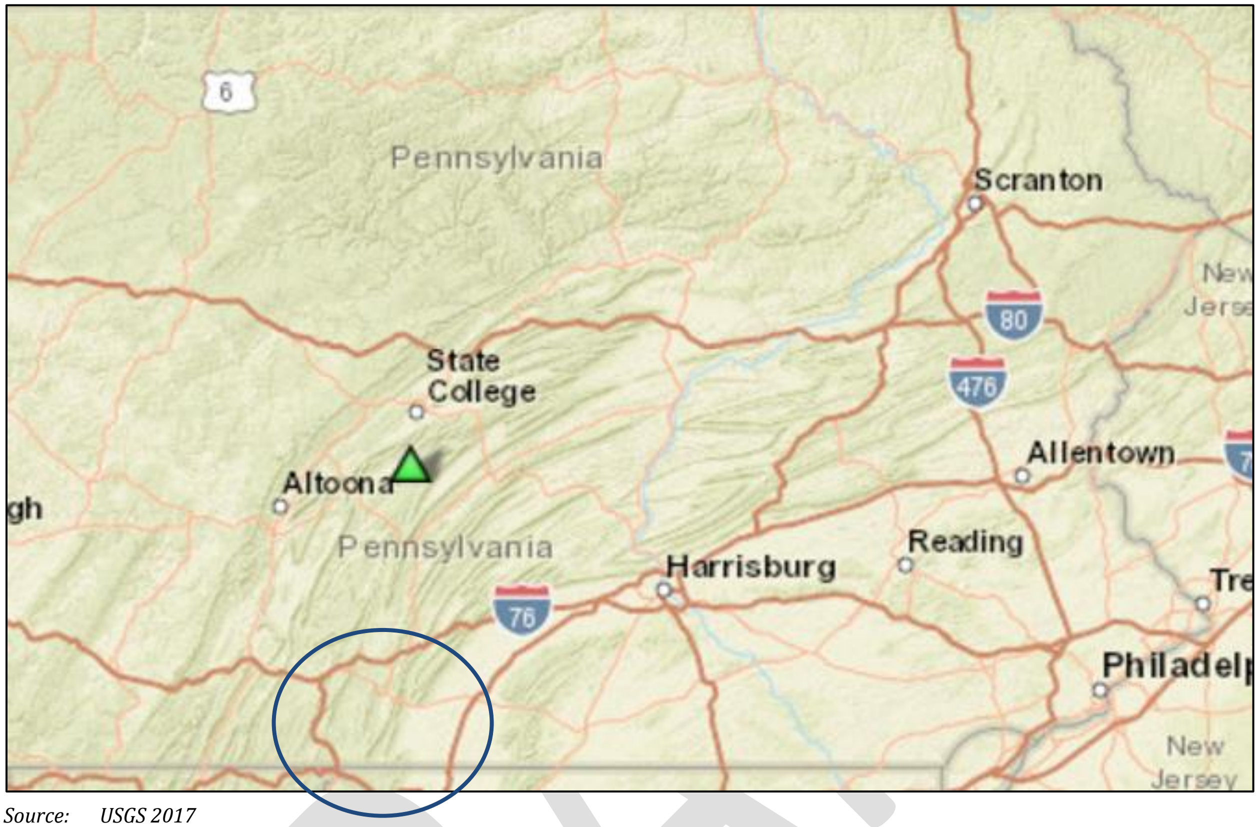
Figure 4.3.3-2. Lamont-Doherty Seismic Stations Locations in Western Pennsylvania



Source: LCSN 2012
Note: Fulton County is approximately located within the oval on the map.

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 within Fulton County, the closest station is in Huntingdon, Pennsylvania hosted by Pennsylvania State University (USGS, n.d.). Figure 4.3.3-3 shows the location of the closest seismic stations to Fulton County.

Figure 4.3.3-3. USGS Seismic Stations



Source: USGS 2017
Note: Seismic station location is indicated by green triangle, and Fulton County is within the blue oval.

The USGS manages 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 2017).

4.3.3.2 Range of Magnitude

Seismic waves are vibrations from earthquakes that travel through the Earth and are recorded on instruments called seismographs. The magnitude or extent of an earthquake is a given 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 sizes of earthquakes. The Richter scale is the most widely known scale that measures 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 undergo any damage. Table 4.3.3-2 lists Richter scale magnitudes and corresponding earthquake effects associated with each magnitude.

Table 4.3.3-2. Richter Scale Magnitudes

Richter Magnitude	Earthquake Effects
3.5 or less	Generally, not felt, but recorded
3.5 to 5.4	Often felt, but rarely causes damage
Under 6.0	At most, slight damage to well-designed buildings; can cause major damage to poorly constructed buildings over small regions.

Richter Magnitude	Earthquake Effects
6.1 to 6.9	Can be destructive up to about 100 kilometers from epicenter.
7.0 to 7.9	Major earthquake; can cause serious damage over large areas.
8.0 or greater	Great earthquake; can cause serious damage in areas several hundred kilometers across.

Source: PEMA 2018

Based on historical data of earthquakes with a recorded intensity, little damage is expected in Fulton County from earthquake events. However, because the worst earthquake recorded in Pennsylvania was a magnitude 5.2, a worst-case scenario for this hazard would be if an earthquake of similar magnitude occurred in Fulton County or near the border in an adjacent county, causing mild damage in populated areas.

The intensity of an earthquake is based on 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 intensity of an earthquake's effects in a given locality according to a scale from I to XII. Descriptions of MMI scales appear in Table 4.3.3-3. 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 Fulton County.

Table 4.3.3-3. 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 occurs	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

Source: PEMA 2018

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. 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 (percent g). For example, at 100 percent g PGA (equivalent to 1.0 g) during an earthquake (an extremely strong ground motion), objects accelerate sideways at the same rate as when they drop from a ceiling. At 10 percent g PGA, ground acceleration is 10 percent that of gravity (New Jersey Office of Emergency Management [NJOEM] 2011). 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 indicates three factors: (1) geographic area affected, (2) probability of an earthquake at each level of severity, and (3) strength of ground movement (severity) expressed in percent 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). Damage levels from an earthquake vary with intensity of ground shaking and with seismic capacity of structures, as noted in Table 4.3.3-4.

Table 4.3.3-4. Damage Levels Experienced in Earthquakes

Ground Motion Percentage	Explanation of Damages
1-2% g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10% g	Usually causes only slight damage, except in unusually vulnerable facilities.
10-20% g	May cause minor-to-moderate damage in well-designed buildings, with higher levels of damage in poorly designed buildings. At this level of ground shaking, only unusually poor buildings would be subject to potential collapse.
20-50% g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50% g	May causes higher levels of damage in many buildings, even those designed to resist seismic forces.

Source: NJOEM 2011
Note: % g Percent of force of gravity
PGA Peak Ground Acceleration

National maps of earthquake shaking hazards have been produced since 1948. These maps provide information essential for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning applied 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 organizations of engineers update seismic-risk maps and seismic design requirements specified in building codes (Brown and others 2001).

To analyze the earthquake hazard in Fulton County, a probabilistic assessment was conducted for the 500-year mean return period (MRP) in Hazards U.S.–Multi-Hazard (HAZUS-MH) v4.2. A HAZUS analysis evaluates 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.

Figure 4.3.3-4 illustrates the geographic distribution of PGA (percent *g*) across Fulton County for each event. Potential losses estimated by HAZUS-MH for the MRP and the associated PGA are discussed in the Vulnerability Assessment section (Section 4.3.3.5) of this profile.

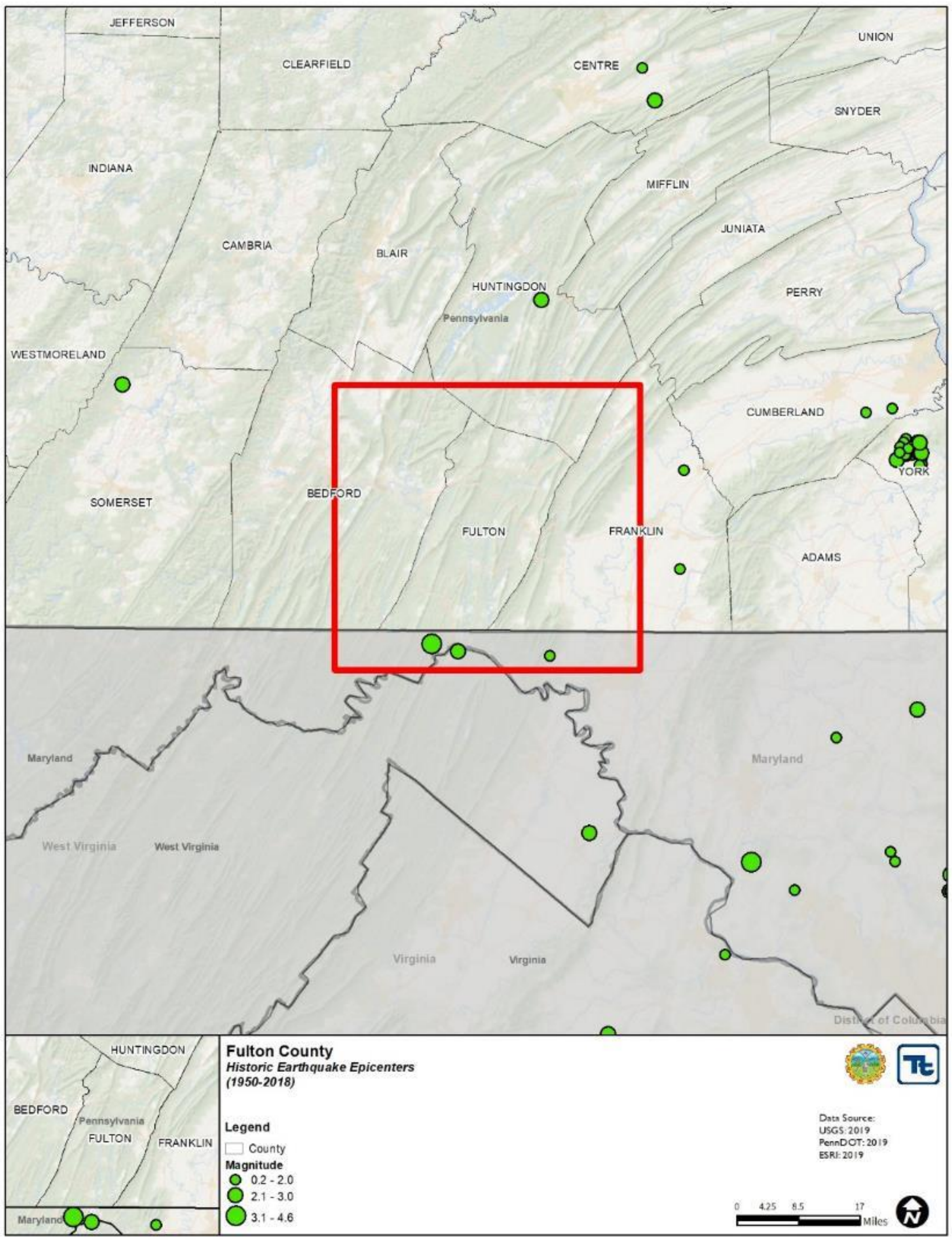
Figure 4.3.3-4. Peak Ground Acceleration Modified Mercalli Scale in Fulton County for a 500-Year MRP Earthquake Event

Source: HAZUS-MH v4.2
Note: The Peak Ground Acceleration for the 500-year MRP is 3.0-3.2%g.

4.3.3.3 Past Occurrence

The historical record of earthquakes goes back approximately 200 years. In Pennsylvania, about 35 earthquakes have caused light damage since the Colonial period. Nearly half of these events had out-of-state epicenters (PEMA 2018). Figure 4.3.3-5 is a map of earthquake epicenters in Pennsylvania from 1950 to 2018. No damages were reported in Fulton County.

Figure 4.3.3-5. Earthquake Epicenters in Pennsylvania (1950-2018)



Source: USGS 2019
Note: Fulton County is approximately located within the red square.

According to the USGS, there have been no earthquake epicenters recorded in Fulton County. PEMA's Pennsylvania Disaster History list includes no significant earthquake events in Pennsylvania, and no Federal Emergency Management Agency (FEMA) major disasters (DR) or emergency declarations (EM) have occurred for significant earthquake events in Pennsylvania (FEMA 2019).

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 (magnitude near 7.0) with its epicenter in a region of Quebec. If a similar-magnitude earthquake would 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.

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

4.3.3.4 Future Occurrence

Earthquakes cannot be predicted and could occur any time of the day or year. Major earthquakes are infrequent in the State and county and may occur only once every few hundred years or longer, but the consequences of major earthquakes may potentially be very high. Based on the historic record, the future probability of damaging earthquakes impacting Fulton County is low.

According to the USGS earthquake catalog, between 1950 and 2019, there have been no earthquakes with epicenters in Fulton County. Based on available historical data, future occurrences of earthquake events can be considered *possible* as defined by the Risk Factor Methodology probability criteria (Section 4.4).

4.3.3.5 Vulnerability Assessment

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

- 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

Earthquakes usually occur without warning and can be felt in areas at great distance from their point of origin. Extent of damage depends on density of population, as well as building and infrastructure construction in the area shaken by the quake. Some areas may be more vulnerable than others based on soil type, age of buildings, and building codes in place. Compounding potential for damage is that, historically, Building Officials Code Administration (BOCA) in the northeastern United States was developed to address local concerns including heavy snow loads and wind; seismic requirements for design criteria are not as stringent compared to the West Coast's reliance on the more seismically focused Uniform Building Code. Thus, a smaller earthquake in the northeastern United States can cause more structural damage than if it occured in the western part of the United States.

The entire population and general building stock inventory of the county are at risk for damage or loss from impacts of an earthquake. Potential losses associated with earth shaking were calculated for Fulton County for the 500-year MRP event. A summary of the data used and methodology applied for this assessment appears below, followed by impacts on population, existing structures, critical facilities, and the economy within Fulton County.

Impact on Life, Health, and Safety

Overall, the entire population of Fulton County is exposed to the earthquake hazard event. According to the 2013-2017 American Community Survey 5-Year Estimates, Fulton County has an estimated total population of 14,631 people. The numbers in the vulnerability assessment reflect the 2010 U.S. Census data because Hazards U.S.--Multi-Hazards (HAZUS-MH) v4.2 uses that as the default database for demographics data. The impact of earthquakes on life, health, and safety depends on the severity of the event. Risks to public safety and loss of life from an earthquake in Fulton 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 locations 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. Table 4.3.3-5 summarizes the estimated sheltering needs for Fulton County.

Table 4.3.3-5. Summary of Estimated Sheltering Needs for Fulton County

Scenario	Displaced Households	Persons Seeking Short-Term Shelter
500-Year Earthquake	2	1

Source: HAZUS-MH v4.2

Structural building damage correlates strongly to the number of injuries and casualties from an earthquake event (NYCEM 2003). Furthermore, different sectors of the community would be exposed to the hazard depending on time of day of occurrence. For example, HAZUS considers that maximum residential occupancy occurs at 2:00 a.m.; educational, commercial, and industrial sectors maximum occupancy at 2:00 p.m.; and peak commute time at 5:00 p.m. Whether affected directly or indirectly, the entire population would have to deal with consequences of earthquakes to some degree. Business interruption could prevent 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. HAZUS-MH v4.2 did not estimate any injuries, hospitalizations, and casualties as a result of the 500-year MRP event.

Impact on General Building Stock

The entire study area’s general building stock is considered at risk and exposed to this hazard. The HAZUS-MH v4.2 model estimates value of exposed building stock and loss (in terms of damage to exposed stock). The County Profile section of this HMP (Section 2) presents statistics on replacement values of general building stock (structure and contents).

A probabilistic model was run to estimate annualized dollar losses within Fulton County by application of HAZUS-MH v4.2. Annualized losses are useful for mitigation planning because they provide a baseline that can be used to compare (1) risk of one hazard across multiple jurisdictions, and (2) degree of risk of all hazards within each participating jurisdiction. Notably, annualized loss does not predict losses in any particular year. Estimated earthquake annualized losses are approximately $163K per year (building and contents) within 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 would directly or indirectly result from ground shaking (NYCEM 2003). NYCEM found a strong correlation between PGA and damage a building might undergo. The HAZUS-MH v4.2 model is based on the best available earthquake science and aligns with these statements. HAZUS-MH v4.2 methodology and model were used to analyze the earthquake hazard for the general building stock within Fulton County. Figure 4.3.3-4 earlier in this profile illustrates the geographic distribution of PGA (%*g*) across the county for the 500-year MRP event.

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 unreinforced 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 affect 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 age of buildings in its analysis. 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 v4.2 across the following damage categories: none, slight, moderate, extensive, and complete. Table 4.3.3-6 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. General building stock damage for these damage categories by occupancy class on a countywide basis is summarized for the 500-year event in Table 4.3.3-7.

Table 4.3.3-6. 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 crippled 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 2015a

Table 4.3.3-7. Estimated Buildings Damaged by General Occupancy for 500-year MRP Earthquake Event

Category	Average Damage State 500-Year MRP				
	None	Slight	Moderate	Extensive	Complete
Residential	6,271 (92.5%)	111 (1.5%)	32 (0.4%)	3 (0.0%)	0 (0.0%)
Commercial	276 (3.8%)	5 (0.1%)	1 (0.0%)	0 (0.0%)	0 (0.0%)
Industrial	112 (1.5%)	2 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Education, Government, Religious, and Agricultural	157 (2.2%)	2 (0.0%)	1 (0.0%)	0 (0.0%)	0 (0.0%)

Source: HAZUS-MH v4.2

Table 4.3.3-8 summarizes estimated building value (buildings and contents) for the 500-year MRP earthquake event. Damage loss estimates include structural and non-structural damage to buildings and loss of contents. Losses for each municipality are less than 1 percent of their total replacement cost value.

Table 4.3.3-8. Estimated Building Value (Building and Contents) Damaged by the Annualized, 500-Year MRP Earthquake Event

Municipality	Total Replacement Cost Value (Building and Contents)	Estimated Total Damages*		Estimated Residential Damage	Estimated Commercial Damage
		Annualized Loss	500-Year	500-Year	500-Year
Ayr Township	$328,056,000	$1,210	$101,915	$68,558	$16,152
Belfast Township	$181,485,000	$703	$63,689	$54,618	$4,409
Bethel Township	$243,010,000	$941	$85,281	$73,134	$5,904
Brush Creek Township	$110,481,000	$351	$36,840	$31,370	$2,524
Dublin Township	$153,284,000	$488	$51,113	$43,523	$3,502
Licking Creek Township	$203,625,000	$648	$67,900	$57,817	$4,653
McConnellsburg Borough	$276,419,000	$1,020	$85,873	$57,767	$13,610
Taylor Township	$141,644,000	$451	$47,232	$40,218	$3,236
Thompson Township	$155,461,000	$602	$54,557	$46,786	$3,777
Todd Township	$298,975,000	$1,103	$92,880	$62,481	$14,721
Union Township	$106,265,000	$411	$37,292	$31,981	$2,582
Valley-Hi Borough*	$5,827,000	$19	$1,943	$1,655	$133
Wells Township	$58,946,000	$188	$19,656	$16,737	$1,347
Fulton County	**$2,263,478,000**	**$8,133**	**$746,171**	**$586,646**	**$76,550**

Source: HAZUS-MH v4.2
Notes:
Total amount is sum of damages for all occupancy classes (residential, commercial, industrial, agricultural, educational, religious, and government).

An estimated $748,000 in damages would occur to buildings in the county during a 500-year earthquake event. This takes into account structural damage, non-structural damage, and loss of contents, representing less than 1 percent of total replacement value for general building stock in Fulton County (total replacement value within the county would exceed $2.2 billion). Earthquakes can cause secondary hazard events such as fires. According to the HAZUS-MH earthquake model, no fires are anticipated as a result of the 500-Year MRP event.

Impact on Critical Facilities

After consideration of general building stock exposed to and damaged by each 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 Fulton County are considered exposed and vulnerable to the earthquake hazard. The Critical Facilities subsection of this HMP in Section 2 (County Profile) discusses the inventory of critical facilities in Fulton County.

HAZUS-MH v4.2 estimates the probability that critical facilities may sustain damage as a result of the 500-year MRP earthquake event. Additionally, HAZUS-MH v4.2 estimates percent functionality of each facility days after the event. Table 4.3.3-9 (500-year MRP earthquake event) lists percent probabilities that critical facilities and utilities would sustain damages within the damage categories (column headings), and list percent functionalities after different numbers of days following those events (column headings).

Table 4.3.3-9. Estimated Damage to and Loss of Functionality of Critical Facilities and Utilities in Fulton 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	94	3	1	0-1	0-1	94	98	100	100
Police	94	3	1	0-1	0-1	94	98	100	100
Fire	95	3	1	0-1	0-1	94	98	100	100
EOC	0	0	0	0-1	0-1	100	100	100	100
School	94	3	1	0-1	0-1	94	98	100	100
Utilities									
Potable	99	0-1	0-1	0	0	100	100	100	100
Wastewater	99	0-1	0-1	0	0	100	100	100	100
Electric	99	0-1	0-1	0	0	100	100	100	100
Communication	99	0-1	0-1	0	0	100	100	100	100

Source: HAZUS-MH v4.2
Notes:
EOC = Emergency Operations Center

Impact on Economy

Earthquakes also impact the economy, including loss of business function, damage to inventory (buildings, transportation, and utility systems), relocation costs, wage loss, and rental loss due to repair and replacement of buildings. HAZUS-MH v4.2 estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by HAZUS-MH v4.2 are summarized in Table 4.3.3-10

Table 4.3.3-10. Building-Related Economic Losses from the 500-Year MRP Earthquake Event

Level of Severity	Mean Return Period 500-year
Income Losses	
Wage	$30,000
Capital Related	$21,600
Rental	$62,400
Relocation	$189,500
Subtotal	**$303,500**
Capital Stock Losses	
Structural	$269,200
Non-Structural	$392,800
Content	$56,700
Inventory	$2,200
Subtotal	**$747,900**

Source: HAZUS-MH v4.2.

For a 500-year event, HAZUS-MH 4.2 estimates that the county would incur approximately $8.5 million in income losses (wage, rental, relocation, and capital-related losses) in addition to structural, non-structural, and content building stock losses ($748,000).

The HAZUS-MH v4.2 analysis did not take into account damage to roadway segments. However, these features assumedly would undergo damage as a result of ground failure, and an earthquake event thus would interrupt regional transportation and distribution of materials. According to HAZUS-MH Earthquake User Manual, losses to the community resulting from damages to lifelines could be much greater than costs of repair (FEMA 2015a).

Earthquake events can significantly damage road bridges; this is 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 degree of vulnerability is age of a facility, which helps indicate the standards the facility was built to achieve.

HAZUS-MH Earthquake User's Manual also estimates 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 transport, and (2) brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2015a).

Table 4.3.3-11 summarizes the estimated debris generated by the earthquake scenario in HAZUS-MH v4.2.

Table 4.3.3-11. Estimate Debris Generated by 500-year MRP Earthquake Event

Municipality	500-Year	
	Brick/Wood (tons)	Concrete/Steel (tons)
Ayr Township	221	54
Belfast Township	199	38
Bethel Township	199	38

Municipality	500-Year	
	Brick/Wood (tons)	Concrete/Steel (tons)
Brush Creek Township	203	40
Dublin Township	203	40
Licking Creek Township	203	40
McConnellsburg Borough	221	54
Taylor Township	203	40
Thompson Township	199	38
Todd Township	221	54
Union Township	199	38
Valley-Hi Borough	203	40
Wells Township	203	40
Fulton County	**2,673**	**557**

Source: HAZUS-MH 4.2

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 damages, spillage of hazardous materials (HazMat), 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 the county. Human exposure and vulnerability to earthquake impacts in newly developed areas are anticipated to be similar to those current 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

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 be magnified by climate change. Soils saturated by repetitive storms could undergo 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. No current models are available to estimate these impacts.

Additional Data and Next Steps

Ground shaking is the primary cause of earthquake damage to man-made 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 NEHRP developed five soil classifications defined by their shear-wave velocity that alter severity of an earthquake. These soil classifications range from A to E, whereby 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 v4.2 to further refine the county's vulnerability assessment.

A HAZUS-MH v4.2 earthquake analysis was conducted for Fulton County by use of the default model data. Additional data needed to further refine and enhance the county's vulnerability assessment includes identifications of unreinforced masonry critical facilities and privately-owned buildings (i.e., residences) via local knowledge and/or pictometry/orthophotos. Use of soil type data can also lead to more accurate estimates of potential losses to the county. These buildings may not withstand earthquakes of certain magnitudes and plans to provide emergency response/recovery efforts for these properties can be established. 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.

4.3.4 Environmental Hazard

This section provides a profile and vulnerability assessment of the environmental hazard profile for Fulton County.

The U.S. Department of Transportation's (DOT) Federal Motor Carrier Safety Administration (FMCSA) categorizes hazardous materials (HazMat) into the following nine classes based on chemical characteristics producing the risk (FMCSA 2019):

- Class 1: Explosives
- Class 2: Gases
- Class 3: Flammable liquids
- Class 4: Flammable solids
- Class 5: Oxidizing substances; organic peroxides
- Class 6: Poisonous and infectious substances
- Class 7: Radioactive materials
- Class 8: Corrosives
- Class 9: Miscellaneous Dangerous Goods

Fulton County is home to 11 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.

Additionally, Concentrated Animal Feeding Operations (CAFO) will be discussed under this hazard profile. CAFOs have been identified as a priority concern by multiple County residents and municipalities, due to their prevalence in Fulton County. While Animal Feeding Operations (AFOs) provide a valuable resource to the livestock industry and contribute to overall affordability of animal products for consumption, they also contribute to negative environmental and human health impacts. According to the Environmental Protection Agency (EPA), AFOs consist of facilities that keep and raise animals in confined situations, thus congregating animals, feed, manure and urine, dead animals, and overall production operations on a small land area. Operations are considered to be an AFO if the animals are confined at least 45 days in a 12-month period, and if there is no grass or other vegetation in the confinement area during the normal growing season. CAFOs are AFOs that meet certain EPA criteria (regarding number of animals and pollutants/waste management dispersal), and they consist of about 15 percent of all AFOs. Although CAFOs can augment the severity of a number of natural and non-natural hazards, this area is being highlighted under the Environmental Hazards profile, as the CAFO's greatest impacts connect to the higher quantity of pollutants and waste produced by the animals.

4.3.4.1 Location and Extent

Based on past occurrences, HazMat releases within Fulton 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.

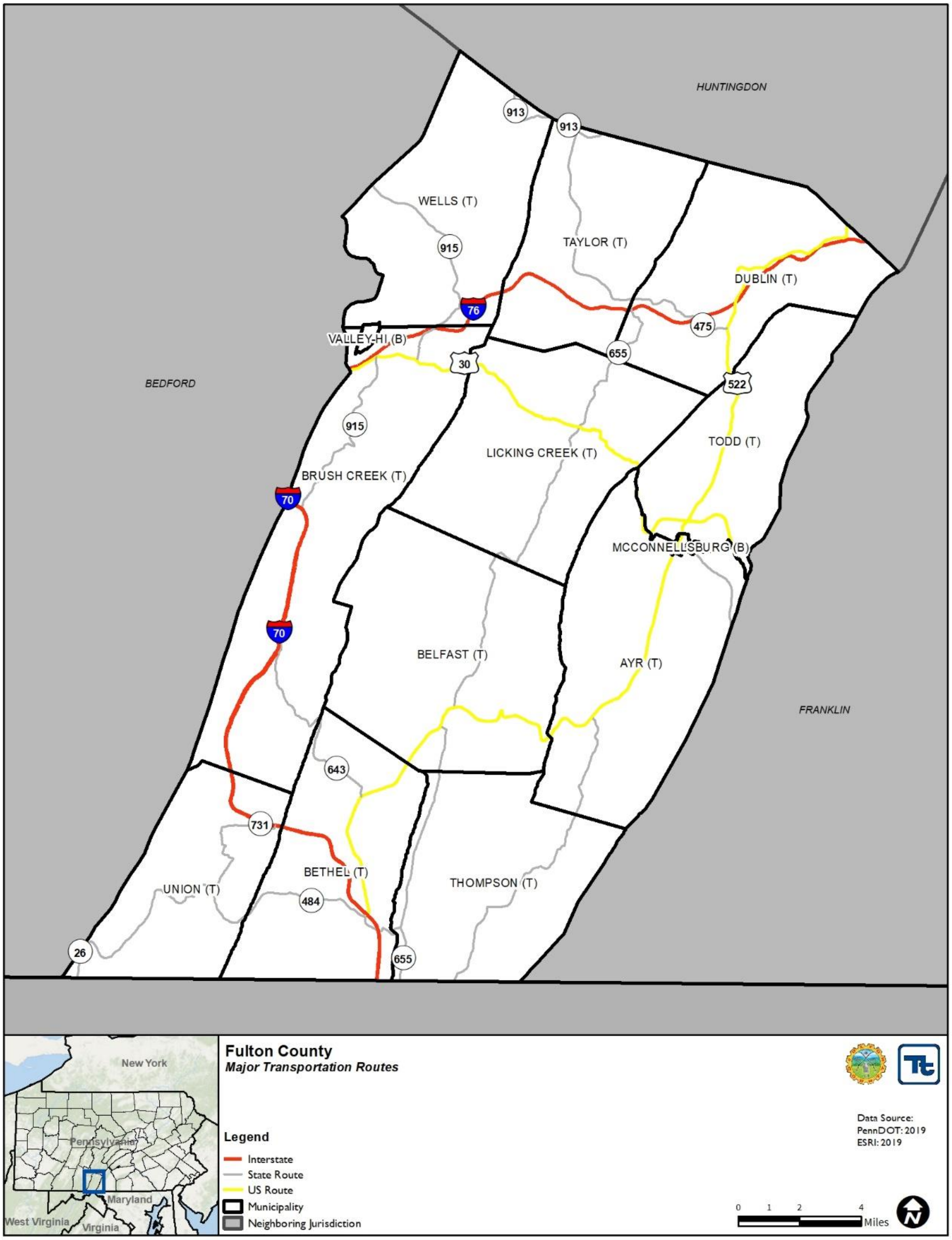
Fulton County is home to 686.3 miles of roadways, including 38.9 miles of interstate highway, 24.2 miles of principal arterial roads, 48.7 miles of minor arterial roads, and over 461.2 miles of local roads. With nearly 700 miles of roadways linking more-populated areas with rural communities, the grid work of roadways facilitates free movement of HazMat throughout the region. 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 Fulton County are listed as follows (and shown in red on Figure 4.3.4-1):

- Pennsylvania Turnpike (I-76)
- Interstate 70 (I-70)
- U.S. Highway 522 (US-522)
- U.S. Highway 30 (US-30)
- PA State Highway 16 (PA-16).

The U.S. 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 an amount over a certain specified level 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 that it is emitted to the air or water or placed in some type of land disposal. The EPA publishes all TRI data in a publicly accessible database in Envirofacts. In 2017, three TRI facilities in Fulton County reported to EPA. Fulton County TRI releases consist of only 0.85% of total TRI releases/transfers in Pennsylvania (EPA 2019).

Figure 4.3.4-1. Major Roadways Used to Transport Hazardous Materials in Fulton County



Fulton County is home to approximately 15 CAFOS. The CAFOs are of varying sizes and most contain either turkeys or pigs. Fulton County is home to a greater number of pig CAFOs than turkey CAFOs. No one jurisdiction in the County is noteworthy for being home to more CAFOs than another.

Per EPA regulations, an AFO must meet certain thresholds to be considered a CAFO. CAFOs can be divided by size categories into large, medium, and small. A large CAFO confines a minimum of the number of animals listed in the table below. A medium CAFO confines the number of animals in the range listed in the table below, and also (1) has a man-made ditch or pipe to carry manure or wastewater to surface water or (2) the animals come into contact with surface water that passes through the area where they are confined. A permitting authority may choose to designate a medium-sized facility as a CAFO if found to be a significant contributor of pollutants. A small CAFO confines fewer than the number of animals listed below and has been designated as a CAFO by the permitting authority if it is a significant source of pollutants.

Table 4.3.4-1. Regulatory Thresholds to Define Large, Medium, and Small CAFOs

Animal Sector	Size Thresholds (Number of Animals)		
	Large CAFO	Medium CAFO*	Small CAFO**
Cattle or Cow/Calf Pairs	1,000 or more	300-999	Less than 300
Mature Dairy Cattle	700 or more	200-699	Less than 200
Veal Calves	1,000 or more	300-699	Less than 300
Swine (weighing over 55 pounds)	2,500 or more	750-2,499	Less than 750
Swine (weighing less than 55 pounds)	10,000 or more	3,000-9,999	Less than 3,000
Horses	500 or more	150-499	Less than 150
Sheep or Lambs	10,000 or more	3,000-9,999	Less than 3,000
Turkeys	55,00 or more	16,500-54,999	Less than 16,500
Laying Hens or Broilers (Liquid Manure Handling Systems)	30,000 or more	9,000-29,999	Less than 9,000
Chickens Other than Laying Hens (Other than a Liquid Manure Handling System)	125,000 or more	37,500-124,999	Less than 37,500
Ducks (Other than a Liquid Manure Handling System)	30,000 or more	10,000-29,999	Less than 10,000
Ducks (Liquid Manure Handling System)	5,000 or more	1,500-4,999	Less than 1,500

* Must also meet one of two "method of discharge" criteria to be defined as a CAFO or may be designated.
** Never a CAFO by regulatory definition but may be designated on a case-by-case basis.

Source: EPA, 2015

4.3.4.2 Range of Magnitude

Environmental hazard incidents within Fulton 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. 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 the greatest risk; however, depending on the material, 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, and mitigating conditions are characteristics of the target and its physical environment that can reduce effects of a hazard. These conditions are described below.

- 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 large-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.

- 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.

Although most recognized for their pollutant contributions, CAFOs can increase the impacts of a hazard event for a variety of hazards, including public health, security, flooding, fire, transportation accidents, and drought. For this reason, CAFO operations require careful management and supervision. As noted above, CAFOs have been highlighted in the Environmental Hazards profile due to their direct connection with environmentally hazardous events; however, all potential impacts will be noted.

The EPA monitors CAFO sites for pollutant control as improperly managed manure and wastewater can negatively impact the environment and public health. This monitoring occurs via the delegation of federal authority to the Pennsylvania Department of Environmental Protection (PA DEP), which in turn delegates its authority of monitoring CAFO sites to the Pennsylvania State Conservation Commission (PA SCC). The PA SCC delegates its authority to local-level county conservation districts so that monitoring and enforcement can occur on a local level. While monitoring at federal, state, and local levels is designed to be as comprehensive as possible, not all information is available to be tracked due to voluntary report statuses, lack of sufficient resources, and competing governmental priorities. The incomplete records for CAFO sites leads to increased resident concern about the impact of pollutant control for CAFOs on County residents, air quality, land/soil quality, and water quality. Residents have also expressed concern about the voluntary nature of most reporting mechanisms regarding CAFOs, particularly with concern to the management and transport of animal waste and manure. The EPA has also documented this area of weakness. Additionally, while farming operations are required to develop Manure Management Plans, these plans do not need to be kept on file by local-level conservation districts. Although farming operations must provide these plans to enforcement officers upon request, the lack of regular reports and immediate access decreases accountability and lessens the ability of independent confirmation.

Manure and wastewater have the potential to introduce nitrogen and phosphorus, organic matter, sediments, pathogens, heavy metals, hormones, and ammonia to the environment. Potential impacts from any of these pollutants can include excess nutrients in the water (e.g., nitrogen and phosphorus), leading to low levels of dissolved oxygen and fish kills; decomposing organic matter that can contribute to toxic algal blooms; degraded water resources; respiratory problems in workers and local residents; and increased chance of illness through the exposure of wastes and pathogens in drinking water.

Regarding the increased potential for illness, several scientific publications and institutions (including Science Daily, the Johns Hopkins School of Public Health, and the National Institute of Health) have noted that exposure to CAFO and manure fertilizers may increase the frequency of Methicillin-Resistant Staphylococcus Aureus (MRSA). MRSA is caused by strains of bacteria that have developed resistance to more widely used antibiotics. Staphylococcus (Staph) is a common bacteria on the human body; however, if an antibiotic-resistant strain of Staph enters the human body, it may be resistant to methicillin, amoxicillin, penicillin, oxacillin, and other common medical treatments. Insect-borne diseases also present a greater threat of infection to residents, necessitating CAFO facilities to consider animal care in addition to manure management.

Another potential hazard from CAFOs concerns animal mortality management. Increased animal mortality can contaminate the water table, soil, and air. If animals in a CAFO were to become infected with a highly infectious and fatal virus that leads to a large loss of animals in a short period of time (e.g., a pig CAFO becoming infected with Porcine Epidemic Diarrhea Virus [PEDv]), the facility may have difficulty in adequately disposing of all the animal remains.

While CAFO operations have come under increasing regulations in the past few years to decrease their potential environmental and public health impacts, one area which is still under-regulated is transportation accidents. Manure and animal waste from CAFOs is frequently transported to and from the facility without significant oversight. Were an accident to occur, this could lead to a HazMat incident in the County or in neighboring counties. HazMat incidents could also occur through other forms of manure spills, such as while pumping manure, while removing animal waste from a manure pit, or while applying manure in the field.

The other hazards that could be magnified by a CAFO have been described, with potential impacts, in the list below.

- **Security** – As with other environmental hazards, events can either be accidental or deliberate in nature. While most environmental events in the County would be accidental, CAFO sites should still consider the possibility of deliberate incidents. If a CAFO does not maintain appropriate security measures, it could become a potential terrorist target due to the wide scope and impact of a HazMat incident.
- **Flooding** – A CAFO located near a river or body of water, particularly one with a tendency to flood during storm events, can increase the chance of freshwater and stormwater contamination. The EPA notes that many AFOs currently lack sufficient stormwater management guards. If a local river floods into a CAFO's land, animal waste and manure may enter the stream and, ultimately, contaminate local drinking water.
- **Fire** – Animal waste contains a higher rate of methane and may be a fire hazard if not adequately controlled for. Additionally, if an unrelated wildfire were to occur, the need for animal evacuation could create transportation difficulties.
- **Drought** – Due to the large number of animals maintained in a CAFO, such facilities require a significant amount of drinking water. This could lead to potential exacerbation of water resource management problems during a drought. Additionally, residents have noted concern about the potential for well water contamination should wastewater and other animal waste not be sufficiently regulated.

The worst-case scenario would be a large, uncontrolled release of a toxic gas within a major urban area. In Fulton County, this could take the form of an accident and major rupture of a tanker hauling a toxic or flammable gas in or near McConnellsburg 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 1,037 people in McConnellsburg Borough alone (U.S. Census Bureau 2018). Other municipalities are vulnerable to HazMat releases along US 522 and other routes. 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.

4.3.4.3 Past Occurrence

Fulton County is approximately 2 hours away, by road, from both Baltimore, MD, and Harrisburg, PA. The County's relative proximity to these more urban areas could eventually lead to an increase in transportation of HazMat via road or air. These transportation routes, combined with the fixed-site facilities and end users of HazMat, could be locations of frequent chemical and petroleum-product release incidents throughout the County, with several deemed as serious events.

The County has undergone HazMat release accidents at facilities and along roadways. Most incidents have involved spills of petroleum products or release of natural gas or propane; these incidents have easily been contained. At least one chemical spill of an unknown substance was documented in Thompson Township in 2007, and one call for an abandoned explosive detonation cord was made in Bethel Township in 2004. Fulton County has an annual contract with EP&S of Vermont, based out Harrisburg, for cleanup of larger HazMat incidents (previously, the County contracted with Cumberland County's Special Hazards Operation Team [SHOT]). Local records do not indicate any HazMat release accidents or explosions since 2010. However, these statistics may not be comprehensive. The reporting requirements from the State changed in 2007, allowing State agencies to categorize incidents as something other than "Hazardous Materials." For instance, a vehicle collision resulting in a spill of petroleum products (e.g., gasoline, motor oil) may be reported as a vehicle accident instead of a HazMat release. In the case of an explosion, the explosive event may not be the primary incident. Rather, the incidents may be based on events that led up to an explosion.

Fulton County also tracks releases of chemicals into air, water, or land disposal units. This information is then published by EPA. In 2017, Fulton County disposed of a total of 1,200 pounds of toxic chemicals, with disposal of 3,445 pounds on-site (through air) and 6,600 pounds off-site. The top five TRI chemicals released by air included manganese (43 percent), ethylene glycol (31 percent), creosote (16 percent), nitric acid (7 percent), zinc compounds (2 percent). The top TRI chemicals released off site consisted of manganese (81 percent), nickel (13 percent), and zinc compounds (6 percent). The amount of 2017 TRI releases decreased from the 2016 disposal amount of 2,374 pounds and the 2015 disposal amount of 3,133 pounds.

The County has documented in Table 4.3.4-4.3.4-2 several instances of manure-related HazMat incidents or spills whose frequency may have been exacerbated by the presence of local CAFOs. Additionally, an incident may not be identified as being connected to or worsened by a nearby CAFO because of voluntary report standards and because this issue is not always noted in the media.

Table 4.3.4-4.3.4-2. Fulton County Manure-related HazMat Incidents

Date	Location	Impacts
March 2002	Brush Creek Tributary	Manure spill of over 770,000 gallons from a concrete pit under a pig farm occurred in Crystal Spring.
July 2004	Buck Hollow Road/Big Cove Tannery	Manure and pollutant spill from a dairy farm resulted in dead fish at hatchery in the area of Big Cove Tannery. Manure contaminated an unnamed tributary to Esther Run.
October 2007	Big Cove Creek	Manure spill of over 200,000 gallons from a dairy farm occurred just north of McConnellsburg.
November 2009	Big Cove Creek	Manure spill occurred at a dairy farm, with an estimated tens of thousands of gallons spilled. Slurry manure flowed about 1,500 feet from the manure storage pit into Big Cove Creek. The Pennsylvania Fish and Boat Commission documented over 1,000 dead fish in a segment of the stream less than a mile long.

4.3.4.4 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 happen at any time. Additionally, the County is home to 11 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 I-70, I-76, US-30, US-522, PA-26, PA-475, PA-484, PA-643, PA-655, PA-731, PA-913, PA-915. Transportation of HazMat on highways involves 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.

As with other environmental hazards, the wide scope and ability for CAFOs to impact environmental releases or other hazard incidents means that an event could occur at any time. This event is difficult to predict as many factors contribute to an event occurrence. Additionally, smaller incidents may occur and not be reported, or they may be labeled as a different type of hazard event. Fulton County is investigating ways to better document CAFO-related environmental events due to local interest in the subject.

While HazMat release incidents in Fulton 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 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, the likelihood of future occurrences within Fulton County remains likely.

4.3.4.5 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 roadways, are examined. The following sections evaluate and estimate potential impacts in Fulton County, presenting specifically:

- 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
- Effect of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time.

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 11 SARA Title III facilities.

As stated above, hazardous materials are transported via rail, pipeline, and along major roadways in the County, including two interstates (I-70, I-76), U.S. Highways (US-30, US-522), and eight state Highways PA-26, PA-475, PA-484, PA-643, PA-655, PA-731, PA-913, PA-915). Accidents on these routes can result in HazMat spills that can contaminate and impact surrounding populations and environment.

The vulnerability radius for each hazard facility is determined by the Fulton 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 Fulton County (

below). Several incidents reported in the County are related to petroleum spills, which may have resulted from motor vehicle incidents. In order to estimate the number of exposed individuals to the hazard, the total population for each municipality was divided by the number of residential buildings to establish an average population per residential structure which intersects the environmental hazard area.

Table 4.3.4-3. Estimated Fulton County Population Vulnerable to Environmental Hazards

Municipality	Total Population	Population within ¼ mile of major roadways	% Population	Population within vulnerability radii of SARA Facility	% Population
Ayr Township	1,942	675	34.8%	395	20.3%
Belfast Township	1,448	540	37.3%	0	0.0%
Bethel Township	1,508	660	43.7%	0	0.0%
Brush Creek Township	819	368	45.0%	0	0.0%
Dublin Township	1,264	938	74.2%	34	2.7%
Licking Creek Township	1,703	540	31.7%	0	0.0%
McConnellsburg Borough	1,220	1,208	99.0%	1,180	96.7%
Taylor Township	1,118	496	44.4%	0	0.0%
Thompson Township	1,098	400	36.4%	0	0.0%

Municipality	Total Population	Population within ¼ mile of major roadways	% Population	Population within vulnerability radii of SARA Facility	% Population
Todd Township	1,527	694	45.4%	409	26.8%
Union Township	706	263	37.3%	0	0.0%
Valley-Hi Borough	15	0	0.0%	0	0.0%
Wells Township	477	263	55.1%	0	0.0%
Fulton County	**14,845**	**7,045**	**47.5%**	**2,018**	**13.6%**

Sources: U.S. Census 2010, Fulton County 2019

Notes:
% Percent
SARA Superfund Amendments and Reauthorization Act

Impact on General Building Stock, Critical Facilities, and Economy

Jurisdictions that are home to EPA-identified hazardous material facilities should be considered vulnerable to releases from these fixed sites. While buildings and critical facilities may be present within the hazard area of a hazardous materials release, estimating direct damage to these structures and facilities is difficult without additional information regarding the specific event (e.g., type of material, concentration, duration of release, etc.). 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.

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.

Transportation of hazardous materials also increases risk of hazardous material releases to those jurisdictions through which carriers pass. Transportation carriers must have response plans in place to address accidents, otherwise the local emergency response team will step in to secure and restore the area. Quick response minimizes the volume and concentration of hazardous materials that disperse through air, water and soil. 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.

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, railroads, pipelines, and within specified vulnerability radii of SARA facilities (Table 4.3.4-4 below).

Table 4.3.4-4. Critical Facilities Vulnerable to Environmental Hazards

Municipality	Facility Types																						
	Church	Commercial	Communication	County Office	DPW	Dam	Day Care	EOC	Fire	Hazmat	Library	Municipal Hall	Police	Polling Station	Post Office	Potable Water	Power	School	Senior	Shelter	Substation	Wastewater Pump	Wastewater Treatment
Ayr Township	0	1	1	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	1	4	1	0	1
Belfast Township	0	0	1	1	0	0	0	0	1	0	0	1	0	1	2	1	0	1	0	3	0	0	0
Bethel Township	0	0	3	0	0	2	0	0	0	0	0	1	0	1	1	0	0	3	1	6	1	1	0
Brush Creek Township	0	0	7	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0	0
Dublin Township	0	0	3	1	0	1	0	0	1	1	0	1	0	1	1	0	0	0	2	7	0	2	2
Licking Creek Township	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5	3	0	0
McConnellsburg Borough	0	0	2	4	0	0	0	1	2	1	1	1	0	1	1	0	0	2	0	9	0	0	0
Taylor Township	0	0	2	0	0	0	0	0	0	1	0	1	0	1	3	0	2	3	0	4	1	2	0
Thompson Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Todd Township	0	0	4	0	1	0	1	0	0	0	0	1	0	1	0	0	1	0	0	4	0	0	1
Union Township	1	0	2	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	4	0	0	0
Valley-Hi Borough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells Township	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	3	0	0	0
Fulton County	**1**	**1**	**28**	**6**	**1**	**3**	**1**	**1**	**4**	**7**	**1**	**7**	**1**	**8**	**10**	**1**	**3**	**9**	**4**	**55**	**6**	**5**	**4**

Source: Fulton County 2019

Impact on the Environment

As discussed above, transportation and HazMat release incidents can profoundly affect the surrounding environment. Contamination of soil, and surface water and groundwater supplies, can result in many direct impacts on surrounding populations and ecosystems. Local flora and fauna within hazard areas are also at risk. The application of salt to de-ice roads may impact groundwater and contaminate potable drinking water sources near major highway corridors and state highway routes in the County. Additional environmental impacts of hazardous material releases include (PEMA 2018):

- Effects on water quality (i.e., changes in water temperature)
- Damage to streams, lakes, ponds, and wetland ecosystems
- Air quality effects – pollutants, smoke, and dust
- Loss of quality in landscape

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 located within identified hazard areas.

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 Hazard Mitigation Plan (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.

Fulton 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 reports 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). Maintaining a record of frequently transported materials can facilitate development of preparatory measures to respond to a release. Predicting costs needed to respond to a release, remediate the environment, or repair damaged infrastructure would be useful for developing mitigation options.

4.3.5 Flood, Flash Flood, Ice Jam

This section provides a profile and vulnerability assessment of the flood hazard in Fulton 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. The Federal Emergency Management Agency's (FEMA) definition of flooding is "a general and temporary condition of partial or complete inundation of two 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 2019).

Most floods fall into three categories: riverine, coastal, and shallow (FEMA 2015a). 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 Fulton County. These types of floods are further discussed below.

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 be called 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 generally develop over a period of hours to days (FEMA 2015a, 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 2018).

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 (NWS 2018). Time elapsed before flash flooding occurs may vary in different parts of the country. Ongoing flooding can intensify to flash flooding where intense rainfall results in a rapid surge of rising flood waters (NWS 2018). 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, frozen, rock, or clay, stream flow may increase because of inability of the soil to absorb additional precipitation (NWS 2018).

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 snow melt. 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 (Northeast States Emergency Consortium [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 to movement. 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).

Dam Failure Floods

A dam is an artificial barrier that can impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water (FEMA 2018). Dams are man-made structures built across a stream or river that impound water and reduce flow downstream (FEMA 2018). They are built for purposes of power production, agriculture, water supply, recreation, and flood protection. Dam failure is catastrophic type of failure characterized by the sudden, rapid, and uncontrolled release of impounded water, or the likelihood of such an uncontrolled release (FEMA 2018). Dams can fail for one or a combination of the following reasons:

- Overtopping caused by floods that exceed capacity of the dam (inadequate spillway capacity)
- Deliberate acts of sabotage (terrorism)
- Structural failure of materials used in dam construction
- Movement and/or failure of the foundation supporting the dam
- Settlement and cracking of concrete or embankment dams
- Piping and internal erosion of soil in embankment dams
- Inadequate or negligent operation, maintenance, and upkeep
- Earthquake (liquefaction/landslides) (FEMA 2019)

Flooding can occur when a dam fails or breaks, which can cause flooding conditions similar to flash floods. Dam failures can cause an increase of flow which can affect low-lying areas downstream of the dam.

Flooding caused by dam failure is addressed in Section 4.3.1 of this plan.

4.3.5.1 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 (PEMA 2018). 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 depends on 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 2018). Floodplain maps of each Fulton County jurisdiction are available at the end of this profile. These maps show locations of both the 1 percent chance annual floodplain and the 0.2 percent chance annual floodplain.

Flooding is the most significant natural hazard in Fulton County. The Potomac River is less than 2 miles away from the county's most southern border, and the county is home to numerous small creeks and tributaries. Fulton County has two lakes of mentionable size: Cowans Gap Lake and Meadow Grounds Lake. Two-thirds of Fulton County's streams flow into the Potomac River Basin. The Potomac drainage area includes 14,679 square miles in the four states of Maryland, Pennsylvania, Virginia, and West Virginia as well as in the District of Columbia. Fulton County lies in the Conococheague/Antietam sub-basin of the Potomac River.

Additionally, about one-third of the county's streams flow into the Juniata River, which is a sub-basin of the Susquehanna River Basin. The Juniata sub-basin encompasses a 3,406-square-mile area and includes Huntingdon and Blair Counties and portions of Somerset, Bedford, Franklin, Perry, Juniata, Snyder, Mifflin, Centre, Cambria, and Fulton Counties. A very small portion of the county is also within the Wills Creek/Evitts Creek/Town Creek sub-basin.

Table 4.3.5-1 lists total land areas within the 1 percent and 0.2 percent annual chance flood zones calculated via a spatial analysis referencing the February 2011 Digital Flood Insurance Rate Map (DFIRM).

Table 4.3.5-1. Total Land Areas in the 1 percent and 0.2 percent Annual Chance Flood Zones (Square Miles)

Municipality	NFIP-Participating Community	Total Area (Square Miles)	1% Flood Event Hazard Area		0.2% Flood Event Hazard Area	
			Area (Square Miles)	% of Total	Area (acres)	% of Total
Ayr Township	X	46.4	4.0	8.5%	4.0	8.5%
Belfast Township	X	50.4	5.3	10.5%	5.3	10.5%
Bethel Township	X	37.1	2.1	5.7%	2.1	5.7%
Brush Creek Township	X	54.6	2.7	4.9%	2.7	4.9%
Dublin Township	X	37.1	3.9	10.6%	3.9	10.6%
Licking Creek Township	X	44.5	4.4	9.9%	4.4	9.9%
McConnellsburg Borough	X	0.4	0.0	1.6%	0.0	1.8%
Taylor Township	X	32.5	2.5	7.8%	2.5	7.8%
Thompson Township	X	37.9	5.5	14.5%	5.5	14.5%
Todd Township	X	29	1.4	5.0%	1.4	5.0%
Union Township	X	30.5	1.5	4.8%	1.5	4.8%
Valley-Hi Borough		0.4	0.2	37.9%	0.2	37.9%
Wells Township	X	37.5	2.1	5.5%	2.1	5.5%
Fulton County (Total)		**438.3**	**35.5**	**8.1%**	**35.6**	**8.1%**

Source: FEMA 2011
Note: Areas listed include areas of inland waterways

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 December 2008, Fulton County developed and implemented Phase I of the Act 167 County-Wide Plan Stormwater Management Plan. This phase of the plan includes the Scope of Study – Establishing procedures used to prepare the plan. These procedures are determined by an overall survey of:

- Specific watershed characteristics and hydrologic conditions
- Stormwater-related problems and significant obstructions
- Alternative measures for control
- Goals, objectives, solution strategies, and estimated costs for Phase 2 of the plan.

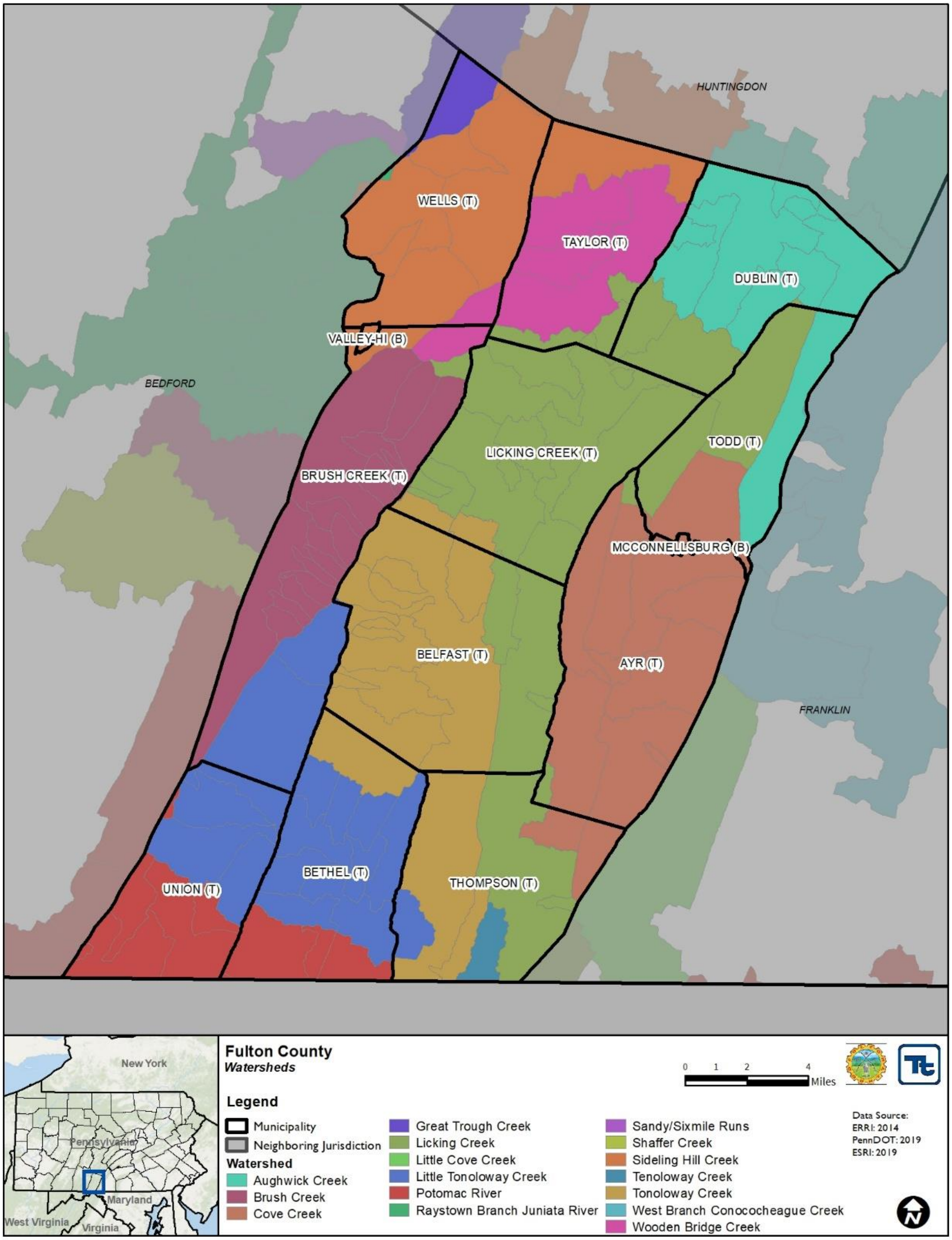
In June 2010, Fulton County published Phase II of the Act 167 County-Wide Plan Stormwater Management Plan. The Phase II Stormwater Management Plan includes stormwater runoff modeling for each watershed in Fulton County. The plan identifies the following PADEP-designated watersheds and associated streams for which Act 167 studies were prepared (Table 4.3.5-2).

Table 4.3.5-2. PA DEP-Designated Watersheds Identified in Act 167 Stormwater Management Plan.

Susquehanna River Watershed	Potomac River Watershed
Aughwick Creek	Licking Creek
Wooden Bridge Creek	Little Tonoloway Creek
Sideling Hill Creek	Tonoloway Creek
Bush Creek	Cove Creek
Great Trough Creek	Potomac River

Source: Fulton County Act 167 Plan, 2010

Figure 4.3.5-1. PA DEP-Designated Watersheds



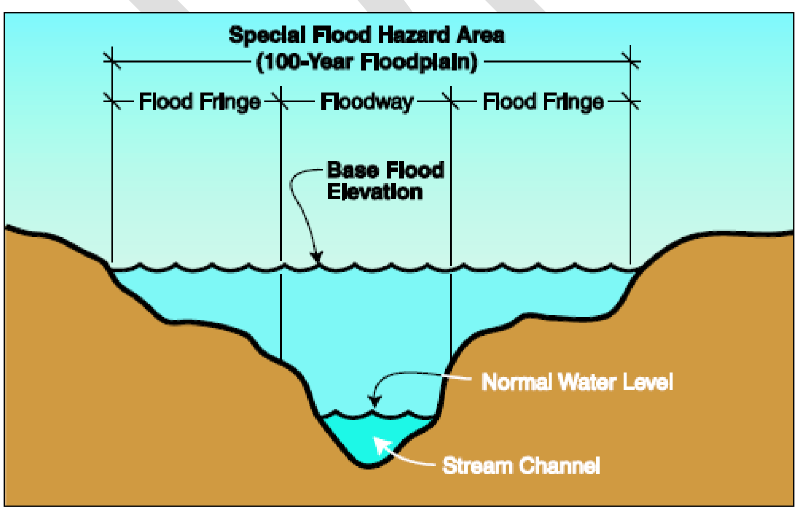
FEMA Regulatory Flood Zones

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 of 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 SFHAs, 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 2011). Fulton County's FIRMs can be accessed online via the FEMA Flood Map Service Center (https://msc.fema.gov/portal/home).

The land area covered by flood waters of the base flood is the SFHA on a FIRM. It is the area where the NFIP's floodplain management regulations must be enforced, and the area where mandatory purchase of flood insurance applies. 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 that 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 (FEMA 2003). 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 4.3.5-2 depicts the SFHA, the BFE, the flood fringe, and the floodway areas of a floodplain for the 1 percent annual chance flood.

Figure 4.3.5-2. Floodplain Diagram

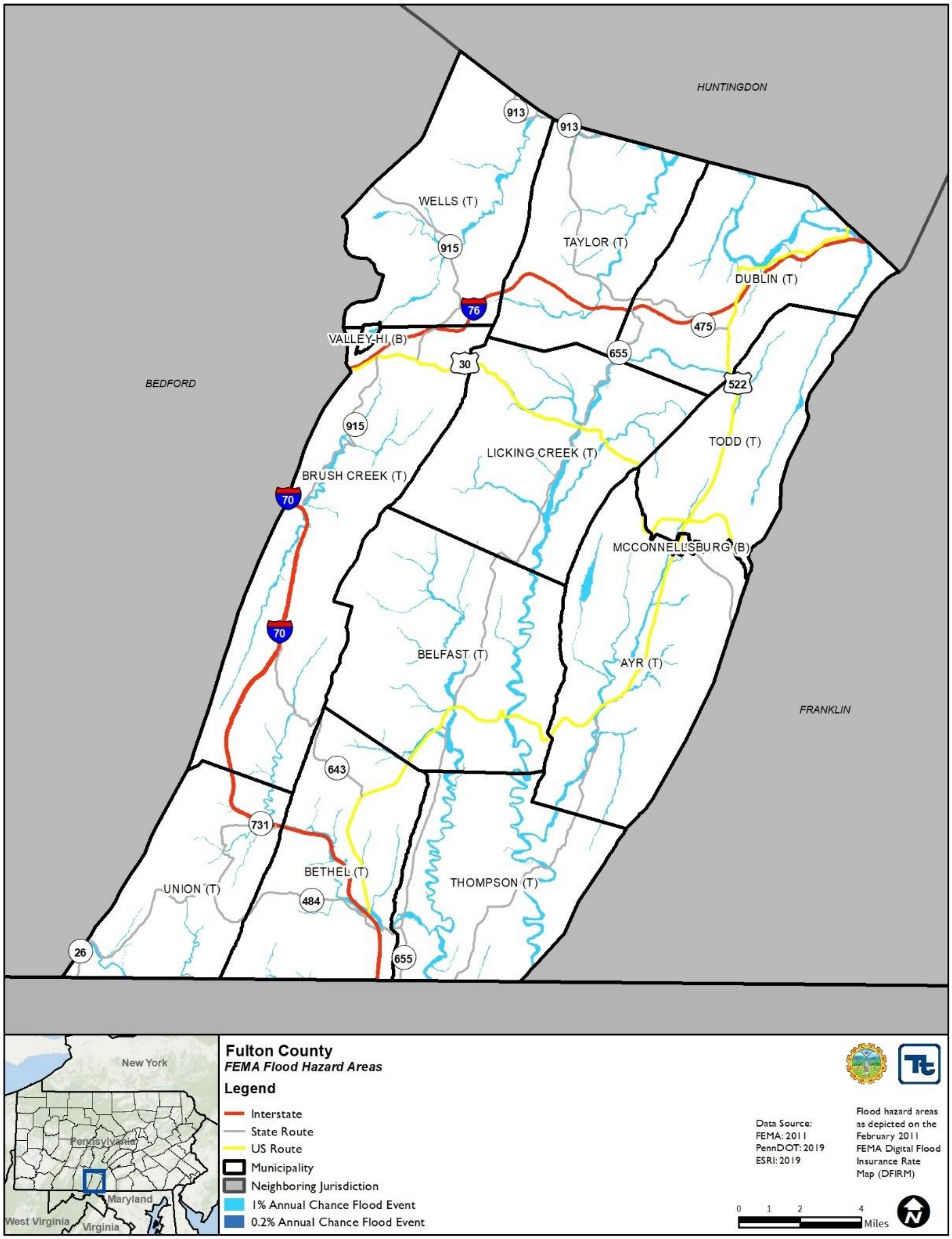


Source: PEMA 2018

The SFHA serves as the primary regulatory boundary used by FEMA and Pennsylvania. 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, February 2011 DFIRMs were considered the best available and were used for the risk analysis. Figure 4.3.5-3 illustrates FEMA flood zones in Fulton County. Maps of each municipality's flood zones are shown at the end of this profile.

Figure 4.3.5-3. FEMA Floodplains in Fulton County



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

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 countywide flood hazards, including descriptions of flood areas studied and engineered methods used, principal flood problems, flood protection measures, and graphic profiles of flood sources (FEMA 2011). The countywide FIS for Fulton County was last completed in 2011, 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, Fulton County underwent or may have been impacted by three historical ice jam incidents between 1780 and 2019 (USACE 2019). Ice jams have formed along Tonoloway Creek. Historical events are further mentioned in the “Previous Occurrences” section of this hazard profile.

4.3.5.2 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 flood waters. 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 2018).

Several factors determine the 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 originate in the Great Lakes or the Atlantic Ocean (PEMA 2018).

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 2018)

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. One element is the size of rivers and streams in an area, 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 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 2016).

Fulton County's worst flood was associated with Hurricane Agnes in 1972. The county underwent widespread flooding and flash flooding. The damage was so severe that the county was declared a major disaster area in June 1972. Specific information on damages due to Hurricane Agnes were unavailable for this update. Another significant flooding scenario mirrors the January 1995 flooding. Several inches of rain poured down on several inches of snow that had already fallen. Many homes reported basement and first-floor flooding. Some homes were severely damaged, one of which could not be repaired. Several businesses were damaged as well. A local car dealership had most of its inventory of vehicles floating down the creek. The County Commissioners filed a Declaration of Disaster for this incident. As a result, municipalities and homeowners gained assistance through low-interest loans offered by FEMA.

4.3.5.3 Past Occurrence

Many sources provided historical information regarding previous occurrences and losses associated with flooding events throughout the State of Pennsylvania and Fulton 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 Center for Environmental Information (NOAA-NCEI) storm event database, Fulton County underwent 17 flood events between January 1, 1950, and June 1, 2018 (the dates for which data are available). Total property damages as a result of these flood events were estimated at $15,000,000. This total also includes damages to other counties.

Between 1954 and 2019, the Commonwealth of Pennsylvania underwent 51 FEMA-declared, flood-related disaster declarations (DR) or emergencies classified as one or a combination of the following disaster types: flood, flash flooding, severe storms, hurricanes, and high wind. Typically, these disasters covered a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations (FEMA 2019). Fulton County was included in 10 of the declarations, as listed in Table 4.3.5-3.

Based on all sources researched, known flooding events resulting in property damages that have affected Fulton County and its municipalities are listed in Table 4.3.5-3. No deaths or injuries caused by flooding have been recorded in Fulton County. With flood documentation for the Commonwealth of Pennsylvania so extensive, not all sources have been identified or researched. Therefore, Table 4.3.5-3 may not include all events that have occurred throughout the county.

Table 4.3.5-3. Flooding Events between 1972 and 2019 in Fulton County

Date of Event	Event Type	Location	FEMA Declaration Number (if applicable)	County Designated?	Losses/Impacts
6/23/1972	Hurricane/Flood	Fulton County	DR-340	Y	Hurricane Agnes. Eligible for individual and public assistance.
7/1974	Flash Flood	Fulton County	N/A	Y	Ft. Littleton Scout Camp.
9/26/1975	Flood	Fulton County	DR-485	Y	Eligible for individual and public assistance.
1/19/2006-2/1/2006	Flood	Fulton County	DR-1093	Y	Eligible for individual and public assistance.
1/19/1996	Flash Flood	Fulton County	N/A	N/A	Countywide impact.
1/19/1996	Flood	Fulton County	N/A	N/A	Regional impact.
6/20/1996	Flash Flood	Fulton County	N/A	N/A	Road flooding occurred along Route 522 about 5 miles south of McConnellsburg.
7/19/1996	Flash Flood	Fulton County	N/A	N/A	Countywide impact.
8/14/1996	Flash Flood	Fulton County	N/A	N/A	Heavy rains flooded the road south of Harrisonville.
9/06/1996	Flash Flood	Fulton County	N/A	N/A	Northern parts of Fulton County were hit with heavy rains from the remnants of Hurricane Fran.
9/13/1996	Flash Flood	Fulton County	N/A	N/A	Thunderstorms dropped up to 8 inches of rain in 4 hours in McConnelsburg, flooding roads across the county. Fifty new and 20 used cars were swept away from Fulton Motors in McConnellsburg. Two homes were destroyed and 80 were damaged.
7/02/1997	Flash Flood	Fulton County	N/A	N/A	Heavy rains flooded roads and small streams in McConnellsburg. A car dealer moved cars to prevent damage.
11/07/1997	Flash Flood	Fulton County	N/A	N/A	Regional impact.
5/01/2003	Flash Flood	Fulton County	N/A	N/A	15,000 in property damage. Heavy rainfall of between 3 and 6 inches within 2 hours produced flash flooding in southern Fulton County. Most of the flooding occurred between the towns of Needmore and Big Cove. Portions of Route 522, Barnett's Run Road, Hess Road, and Gem Bridge Road were closed due to flooding. A significant amount of culvert and road damage occurred on Gem Bridge Road. Between 30 and 35 loads of shale and 150 tons of rock were hauled in for repair to roadways. A mudslide along Route 655 near Quarry Hill required extensive cleanup. One family briefly evacuated their home due to rising water in the yard and basement.
9/08/2004-09/09/2004	Flood	Fulton County	DR-1555	Y	Severe storms and flooding associated with Tropical Depression Frances. Major disaster declaration declared on 09/19/2004 for Individual Assistance.
9/17/2004-10/01/2004	Severe Storms/Flooding	Fulton County	DR-1557	Y	Tropical Depression Ivan. Governor Edward G. Rendell; AS OF 10/19/04 - Presidential - Major Disaster (Individual Assistance and Public Assistance).

Date of Event	Event Type	Location	FEMA Declaration Number (if applicable)	County Designated?	Losses/Impacts
9/9/2004	Flood	Fulton County	N/A	N/A	4½ inches of rainfall at the northern tier of the county to 8 inches in Buck Valley, resulting in road closures, fallen branches, and sporadic telephone interruptions. Roads impacted included SR 484, SR 2004, SR 4008, US 522.
9/17/2004	Flood	Fulton County	N/A	N/A	Regional impact.
9/28/2004	Flood	Fulton County	N/A	N/A	The remnants of Hurricane Jeanne moved northeast along the east slopes of the Appalachians during Tuesday, September 28, eventually moving off the mid-Atlantic Coast by early Tuesday evening. However, a large plume of tropical moisture northwest of the system produced widespread heavy rainfall across south central Pennsylvania during Tuesday, with rainfall amounts of 2 to 4 inches. This rainfall, combined with excessively wet soil and swollen rivers from the remnants of two antecedent tropical systems, produced mainly minor flooding across portions of south central Pennsylvania, with several road closures and some basement flooding reported.
9/17/2004-10/1/2004	Hurricane/Flood	Fulton County	DR-1557	Y	Pennsylvania Tropical Depression Ivan. Eligible for individual and public assistance.
8/29/2005-10/1/2005	Hurricane/Flood	Fulton County	EM-3235	Y	Pennsylvania Hurricane Katrina Evacuation. Eligible for public assistance.
6/2006	Flood	Fulton County	N/A	Y	Governor Edward G. Rendell; Presidential - Major Disaster for Individual Assistance, Public Assistance, and Hazard Mitigation.
3/5/2008	Flood	Fulton County	N/A	N/A	Heavy rain and flooding caused several road closures: - PA 655 N & S of US 30 - Licking Creek Township - Thompson Township - Todd Township Water rescue activated. Area impacted was in Dublin Township.
5/23/2009	Flood	Fulton County	N/A	N/A	Severe weather/flooding—vehicle with two occupants stranded. Area impacted was in Belfast Township and included Pleasant Ridge Rd. (RT 655) 1 mile off Great Cove Rd. (RT 522).
1/25/2010	Flood	Fulton County	N/A	N/A	Heavy rain caused flooding and closed several roads in the county. Route 522 North (Great Cove Road) between Route 30 and Hustontown was closed, along with Route 655. Dublin Mills Road and Witter Road in Taylor Township were also closed.
3/13/2010	Flood	Fulton County	N/A	N/A	Heavy rainfall between 1 and 3 inches combined with snowmelt to produce areal flooding. The flooding closed a portion of Dublin Mills Road along Sideling Hill Creek in the far northern part of the county near the Fulton Huntingdon line.
8/26/2011	Hurricane/Flood	Fulton County	N/A	N/A	Governor's Proclamation for Hurricane Irene. Applicable to entire state (i.e., no specific counties designated).
9/3/2011-10/15/2011	Hurricane/Flood	Fulton County	EM-3340	Y	Remnants of Tropical Storm Lee. Eligible for public assistance.

Date of Event	Event Type	Location	FEMA Declaration Number (if applicable)	County Designated?	Losses/Impacts
10/26/2012	Hurricane/Flood	Fulton County	N/A	N/A	Governor's Proclamation for Hurricane Sandy. Applicable to entire state (i.e., no specific counties designated).
10/26/2012-11/8/2012	Hurricane/Flood	Fulton County	EM-3356/DR-4099	Y	Hurricane Sandy. Eligible for Public Assistance.
06/01/2018	Flash Flood	McConnellsburg	N/A	N/A	Reservoir Road a Cloverleaf Court was flooded and impassable.
06/01/2018	Flash Flood	McConnellsburg	N/A	N/A	Great Cove Creek was out of its banks and flowing over a bridge on Confederate Road.
05/03/2019	Flood	Harrisonville	N/A	N/A	Flooding caused Black Bear Road to be shut down until 06/02/2019.

Sources: NCEI 2019; FEMA 2019

DR *Federal Disaster Declaration*
EM *Emergency Management*
EMA *Emergency Management Agency*
FEMA *Federal Emergency Management Agency*
NCEI *National Centers for Environmental Information*
NOAA *National Oceanic Atmospheric Administration*
N/A *Not applicable/not available*
SBA *Small Business Administration*
US *United States*

Based on review of the CRREL database, Table 4.3.5-4 lists the ice jam events that have occurred in or near the county between 1780 and 2019. Events listed below that occurred outside of the county were included because they were close enough to the county borders to cause possible flooding impacts on Fulton County. Information regarding losses associated with these reported ice jams was limited.

Table 4.3.5-4. Ice Jam Events in Fulton County between 1780 and 2019

City (Additional Geographic Identifier)	River	Jam Date	Water Year	Gage Number	Impact
Needmore (Belfast Township)	Tonoloway Creek	1/5/1990	1990	01613050	Maximum annual gage height of 4.49 feet due to an ice jam reported at USGS gage Tonoloway Creek near Needmore, at 0745 hours on January 5, 1990. Estimated average daily discharge 20 cfs.
Needmore (Belfast Township)	Tonoloway Creek	2/2/1981	1981	01613050	Ice jam reported on February 2, 1982 (average daily discharge 20 cfs compared to 0.7 cfs previous day) and February 11, 1982 (average daily discharge 61 cfs compared to 2.5 cfs previous day) at USGS gage Tonoloway Creek near Needmore. No stages given. Maximum annual gage height of 6.38 feet due to ice jam reported on February 20, with average daily discharge of 181 cfs (compared to 23 cfs previous day).
Needmore (Belfast Township)	Tonoloway Creek	2/13/1971	1971	01613050	The estimated water discharge was 100 cfs. Maximum gage height was 7.37 feet.
Outside Fulton County					
Gapsville (Bedford County)	Brush Creek	2/27/1936	1936	1561000	USGS did not record a gage height on February 27, 1936, on Brush Creek at Gapsville, PA, due to backwater from ice.
Sylvan (Franklin County)	Licking Creek	1/15/40	1940	1613500	Maximum annual gage height of 8.60 feet, affected by backwater from ice, reported at USGS gage Licking Creek near Sylvan, on January 15, 1940.
Three Springs (Huntingdon County)	Aughwick Creek	2/24/1979	1979	1564500	No stage reported, average daily discharge 1340 cfs (140 cfs previous day).
Three Springs (Huntingdon County)	Aughwick Creek	1/22/1959	1959	1564500	Maximum annual gage height of 11.4 feet, affected by backwater from ice, reported at USGS gage Aughwick Creek near Three Springs, on January 22, 1959. Bankfull stage 6 feet. Discharge not determined; maximum for year.
Orbisonia (Huntingdon County)	Aughwick Creek	2/28/1935	1935	1564000	USGS recorded a gage height of 9.2 feet on February 28, 1935 on Augwick Creek near Orbisonia, PA, due to backwater from ice.

Source: USACE 2019

Notes:

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

cfs Cubic feet per second

CRREL Cold Regions Research and Engineering Laboratory

USGS U.S. Geological Survey

4.3.5.4 Future Occurrence

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of flood waters) and the related probability of occurrence. The NFIP uses historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence is expressed in percentages as the chance of a flood of a specific extent occurring in any given year.

The NFIP recognizes the 1 percent annual chance flood, also known as the *base flood*, as the standard for identifying properties subject to federal flood insurance purchase requirements. A 1 percent annual chance flood is a flood that has a one percent chance of occurring over a given year. The DFIRMs identify areas subject to the 1 percent and 0.2 percent annual chance flooding. Areas subject to 2 percent and 10 percent annual chance events are not shown on maps; however, water surface elevations associated with these events are included in the flood source profiles contained in the Flood Insurance Study Report. Table 4.3.5-5 shows a range of flood recurrence intervals and associated probabilities of occurrence.

Table 4.3.5-5. Recurrence intervals and associated probabilities of occurrence

Flood Recurrence Interval	Chance of Occurrence in Any Given Year (%)	Flows
5 year	20	Mild
10 year	10	Light
25 year	4	Light to Moderate
50 year	2	Moderate
100 year	1	Heavy to Extreme
500 year	0.2	Extreme

Given the history of flood events that have impacted Fulton 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.

For the 2019 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of flooding events for Fulton County. Information from NOAA-NCEI storm events database, FEMA, Pennsylvania State Climatologist, and the CRREL ice jam database were used to identify the number of flood events that occurred between 1950 and 2019. Using these sources ensures the most accurate probability estimates possible. The table below shows these statistics as well as the annual average number of events and the estimated percent chance of an incident occurring in a given year.

Table 4.3.5-6. Probability of Future Flooding Events

Hazard Type	Number of Occurrences Between 1972 and 2019	Recurrence Interval (in Years) (# Years/Number of Events)	Percent Chance of Occurrence in Any Given Year
Flash Flood	12	4.0	25%
Flood	21	2.2	46%
Ice Jam	3	10.0	10%
Total	36	1.3	75%

Sources: NOAA-NCEI 2019; USACE 2019; Fulton County 2019

It is estimated that Fulton County will continue to experience direct and indirect impacts of flooding events annually 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. Therefore, the future occurrence of floods in Fulton County has been adjusted and characterized as *likely*, when taking into consideration flash flooding, as defined by the Risk Factor Methodology probability criteria (see Section 4.4).

4.3.5.5 Vulnerability Assessment

To understand risk, a community must evaluate the assets exposed and vulnerable within the identified hazard area. For the flood hazard, the 1- and 0.2-percent annual chance flood events were examined. The following section discusses potential flood impacts, including:

- 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
- Effect of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time.

The 1- and 0.2-percent annual chance flood events were examined to evaluate Fulton County's flood risk. Polygons representing the 1- and 0.2-percent annual chance events from the FEMA Risk Map products dated February 18, 2011, were used to estimate exposure. Figure 4.3.5-3 presented earlier in this section illustrates the flood boundaries used for the vulnerability assessment. The 1-percent annual chance flood depth grid generated for the FEMA Risk Map program was imported into FEMA's HAZUS-MH v4.2 riverine flood model to estimate potential losses.

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 adequate warning time is provided to residents. Assumedly, the population living in or near floodplain areas that could be impacted by a flood would 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 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.

In order to estimate the number of exposed individuals to the hazard, the total population for each municipality was divided by the number of residential buildings to establish an average population per residential structure that intersects the FEMA delineated floodplain. Table 4.3.5-7 lists the estimated population located within the 1 percent annual chance flood zone by municipality. Use of this approach resulted in an estimate of 114 people within the 1 percent annual chance floodplain (1.8%), and 114 people within the 0.2 percent annual chance floodplain. The 0.2 percent annual chance floodplain is a relatively small area and does not intersect with any structures. Limitations of these analyses are recognized, and thus results are used only to provide a general estimate.

Table 4.3.5-7. Estimated Fulton County Population Exposed to the 1 percent and 0.2 percent Flood Hazard (2010 Census)

Municipality	U.S. Census 2010 Population	Estimated Population Exposed			
		1-percent Annual Chance Flood*	% of Total	0.2-percent Annual Chance Flood*	% of Total
Ayr Township	1,942	18	0.9%	18	0.9%
Belfast Township	1,448	8	0.6%	8	0.6%
Bethel Township	1,508	6	0.4%	6	0.4%
Brush Creek Township	819	5	0.6%	5	0.6%
Dublin Township	1,264	9	0.7%	9	0.7%
Licking Creek Township	1,703	33	1.9%	33	1.9%
McConnellsburg Borough	1,220	6	0.5%	6	0.5%
Taylor Township	1,118	12	1.1%	12	1.1%
Thompson Township	1,098	0	0.0%	0	0.0%
Todd Township	1,527	1	0.1%	1	0.1%
Union Township	706	0	0.0%	0	0.0%
Valley-Hi Borough	15	0	0.0%	0	0.0%
Wells Township	477	16	3.3%	16	3.3%
Fulton County	**14,845**	**114**	**0.8%**	**114**	**0.8%**

Sources: U.S. Census 2010, FEMA 2011
Note: % Percent
** Estimated population exposed is calculated by the total population for each municipality was divided by the number of residential buildings to establish an average population per residential structure which intersects the FEMA delineated floodplain. Limitations of these analyses are recognized, and thus results are used only to provide a general estimate.*

The table above shows that less than 1 percent of the total county population is exposed to the 1 percent annual chance flood event, and the 0.2 percent annual chance flood event. Licking Creek Township has the largest portion of its population within the 1 and 0.2 percent annual chance event floodplains—1.9 percent of the population. For this HMP, potential population exposed is used as a guide for planning purposes.

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 net 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 v4.2 estimates potential sheltering needs based on a 1 percent annual chance flood event. During the 1 percent flood event, HAZUS-MH v4.2 estimates 586 people will be displaced, and 0 people will seek short-term sheltering, representing less than 1 percent of the Fulton County population seeking short-term shelter. These statistics, by municipality, are listed in Table 4.3.5-8. The estimated displaced population and number of persons seeking short-term sheltering differ from the number of persons exposed to the 1 percent annual chance flood. The Flood Technical Manual for HAZUS 4.2 explains the assumptions made for the displacement and sheltering values generated through the flood model: "Because the Flood Model does not address flooding, such as flash flooding or long-duration flooding, HAZUS assumes that the local authorities will have time to alert the residents and evacuate directly from the areas that will flood. This means any portion of a census block that is flooded initially is assumed to have all of the residents removed from the area. Ultimately, the level of damage within the General Building Stock (GBS) and the characteristics of the population will determine how many people require short-term sheltering (FEMA, 2018).” This methodology may overestimate the number of displaced populations. Limitations of these analyses are recognized, and thus results are used only to provide a general estimate.

Table 4.3.5-8. Estimated Population Displaced or Seeking Short-Term Shelter from the 1 percent Annual Chance Flood Event

Municipality	U.S. Census 2010 Population	1-Percent Annual Chance Event	
		Displaced Population*	Persons Seeking Short-Term Sheltering
Ayr Township	1,942	72	0
Belfast Township	1,448	83	0
Bethel Township	1,508	29	0
Brush Creek Township	819	16	0
Dublin Township	1,264	67	0
Licking Creek Township	1,703	145	0
McConnellsburg Borough	1,220	7	0
Taylor Township	1,118	30	0
Thompson Township	1,098	89	0
Todd Township	1,527	22	0
Union Township	706	5	0
Valley-Hi Borough*	15	0	0
Wells Township	477	21	0
Fulton County	**14,845**	**586**	**0**

Source: HAZUS-MH v4.2
**Note: The population displaced and seeking shelter was calculated using 2010 U.S. Census data, which is the default demographic database for HAZUS-MH v4.2. If a flood hazard area intersects any portion of a census block, it is assumed that local authorities will have time to alert and residents and evacuate directly from the areas that will flood. This means any portion of a census block that is flooded initially is assumed to have all of the residents removed from the area.*

Total number of injuries and casualties resulting from typical riverine flooding is generally limited because of advance weather forecasting, blockades, and warnings. Therefore, injuries and deaths generally 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—persons trying to cross flooded roadways or channels. Mitigation action items addressing this issue are included in Section 6 (Mitigation Strategies) of this plan.

Cascading impacts may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to growth of mold in buildings. Mold may present a health risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly, and pregnant women. The degree of impact will vary and is not strictly measurable. Molds can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (Centers for Disease Control and Prevention [CDC] 2015).

Molds and mildews are not the only public health risk associated with flooding. Flood waters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue.

Current loss estimation models such as HAZUS-MH are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Impact on General Building Stock

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

To estimate replacement cost value exposure and number of structures in the hazard area, default dasymetric building stock data from HAZUS-MH v4.2 and the building footprint layer from the county were used. Replacement cost values of the dasymetric Census blocks with their centroids in the floodplain were totaled. Table 4.3.5-9 lists building stock exposure per municipality, Table 4.3.5-10 lists building stock exposure by watershed, and Table 4.3.5-11 lists building stock potential loss to the 1 percent annual chance flood event.

In total, 93 structures, or 1.1 percent of the building stock, are within the 1 and 0.2 percent annual chance flood zones. Approximately $63 million of building/contents are within the 1 and 0.2 percent annual chance flood zones in Fulton County. This represents approximately 2.8 percent of the county's total general building stock replacement value inventory ($2.2 billion).

Potential damage estimated to the Fulton County general building stock inventory associated with the 1 percent annual chance flood exceeds $16 million. Estimated building stock potential loss estimates per municipality are listed in Table 4.3.5-11

Table 4.3.5-9. Estimated General Building Stock Exposure to the 1 Percent Annual Chance Flood Event

Municipality	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed							
			Number of Buildings - 1-percent Annual Chance Flood	% of Total	RCV - 1-percent Annual Chance Flood	% of Total	Number of Buildings - 0.2-percent Annual Chance Flood	% of Total	RCV - 0.2-percent Annual Chance Flood	% of Total
Ayr Township	1,139	328,056,000	13	1.1%	$3,427,000	1.0%	13	1.1%	$3,427,000	1.0%
Belfast Township	740	181,485,000	7	0.9%	$8,024,000	4.4%	7	0.9%	$8,024,000	4.4%
Bethel Township	853	243,010,000	9	1.1%	$21,466,000	8.8%	9	1.1%	$21,466,000	8.8%
Brush Creek Township	519	110,481,000	4	0.8%	$2,226,000	2.0%	4	0.8%	$2,226,000	2.0%
Dublin Township	697	153,284,000	7	1.0%	$3,377,000	2.2%	7	1.0%	$3,377,000	2.2%
Licking Creek Township	881	203,625,000	19	2.2%	$7,709,000	3.8%	19	2.2%	$7,709,000	3.8%
McConnellsburg Borough	538	276,419,000	4	0.7%	$0	0.0%	4	0.7%	$0	0.0%
Taylor Township	697	141,644,000	16	2.3%	$4,002,000	2.8%	16	2.3%	$4,002,000	2.8%
Thompson Township	572	155,461,000	0	0.0%	$12,207,000	7.9%	0	0.0%	$12,207,000	7.9%
Todd Township	858	298,975,000	3	0.3%	$942,000	0.3%	3	0.3%	$942,000	0.3%
Union Township	421	106,265,000	1	0.2%	$0	0.0%	1	0.2%	$0	0.0%
Valley-Hi Borough	29	5,827,000	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Wells Township	292	58,946,000	10	3.4%	$0	0.0%	10	3.4%	$0	0.0%
Fulton County	**8,236**	**2,263,478,000**	**93**	**1.1%**	**63,380,000**	**2.8%**	**93**	**1.1%**	**$63,380,000**	**2.8%**

Source: HAZUS-MH v4.2; FEMA 2011
Notes:
% Percent
RCV Replacement cost value (structure and contents)

Table 4.3.5-10. Estimated General Building Stock Exposure by Watershed to the 1 Percent and 0.2 Percent Annual Chance Flood Events

Watershed	Total Number of Buildings	1% Annual Chance Flood Boundary		0.2% Annual Chance Flood Boundary	
		Number of Buildings	% of Total	Number of Buildings	% of Total
Aughwick Creek	498	9	1.8%	9	1.8%
Brush Creek	359	3	<1%	3	<1%
Cove Creek	2196	18	<1%	18	<1%
Great Trough Creek	5	0	<1%	0	<1%
Licking Creek	1833	20	1.1%	20	1.1%
Little Tonoloway Creek	918	9	<1%	9	<1%
Potomac River	459	2	<1%	2	<1%
Sideling Hill Creek	487	25	5.1%	25	5.1%
Tenoloway Creek	61	0	<1%	0	<1%
Tonoloway Creek	1019	6	<1%	6	<1%
West Branch Conococheague Creek	21	0	<1%	0	<1%
Wooden Bridge Creek	380	1	<1%	1	<1%
Fulton County (Total)	**8236**	**93**	**1.1%**	**93**	**1.1%**

Source: FEMA 2011, ERRI 2014

Table 4.3.5-11. Estimated General Building Stock Potential Loss to the 1 Percent Annual Chance Flood Event

Municipality	Total Replacement Cost Value	All Occupancies		Residential		Commercial		Agricultural, Industrial, Religious, Education, and Government	
		Estimated Loss	% of Total	Estimated Loss	% of Total	Estimated Loss	% of Total	Estimated Loss	% of Total
Ayr Township	$328,056,000	$1,221,000	0.4%	$1,067,000	0.3%	$19,000	0.0%	$135,000	0.0%
Belfast Township	$181,485,000	$2,114,000	1.2%	$1,178,000	0.6%	$523,000	0.3%	$413,000	0.2%
Bethel Township	$243,010,000	$1,745,000	0.7%	$533,000	0.2%	$582,000	0.2%	$630,000	0.3%
Brush Creek Township	$110,481,000	$393,000	0.4%	$266,000	0.2%	$42,000	0.0%	$85,000	0.1%
Dublin Township	$153,284,000	$1,452,000	0.9%	$830,000	0.5%	$227,000	0.1%	$395,000	0.3%
Licking Creek Township	$203,625,000	$3,066,000	1.5%	$1,962,000	1.0%	$912,000	0.4%	$192,000	0.1%
McConnellsburg Borough	$276,419,000	$92,000	0.0%	$27,000	0.0%	$47,000	0.0%	$18,000	0.0%
Taylor Township	$141,644,000	$1,362,000	1.0%	$576,000	0.4%	$684,000	0.5%	$102,000	0.1%
Thompson Township	$155,461,000	$3,517,000	2.3%	$3,002,000	1.9%	$350,000	0.2%	$165,000	0.1%
Todd Township	$298,975,000	$571,000	0.2%	$135,000	0.0%	$66,000	0.0%	$370,000	0.1%
Union Township	$106,265,000	$222,000	0.2%	$222,000	0.2%	$0	0.0%	$0	0.0%
Valley-Hi Borough	$5,827,000	$1,000	0.0%	$1,000	0.0%	$0	0.0%	$0	0.0%
Wells Township	$58,946,000	$317,000	0.5%	$210,000	0.4%	$2,000	0.0%	$105,000	0.2%
Fulton County	**$2,263,478,000**	**$16,073,000**	**0.7%**	**$10,009,000**	**0.4%**	**$3,454,000**	**0.2%**	**$2,610,000**	**0.1%**

Source: HAZUS-MH v4.2
Note: % Percent

NFIP Statistics

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, the definition of an SRL property is a residential property covered by an NFIP flood insurance policy, and for which at least one of the following sets of claim payments have occurred:

- At least four NFIP claim payments (including building and contents) over $5,000 each, with the cumulative amount of these claims payments exceeding $20,000
- At least two separate claims payments (building payments only), with the cumulative amount of the building portion of these claims payments exceeding the market value of the building

Moreover, for both of the above, at least two of the referenced claims must have occurred within any 10-year period and must have been submitted separately on dates more than 10 days apart.

An RL property is defined by FEMA's Flood Mitigation Assistance (FMA) Program as 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.

Fulton County has 1 RL property throughout the county. Table 4.3.5-12 summarizes NFIP policies and claims for Fulton County.

Table 4.3.5-12. NFIP Policies, Claims, and Repetitive Loss Statistics

Municipality	# Policies (1)	# Claims (Losses) (1)	# Repetitive Loss Properties (1)	Total Loss Payments (2)
Ayr Township	9	0	0	$0
Belfast Township	7	0	0	$0
Bethel Township	2	0	0	$0
Dublin Township	3	0	0	$0
Licking Creek Township	8	6	1	$125,427
McConnellsburg Borough	1	0	0	$0
Taylor Township	1	4	0	108,623
Thompson Township	1	0	0	$0
Wells Township	2	4	0	22,882
Fulton County	34	14	1	$282,492.26

Source: FEMA 2018, FEMA 2019
Notes:
(1) Policies, claims, RL, and SRL statistics provided by FEMA, and are current as of February 28, 2019. Communities with SRL properties are noted in the column. The number of claims represents claims closed by September 11, 2019.
(2) Total building and content loss information was collected from the claims file provided by FEMA: http://bsa.nfipstat.fema.gov/reports/1040.htm#42.

Impact on Critical Facilities

Critical services during and after a flood event may not be available if critical facility structures are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area, including for emergency service providers needing to get to vulnerable populations or to make repairs. Major roadways that may be impacted by the 1-percent annual chance flood event include I-70, I-76 US-30, US-522 PA-26, PA-643, PA-731, PA-913, PA-915, and PA-928. Bridges washed out or blocked by floods or debris also can cause isolation. Water and sewer systems can be flooded or backed up, causing health problems. Floodwaters can get into drinking water supplies, causing contamination. Culverts can be blocked by debris from flood events, also causing localized urban flooding. Sewer systems can be backed up, causing wastewater to spill into homes, neighborhoods, rivers, and streams. Table 4.3.5-13 lists critical facilities and utilities within the 1 percent annual chance flood boundary. There are no critical facilities located within the 0.2 percent annual chance flood boundary in Fulton County.

Table 4.3.5-13. Critical Facilities and Utilities Within the 1 percent Annual Chance Flood Boundary

Municipality	Facility Types						
	Communication	Dam	Hazmat	Post Office	Potable Water	Substation	Wastewater Pump
Ayr Township	0	0	0	0	0	0	0
Belfast Township	0	0	0	0	1	0	0
Bethel Township	1	0	0	0	0	0	1
Brush Creek Township	0	0	0	0	0	0	0
Dublin Township	0	1	0	0	0	0	0
Licking Creek Township	0	0	1	0	0	1	0
Mcconnellsburg Borough	0	0	0	0	0	0	0
Taylor Township	0	0	0	2	0	1	0
Thompson Township	0	0	0	0	0	0	0
Todd Township	0	0	0	0	0	0	0
Union Township	0	0	0	0	0	0	0
Valley-Hi Borough	0	0	0	0	0	0	0
Wells Township	0	0	0	0	0	0	0
Fulton County	**1**	**1**	**1**	**2**	**1**	**2**	**1**

Source: Fulton County 2019, FEMA 2011

Impact on the Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to building damages and associated tax loss, impacts to utilities and infrastructure, agricultural losses, business interruption, and effects on tourism. In areas that are directly flooded, commercial and industrial building repairs/renovations may be necessary, disrupting associated services.

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. As presented above, several critical facilities and utilities are exposed and potentially vulnerable to the 1- and 0.-2 percent annual chance flood events.

Debris management may also be a large expense after a flood event. HAZUS-MH v4.2 estimates the amount of debris generated during a flood event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.), (2) structural (wood, brick, etc.), and (3) foundations (concrete slab and block, rebar, etc.). These distinctions are necessary because of the different types of equipment needed to handle debris. Table 4.3.5-14 summarizes the debris estimates to result from a 1-percent annual chance flood event. Notably, this table lists estimated debris generated by riverine flooding only and does not include additional potential damage and debris possibly generated by force of wind that may be associated with storm events that cause flooding.

Table 4.3.5-14. Estimated Debris Generated from the 1 Percent Annual Chance Flood Event

Municipality	1% Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Ayr Township	79	56	9	14
Belfast Township	141	86	23	32
Bethel Township	90	47	20	23
Brush Creek Township	34	21	5	8
Dublin Township	123	67	23	33
Licking Creek Township	195	130	27	38
McConnellsburg Borough	4	3	0	0
Taylor Township	74	48	10	15
Thompson Township	374	179	108	88
Todd Township	9	5	1	3
Union Township	30	12	9	9
Valley-Hi Borough	0	0	0	0
Wells Township	28	16	6	7
Fulton County	**1,180**	**670**	**240**	**269**

Source: HAZUS-MH v4.2

Impact on the Environment

As discussed, floodplains serve beneficial and natural functions on ecological/environmental, social, and economic levels. Areas in the floodplain that typically provide these natural functions and benefits are wetlands, riparian areas, sensitive areas, and habitats for rare and endangered species. To determine the exposure of natural and beneficial land in Fulton County to the flood hazard, the acreage of wetlands and forested land were calculated. To determine exposure of natural and beneficial land in Fulton County to the flood hazard, acreages of wetlands and forested land were calculated. Table 4.3.5-15 lists the results of these calculations.

Table 4.3.5-15. Area of Natural and Beneficial Land Within the Floodplain

Wetlands	Area in the 1 percent Annual Chance Floodplain (Square Miles)	Area in the 0.2 percent Annual Chance Floodplain (Square Miles)
Wetlands	0.57	0.57
Forest	229.4	229.4

Sources: USGS National Land Cover Data (NLCD) 2019, FEMA 2011

Flooding can cause a wide range of environmental impacts, including but not limited to erosion and loss of vegetation and habitats. These impacts, in turn, may lead to decreased protection of the waterbody from adjacent land uses and to degraded water quality. Moreover, floods may generate large amounts of tree and construction debris, disperse household hazardous waste into the fluvial system, and contaminate water supplies and wildlife habitats with extremely toxic substances. Long-duration floods could exacerbate environmental problems because cleanup likely would be delayed and contaminants could remain in the environment for a longer period of time. Cleanup after a flood raises additional environmental concerns. The volume of debris to be collected, the extent to which public utilities (water supply systems and sewer operations) have been damaged, and the quantity of agricultural and industrial pollutants entering water bodies might present additional issues (Montz and Tobin 1997, Rubin 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 within vulnerable areas and to encourage higher regulatory standards on the local level.

Effect of Climate Change on Vulnerability

As discussed earlier, annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to affect drinking water, increase the risk to flash flooding and riverine flooding, and flood critical transportation corridors and infrastructure. Increases in precipitation may alter and expand the floodplain boundaries and runoff patterns, resulting in populations, buildings, and critical facilities and infrastructure that were previously outside the floodplain. This increase in exposure would result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by future flooding events due to loss of service or access.

Additional Data and Next Steps

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

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

Figure 4.3.5-4. Ayr Township Municipal Flood Map

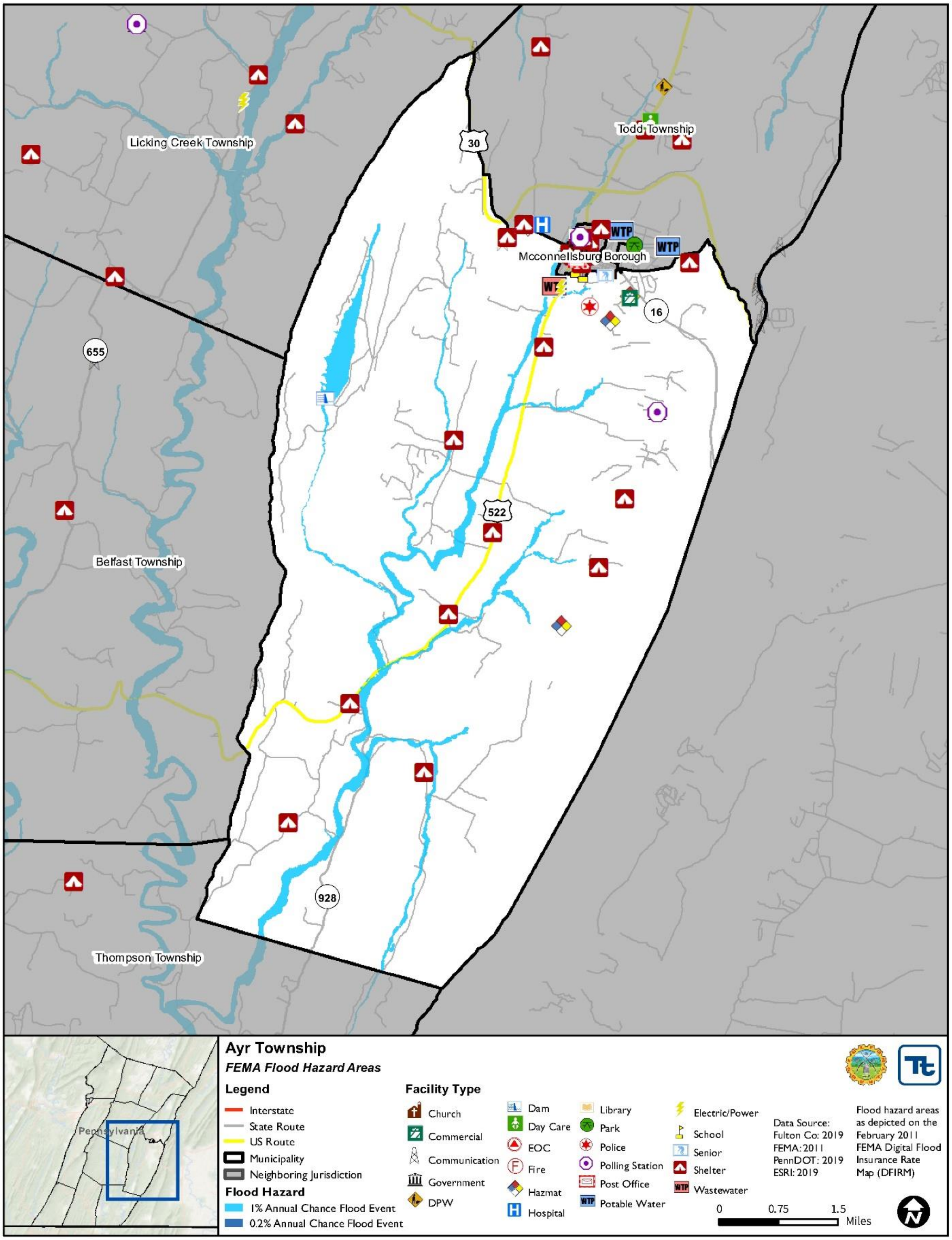


Figure 4.3.5-5. Belfast Township Municipal Flood Map

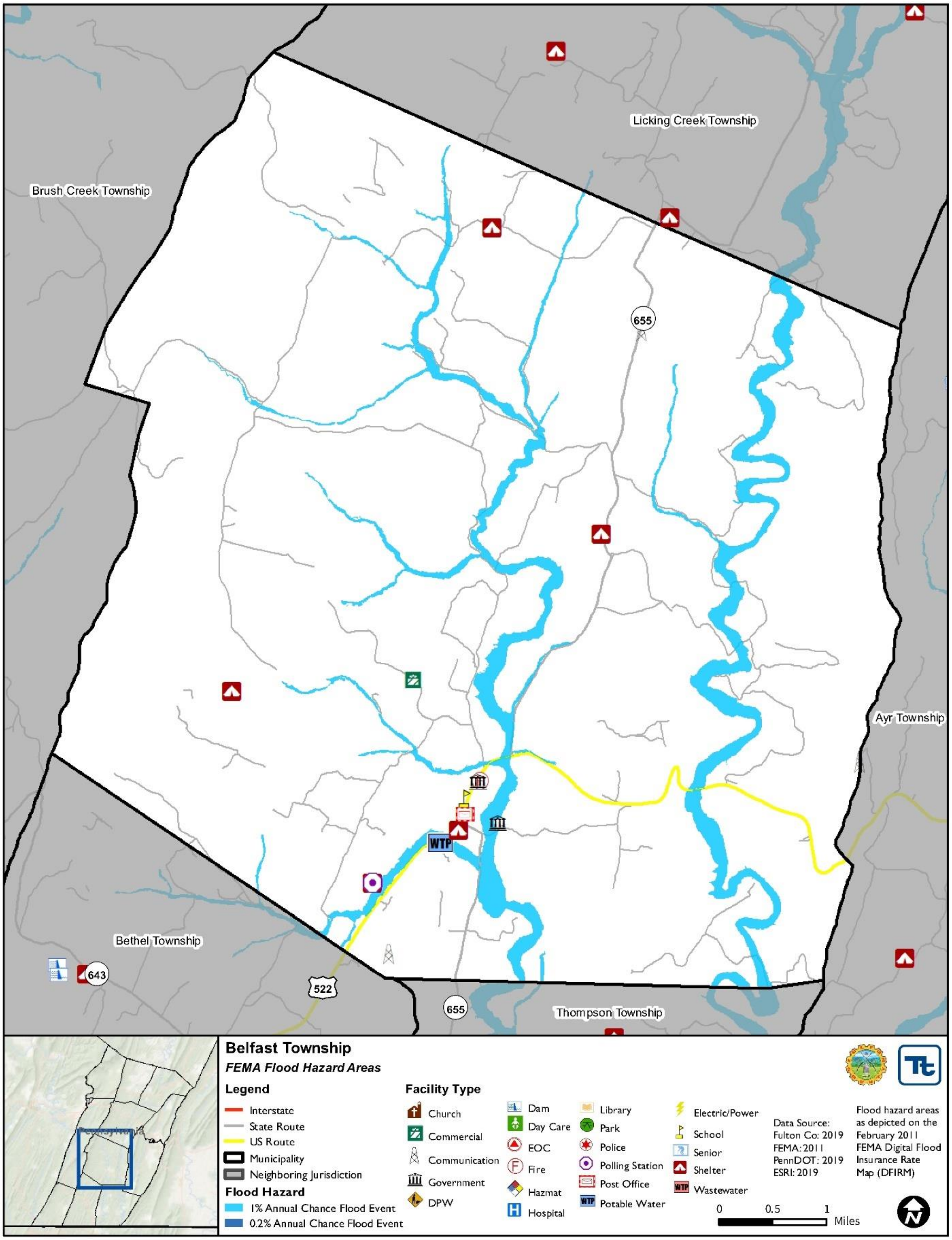


Figure 4.3.5-6. Bethel Township Municipal Flood Map

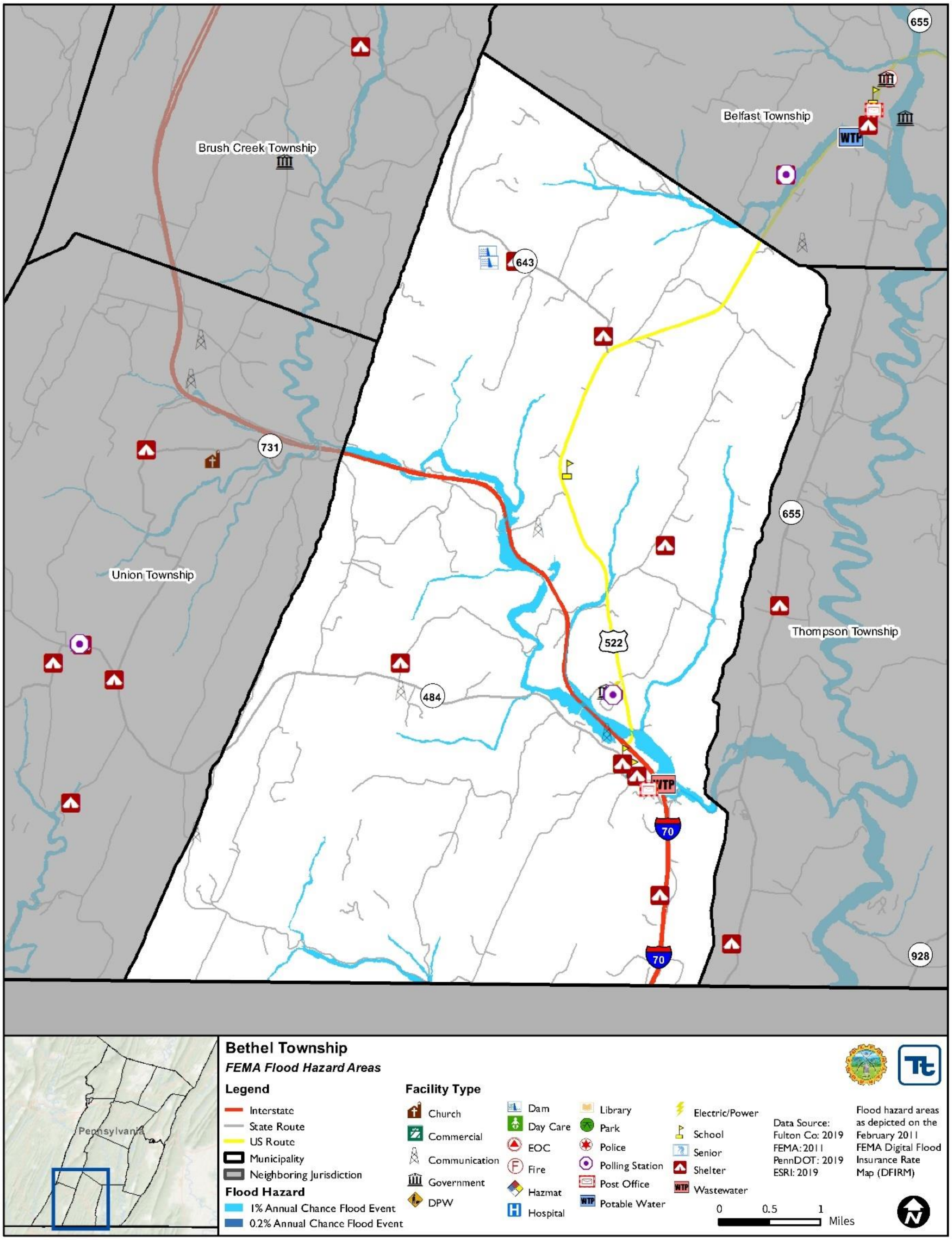


Figure 4.3.5-7. Brush Creek Township Municipal Flood Map

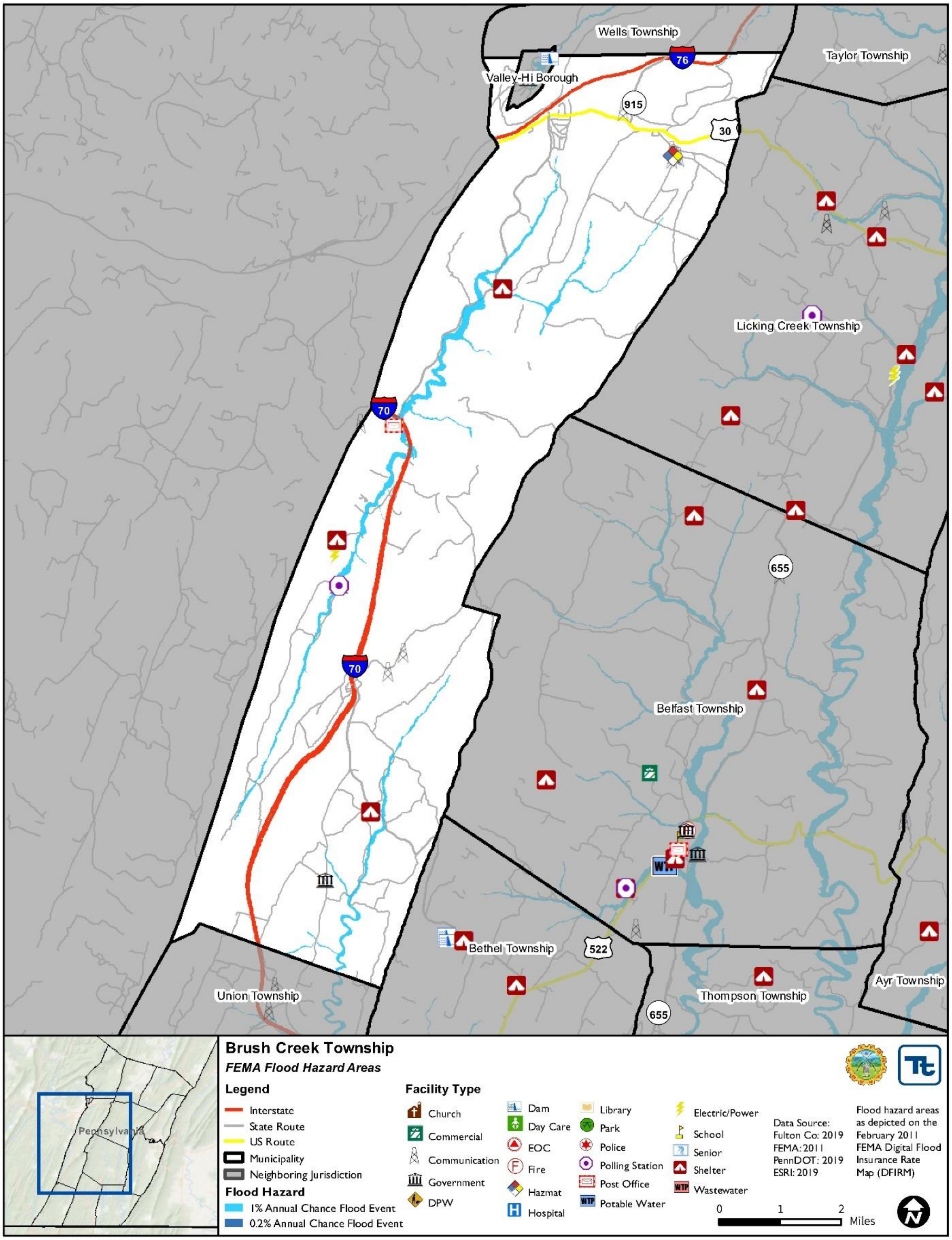


Figure 4.3.5-8. Dublin Township Municipal Flood Map

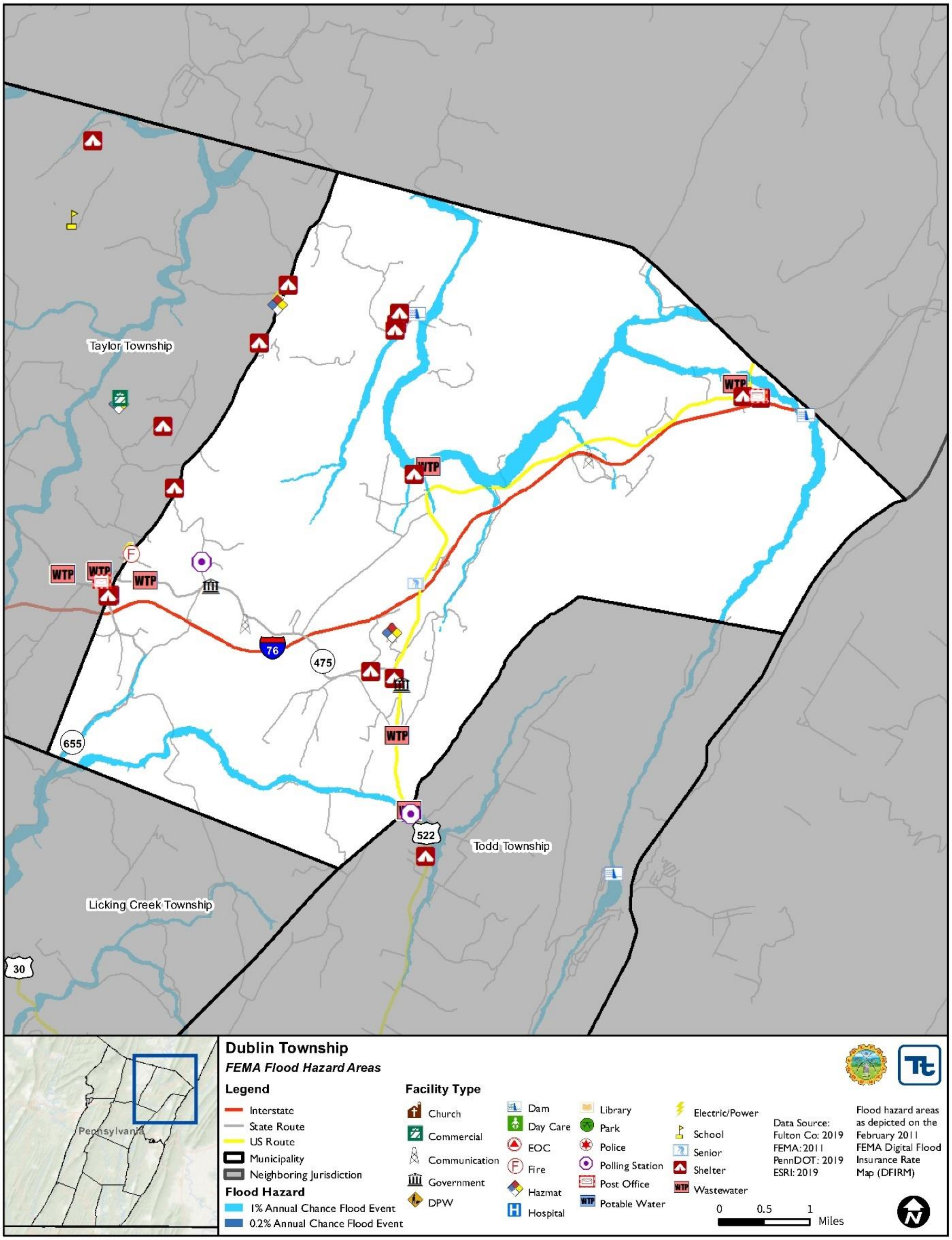


Figure 4.3.5-9. Licking Creek Township Municipal Flood Map

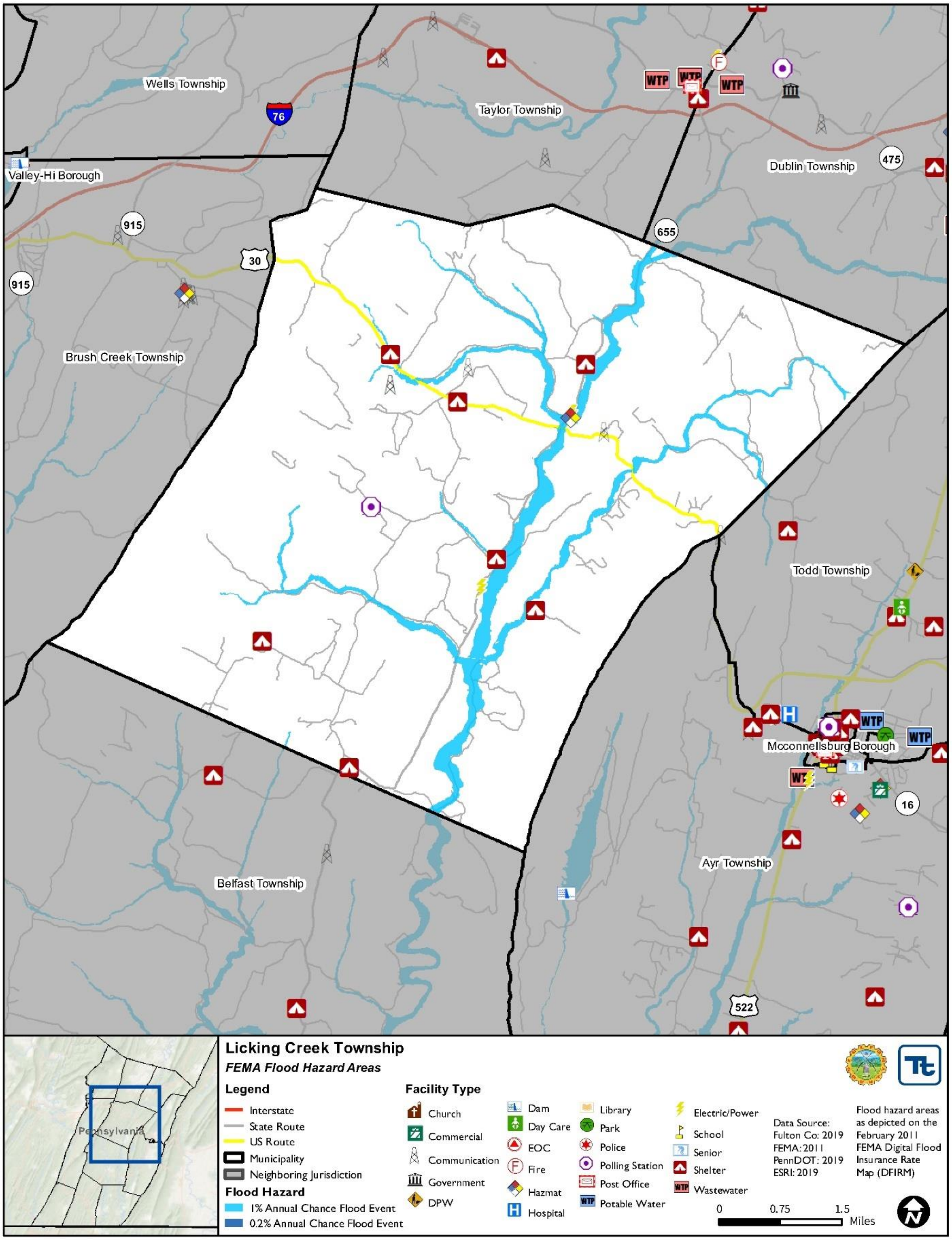


Figure 4.3.5-10. McConnellsburg Borough Municipal Flood Map

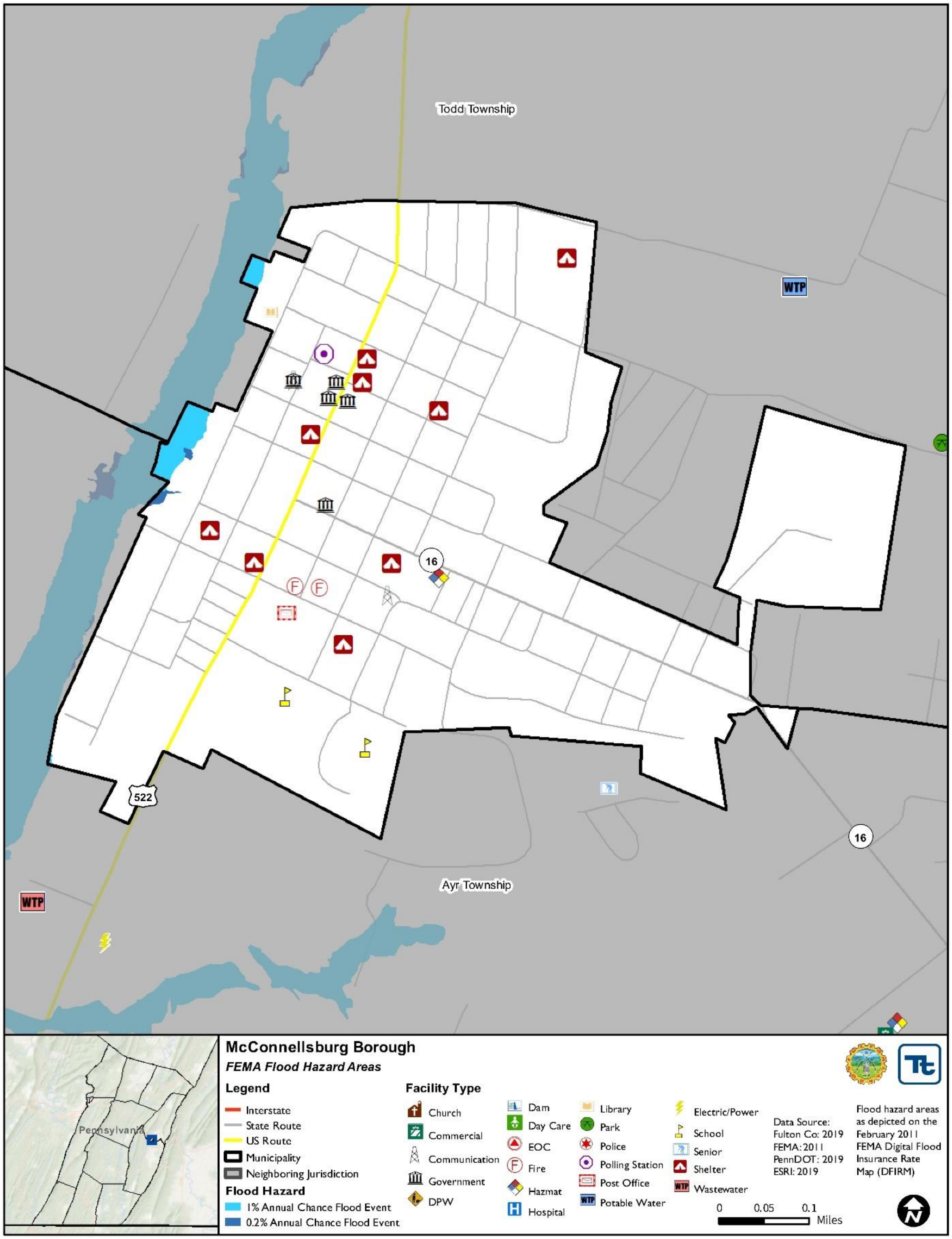


Figure 4.3.5-11. Taylor Township Municipal Flood Map

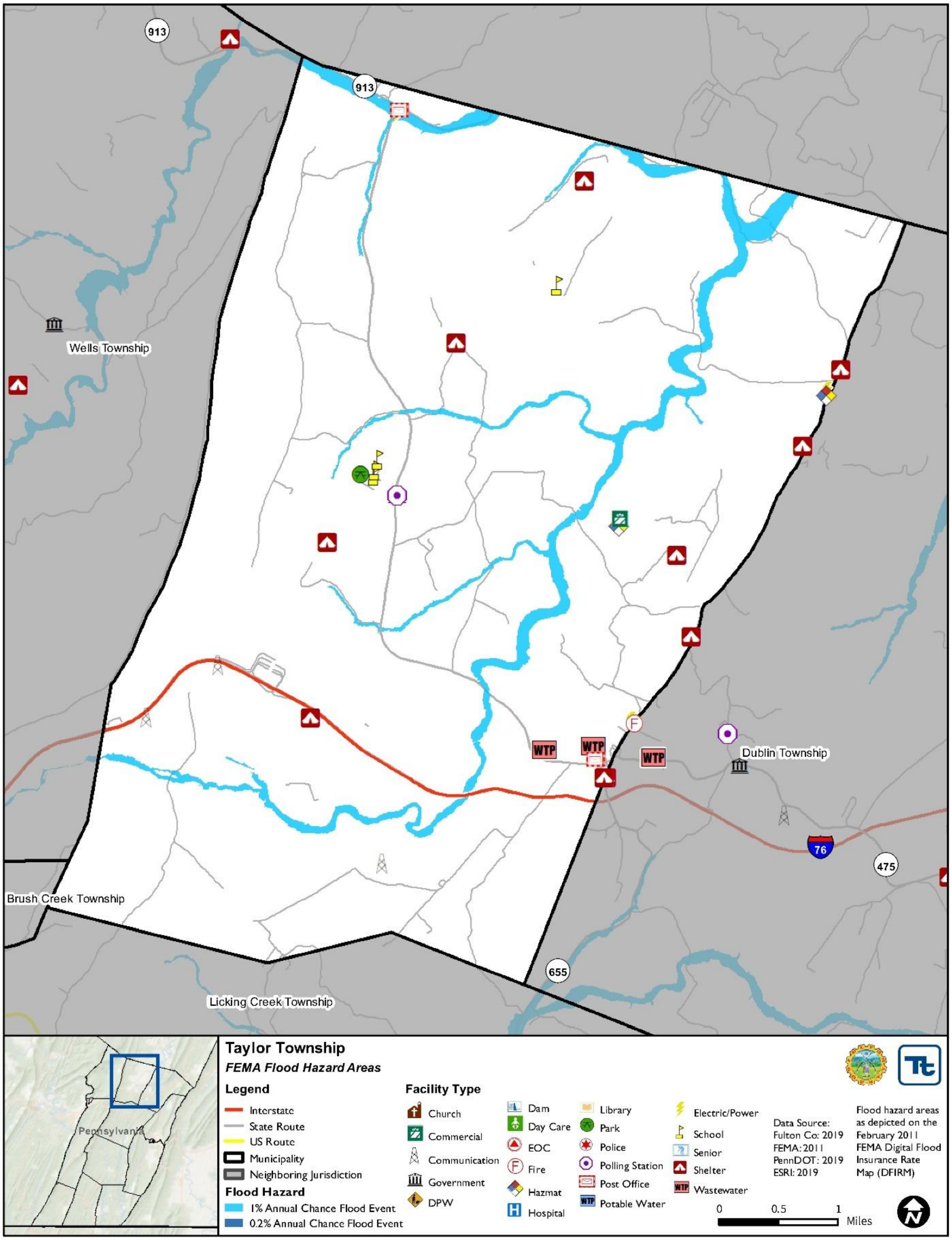


Figure 4.3.5-12. Thompson Township Municipal Flood Map

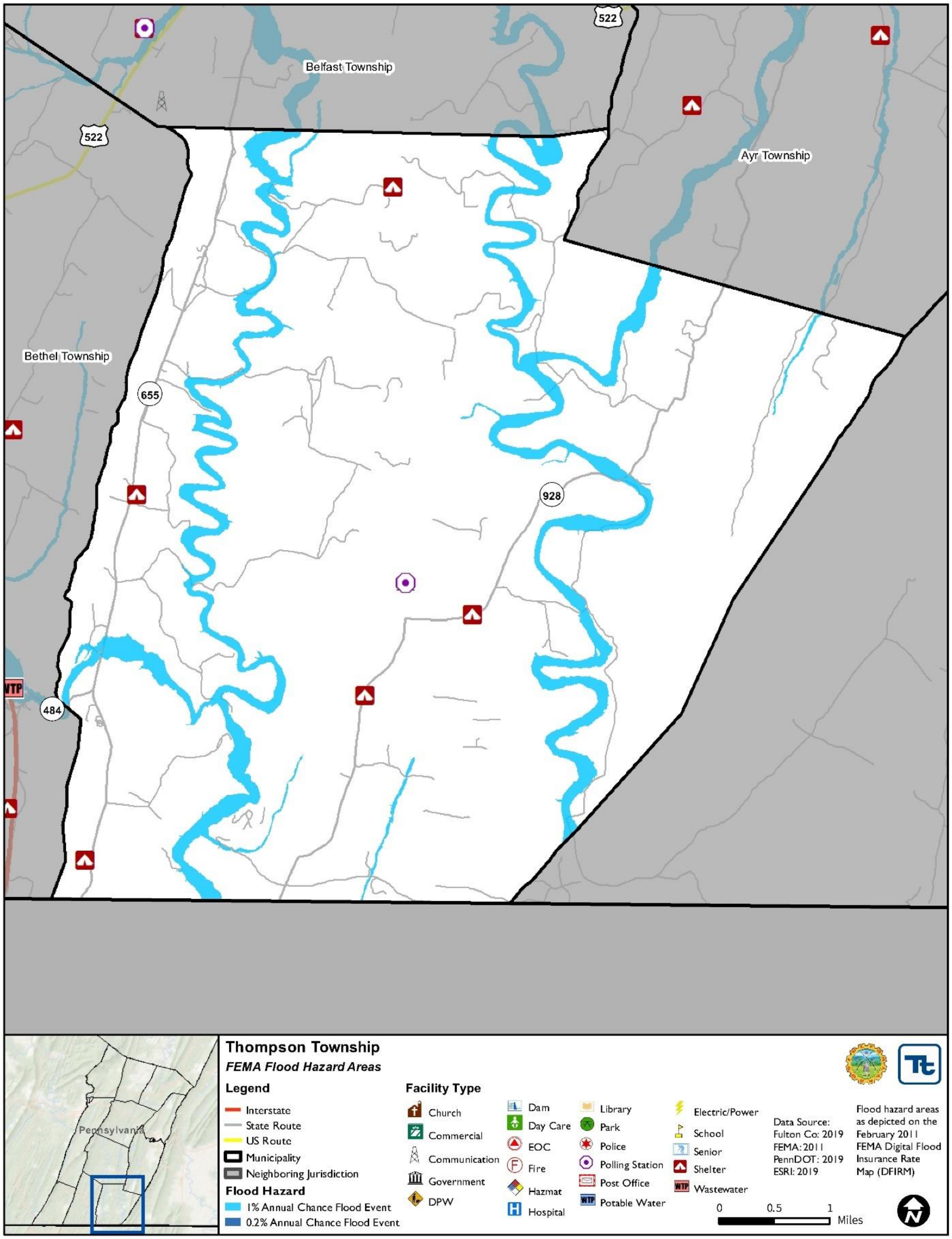


Figure 4.3.5-13. Todd Township Municipal Flood Map

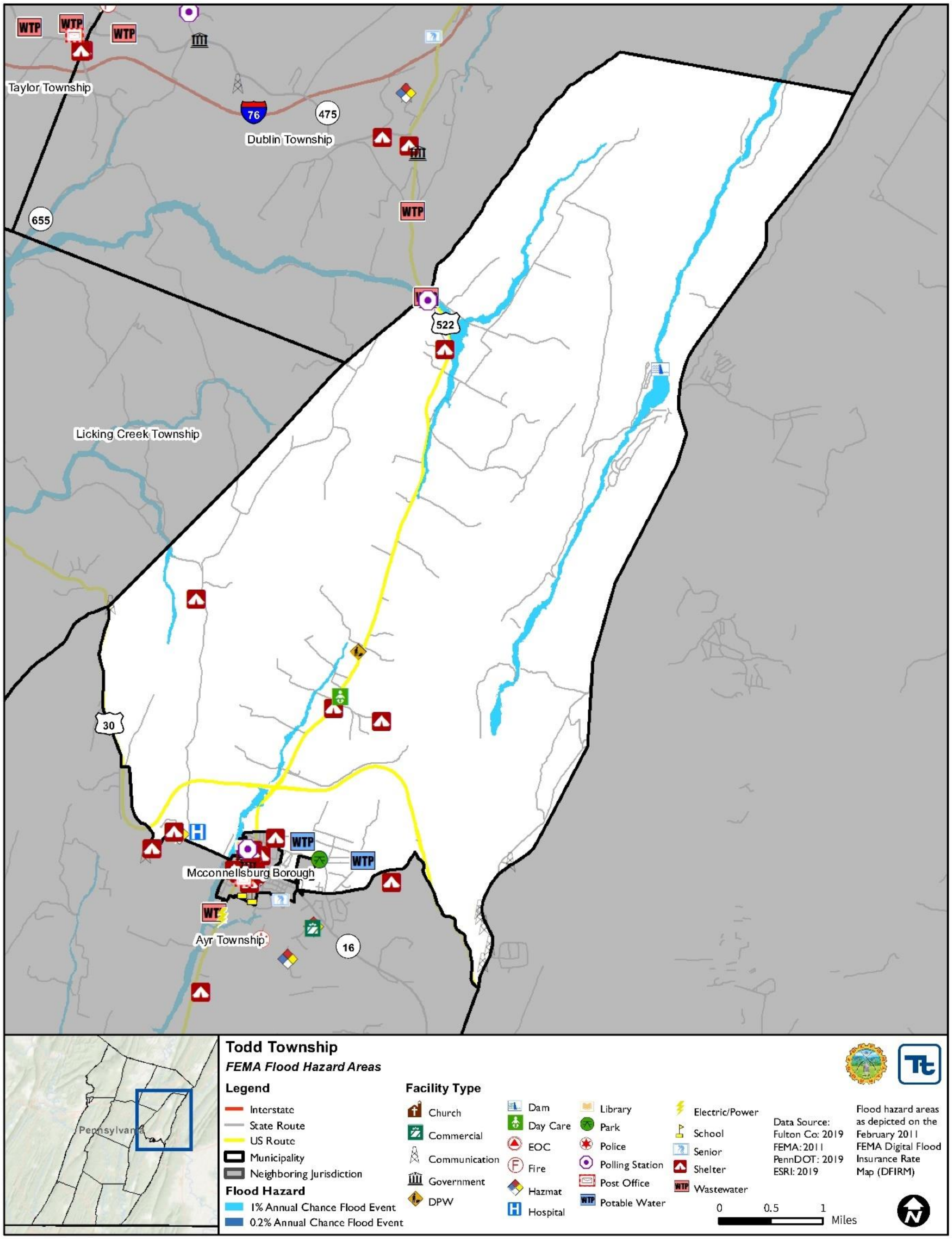


Figure 4.3.5-14. Union Township Municipal Flood Map

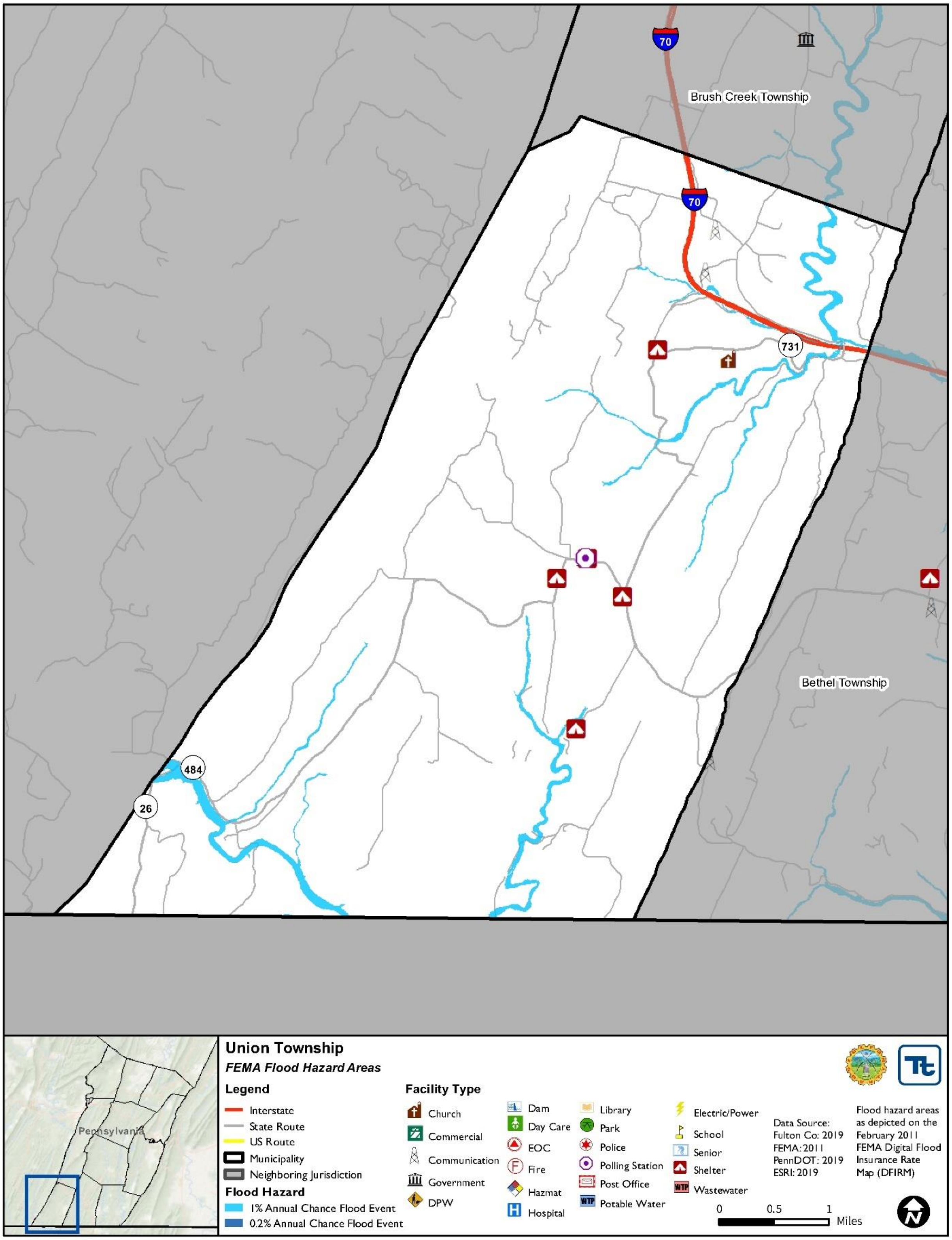


Figure 4.3.5-15. Valley-Hi Borough Municipal Flood Map

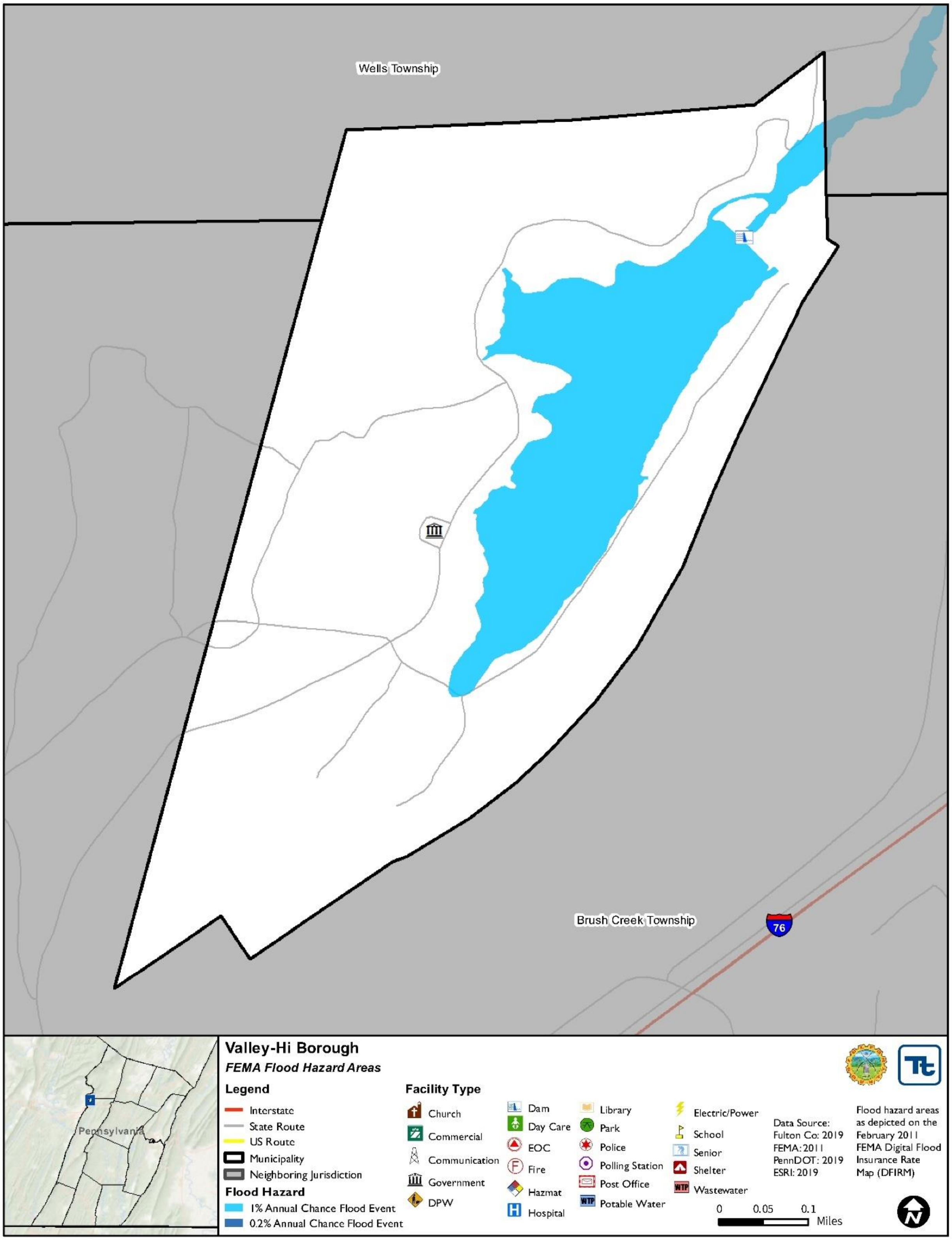
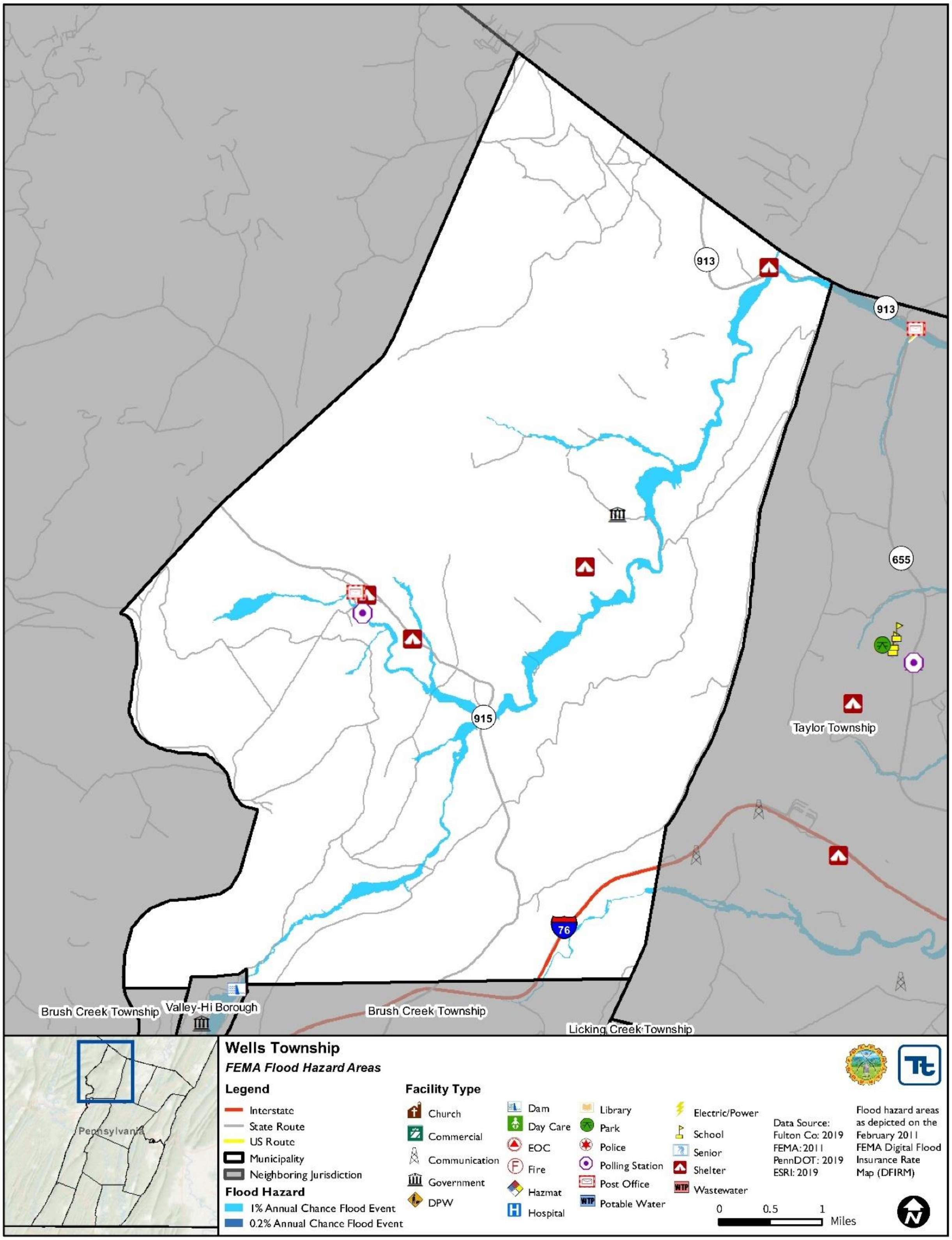


Figure 4.3.5-16. Wells Township Municipal Flood Map



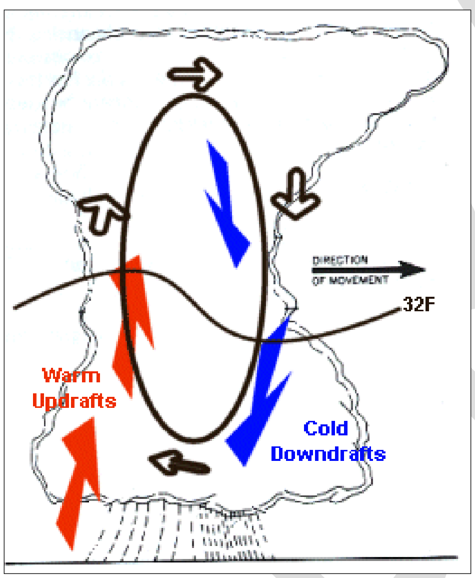
4.3.6 Hailstorm

This section describes the location and extent, range of magnitude, past occurrence, future occurrence, and vulnerability assessment for the hailstorm hazard for Fulton County.

A hailstorm is a storm accompanied by hail, which is precipitation in the form of small balls or lumps of clear ice or compact snow (Merriam Webster, 2017). 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] 2009). Figure 4.3.6-1 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 4.3.6-1. Hail Formation

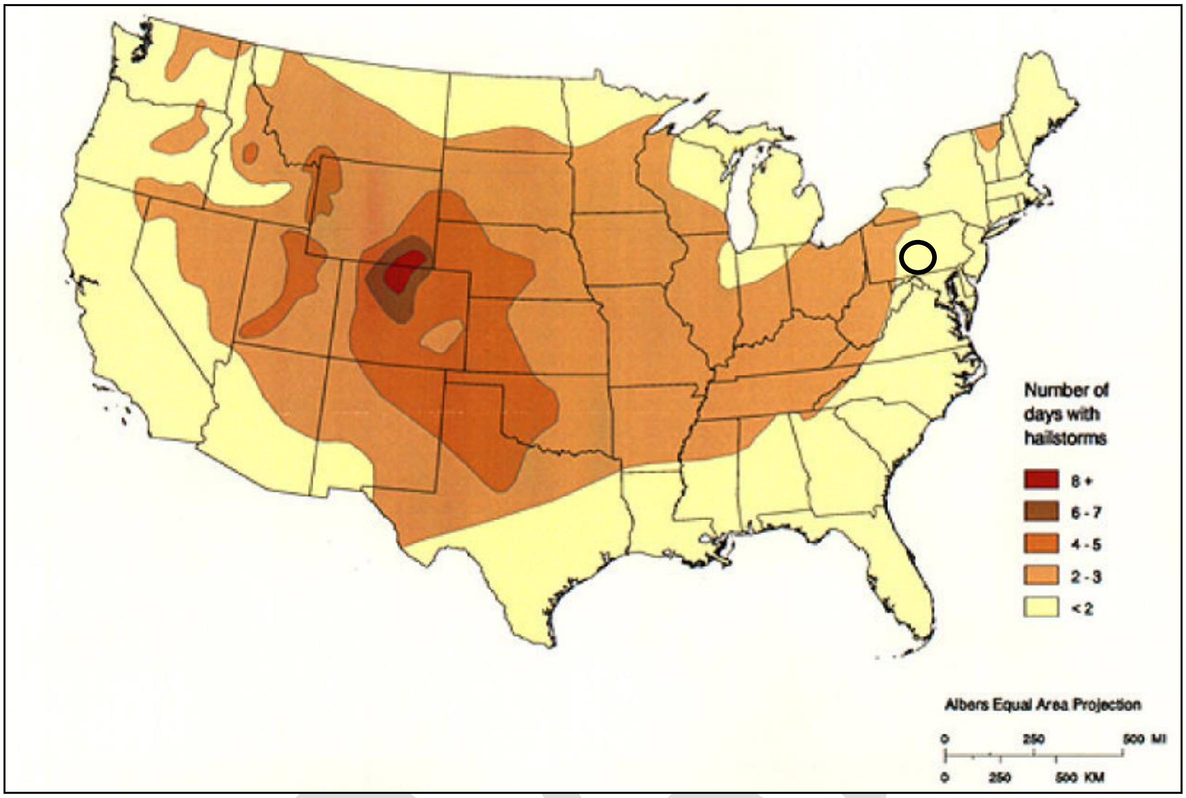


Source: National Oceanic and Atmospheric Administration (NOAA) 2012
°F degrees Fahrenheit

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 may accompany a thunderstorm (Federal Alliance for Safe Homes 2013). As indicated on Figure 4.3.6-2, Fulton County undergoes fewer than two hailstorms per year, on average.

Figure 4.3.6-2. Annual Frequency of Hailstorms in the U.S.



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

Hailstorms may be a part of a severe thunderstorm or other severe weather patterns. 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 inches 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.

Fulton County has experienced hail ranging in size from 0.75 to 2.75 inches in diameter. No deaths or injuries due to hail have been recorded in the County. The largest recorded hail in Fulton County occurred on May 26, 2002, when thunderstorms produced baseball-sized hail near Buck Valley. The most damaging hailstorm in Fulton County occurred on May 26, 2011. Hail fell across the county, causing over $100,000 in damage.

Based on reports from the National Centers for Environmental Information (NCEI) and Fulton County residents, the worst-case scenario for a hailstorm would be a storm that dropped baseball-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 hailstones pose serious risk to people who are exposed. Table 4.3.6-1 shows the various sizes of hail as compared to real-world objects.

Table 4.3.6-1. Hail Size

Size	Inches in Diameter	Updraft Speed (MPH)
BB	<0.25	< 24
Pea	0.25	24
Marble	0.50	35
Dime	0.70	38
Penny	0.75	40
Nickel	0.88	46
Quarter	1.0	49
Half-dollar	1.25	54
Walnut	1.5	60
Golf Ball	1.75	64
Hen Egg	2.0	69
Tennis Ball	2.5	77
Baseball	2.75	81
Tea Cup	3.0	84
Grapefruit	4.0	98
Softball	4.5	103

Source: NWS n.d.

4.3.5.3 Past Occurrence

Hailstorms occur as a routine part of severe weather in Fulton County. The potential for hailstorms 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, Fulton County has a low potential for significant hail events based on previous records.

The Commonwealth of Pennsylvania 2018 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 Fulton County.

According to the U.S. Department of Agriculture (USDA) Risk Management Agency, hailstorm events within Fulton County between 1948 and 2017 have resulted in $56,541.90 in crop insurance claims. Over 90% of the amount of crop loss dollars are due to hail events from only three years: 2008, 2011, and 2013. In 2013, the County experienced $43,399 in loss claims; in 2008, the County claimed $6,456; in 2011, the County claimed $5,351 in losses (USDA 2019).

The NOAA-NCEI (formerly NCDC) Storm Events database includes hail reported during storm incidents in Fulton County from 1950 to March 31, 2019, as shown in Table 4.3.6-2. The database indicates that 14 separate reports were issued throughout the County from 1950 to 2017. Some reports specified different times of day or different localities regarding the same storm. According to these reports, Fulton County has undergone hail ranging in size from 0.75 inches to 2.75 inches in diameter, with no reported deaths or injuries and only one event contributing to property damages. This information differs from USDA records, as shown below.

Table 4.3.6-2. History of Hailstorms in Fulton County, 1988 to 2019

Date	Location	Diameter (in)	Deaths	Injuries	Property Damage ($)	Crop Damage ($)
5/16/1988	Fulton County	1	0	0	0	0
7/10/1995	Town Hill	1	0	0	0	0
6/4/1996	Big Cove Tannery	0.75	0	0	0	0
7/30/1996	Gracey	1.75	0	0	0	0
7/14/2000	Big Cove Tannery	1.75	0	0	2,000	0
5/26/2002	Buck Vly	2.75	0	0	0	0
5/26/2002	Needmore	1.5	0	0	0	0
6/13/2007	Akersville	0.75	0	0	0	0
5/26/2011	Dickeys Mtn	2	0	0	0	0
6/29/2012	Sideling Hill	1.75	0	0	0	0
6/29/2012	Sideling Hill	1	0	0	0	0
6/24/2013	Cito	1.75	0	0	0	0
6/24/2013	Webster Mill	1.75	0	0	0	0
8/7/2013	Burnt Cabins Strip	1	0	0	0	0

Source: NCEI 2019
Notes:
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 in the County occurred on May 26, 2011. While this event is noted in the NCEI database, the database does not list some of the property damage reported by residents; this damage led to a minimum of $100,000 worth of repairs. Thompson Township, in particular, was severely impacted. County residents stated that they had never witnessed anything like this before and reported hailstones as large as softballs. The images below demonstrate the size of the hailstones and the severe impact of the storm on residents.

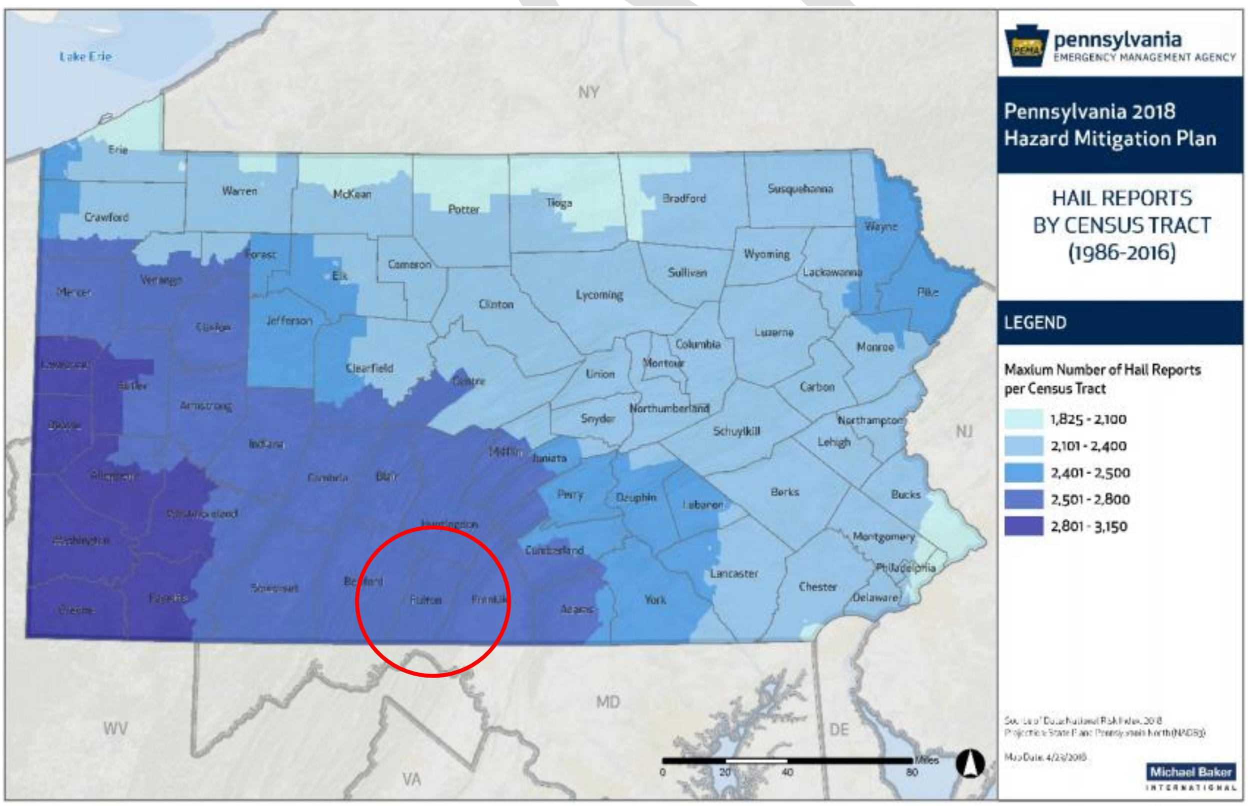
Source: Fulton County 2011

Source: Fulton County, 2011

4.3.5.4 Future Occurrence

It is not possible to predict the formation of a hailstorm with more than a few days' lead time. The past occurrences described above, however, indicate that hailstorm events in Fulton County probably will occur every year throughout the months of May through September. Encompassing events between 1986 and 2016, Figure 4.3.6-3 below shows the maximum number of hail reports per Census Tract across Pennsylvania.

Figure 4.3.6-3. Hail Reports by Census Tract in Pennsylvania



Source: PEMA 2018
Note: The red oval indicates the location of Fulton 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 within the identified hazard area. Regarding hail events, the entire County has been identified as the hazard area. Therefore, all assets in Fulton 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:

- 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
- Collection of further data that will assist in understanding this hazard

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.

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.

As discussed earlier in the Past Occurrence subsection, Fulton County has experienced some historical hailstorm property damage and significant crop damage ($2,000 in property damage claims from only one event [per NCEI records] and $56,541.90 in USDA crop damage claims [per USDA records, which differ from the NCEI 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 the year 2017. If a hailstorm would eliminate the entire agricultural yield in Fulton County, total losses on the County's 100,465 acres of farmland could reach nearly $76 million.

Future Growth and Development

Areas targeted for potential future growth and development within the next 5 to 10 years have been identified across Fulton County and are further discussed in Section 2.4 of this HMP. New developments and new residents are expected to be exposed to the hailstorm hazard in the future.

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 the 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 information and actual loss data specific to the plan participants will further enhance Fulton County’s vulnerability assessment.

4.3.7 Landslide

This section provides a profile and vulnerability assessment of the landslide hazard in Fulton County. According to the U.S. Geological Survey (USGS), the term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows (USGS 2016). Landslides are classified by type of material involved and the type of movement. In addition, they are classified at the rate of movement and the water content of the material. Movement rates range from inches over many years to many feet per second (DCNR 2001).

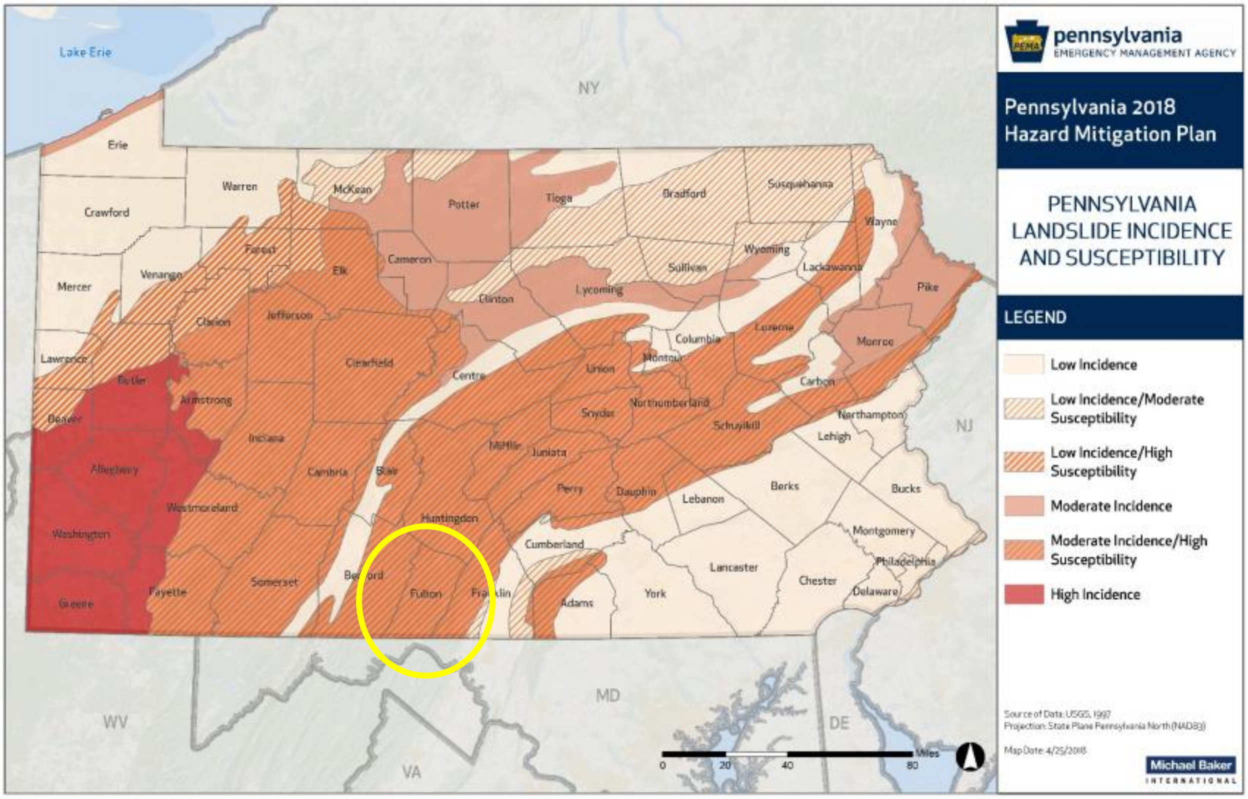
Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes through construction or erosion, earthquakes, and changes in groundwater levels. Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the 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 altering the natural slope gradient, increasing soil water content, and removing vegetation cover.

4.3.7.1 Location and Extent

The entire U.S. experiences landslides, with 36 states having moderate to highly severe landslide hazards. Expansion of urban and recreational developments into hillside areas exposes more people to the threat of landslides each year. According to the USGS, Fulton County has high landslide potential.

Rockfalls and other slope failures occur in areas of Pennsylvania with moderate to steep slopes; however, most of Pennsylvania has areas susceptible to landslides. The southwestern area of Pennsylvania has the highest concentration of landslides (PEMA, 2018; DCNR 2001). According to DCNR, most major and minor highways have sections cut in rock or soil that can lead to slope failure. Steep mountain slopes across Pennsylvania have experienced debris avalanches associated with extreme rainfall or rain-on-snow events. Additionally, urban and rural land development is increasing the number of landslide occurrences. Major highway construction with large excavations and fills creates potential for landslides (DCNR 2001). Figure 4.3.7-1 shows the landslide susceptible areas across the Commonwealth. Fulton County is noted as having moderate incidence and high susceptibility to landslides throughout the entire county.

Figure 4.3.7-1. Areas of Pennsylvania Susceptible to Landslides



Source: *PEMA, 2018*

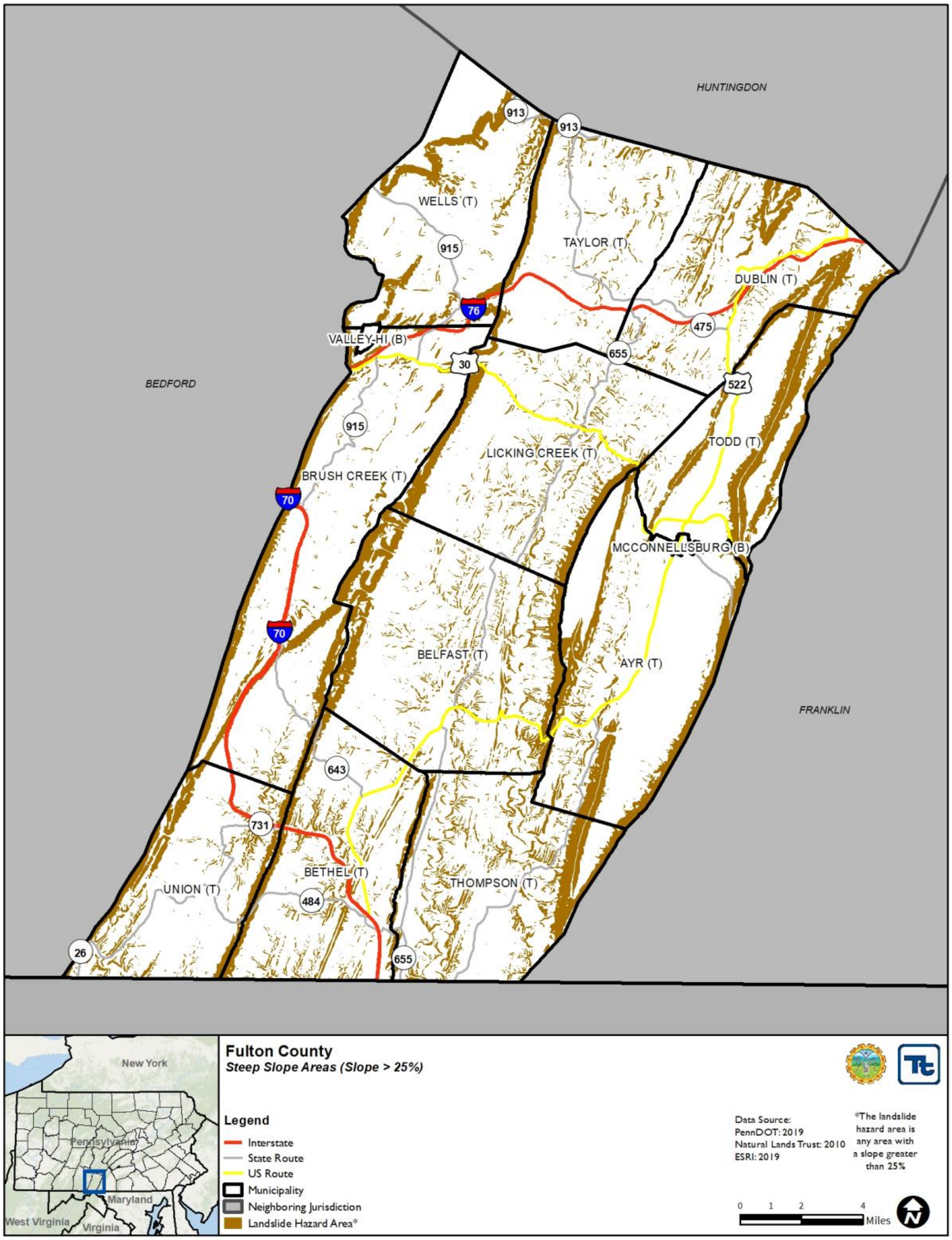
Note: *The yellow circle indicates the approximate location of Fulton County. Fulton County is shown as having a moderate incidence and high susceptibility to landslide throughout the entire county.*

To determine the extent of a landslide hazard, the affected areas need to be identified, and the probability of the landslide occurring within some time period needs to be assessed. Natural variables that contribute to the overall extent of potential landslide activity in any particular area include soil properties, topographic position and slope, and historical incidence. Predicting a landslide is difficult, even under ideal conditions and with reliable information. As a result, the landslide hazard is often represented by landslide incidence and/or susceptibility, as defined below:

- Landslide incidence is the number of landslides that have occurred in a given geographic area. High incidence means greater than 15% of a given area has been involved in landsliding; medium incidence means that 1.5 to 15% of an area has been involved; and low incidence means that less than 1.5% of an area has been involved (Radbruch-Hall 1982).
- Landslide susceptibility is defined as the probable degree of response of geologic formations to natural or artificial cutting, to loading of slopes, or to unusually high precipitation. It can be assumed that unusually high precipitation or changes in existing conditions can initiate landslide movement in areas where rocks and soils have experienced numerous landslides in the past. Landslide susceptibility depends on slope angle and the geologic material underlying the slope. Landslide susceptibility only identifies areas potentially affected and does not imply a time frame when a landslide might occur. High, medium, and low susceptibility are delimited by the same percentages used for classifying the incidence of landsliding (Radbruch-Hall 1982).

According to the Steep Slopes GIS layer from the Natural Lands Trust as shown in Figure 4.3.7-2, Fulton County has a considerable amount of steep slope area distributed throughout Fulton County. For the purposes of this planning effort, any area with a slope greater than 25 percent is considered the hazard area.

Figure 4.3.7-2. Landslide Hazard Area in Fulton County



4.3.7.2 Range of Magnitude

Landslides have the potential to 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 Commonwealth are moderate to slow moving, damaging things rather than people. Almost all of the 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. As residential and recreational development increases on and near steep mountain slopes, the hazards from these events will also increase (PEMA 2018).

According to DCNR, the Pennsylvania Department of Transportation and large municipalities incur substantial costs due to landslide damage and to extra construction costs for new roads in known landslide-prone areas. One PennDOT estimate in 1991 showed an average of $10 million per year in landslide repair contracts across the Commonwealth and a similar amount in mitigation costs for grading projects (DCNR 2001).

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

- Changes to topography
- Damage or destruction of vegetation
- Potential diversion or blockage of water in the vicinity of streams, rivers, etc.
- Increased sediment runoff both during and after event (PEMA 2018).

Fulton County's worst-case scenario would be an event similar to one in Beaver County in 1942 (PEMA 2018). 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.

4.3.7.3 Past Occurrence

Outside of impacts to important transportation routes, landslide history is not documented as completely (if at all) as other hazards, primarily because landslides are not always seen, and therefore historical landslide occurrences in Fulton County are not well known.

The National Center for Environmental Information (NCEI) does not have any records of landslides in the county (NCEI 2019). Between 1954 and 2019, FEMA issued a disaster (DR) or emergency (EM) declaration for Pennsylvania for one geological hazard-related event, classified as severe storms, flooding, and mudslide. This declaration did not include Fulton County (FEMA 2019).

4.3.7.4 Future Occurrence

Based upon risk factors and past occurrences, it is likely that landslides will continue to occur in Fulton County in the future. However, severity of the landslides can vary depending on type and location of event. Landslide probabilities are largely a function of surface geology but are also influenced by both weather and human activities. Mismanaged, intense development in steeply sloped areas could increase the frequency of landslide occurrence. Periods of intense rain or snowmelt can also increase the risk of landslides.

Mismanaged, intense development in steeply sloped areas could increase the frequency of landslides in Fulton County. Building and road construction are contributing development factors to landslides, as they can often undermine or steepen otherwise stable soil. Any events that do occur would take place in steeply sloped areas that do not feature extensive land development or many structures. Increased deforestation and soil disturbances caused by development on sloped areas further increases these risks. As timbering and development of sloped land continue, the risk of significant landslides increases. The probability of future occurrence of landslides in Fulton County cannot be calculated due to the lack of reported landslide events within the County. This does not indicate that landslides do not occur, but that they are not commonly reported in the County.

Based on available historical data, the 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 what assets are exposed or vulnerable in the hazard area identified. The following section discusses potential impact of the landslide hazard on Fulton 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.

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 making inquiries to planning and engineering departments of local governments (National Atlas 2018).

Overall, 17.5 percent (or 76.9 square miles) of Fulton County is located within the landslide hazard area. Landslide hazard areas are present throughout Fulton County. For the purposes of this assessment, steep slope areas with a slope angle greater than 25 percent are considered the hazard zone. Refer to Figure 4.3.7-2 earlier in this section. Further information regarding these hazard areas is presented below.

Impact on Life, Health, and Safety

As discussed above, 17.5 percent of Fulton County is located in the landslide hazard area. Therefore, the County's population (U.S. Census 2010 population of 14,845) within this area is considered exposed to this hazard; however, based on the historic record, landslide events tend to be localized events. Landslide events can cause both direct and indirect (impact on buildings) damage to the County's population.

To estimate populations within the hazard area, the hazard area boundary (shown in Figure 4.3.7-2) was overlaid upon the 2010 U.S. Census population data (U.S. Census 2010). Census blocks with their centers (centroids) within the boundary of the landslide hazard area were used to calculate the estimated population considered exposed to this hazard. The U.S. Census blocks do not align exactly with the hazard area, and thus these estimates should be considered for planning purposes only. Additionally, the hazard area boundary is only available at the municipal level and more detailed breakdowns are not available; this presents another reason to only use these estimates for planning purposes. In addition to being available at the census block level, the 2010 U.S. Census data is the default demographic data in HAZUS-MH v4.2. The census block level provides a higher resolution of population distribution than American Community Survey spatial data, which is only available at the census tract level. The 2010 U.S. Census data is also used to maintain consistency in data throughout vulnerability assessments throughout this Hazard Mitigation Plan (HMP).

Table 4.3.7-1 lists populations exposed by municipality (U.S. Census 2010). The population downslope of the landslide hazard areas is particularly vulnerable to this hazard. Due to the nature of U.S. Census block data, it is difficult to determine demographics of populations vulnerable to mass movements of geological material. Using this approach, 176 people (1.2 percent of the population) are located in the landslide hazard area. Please note while reviewing the table that exposure rates do not equate to actual potential impacts. Although an entire jurisdiction may be located in a high-susceptibility area, as noted, most landslide events are localized. Therefore, while a large number of residents may have a high exposure risk to landslide events, few residents will actually be significantly impacted.

Table 4.3.7-1. Estimated Fulton County Population Vulnerable to the Landslide Hazard Area

Municipality	U.S. Census 2010 Population	Estimated Population Exposed	
		Estimated Population Exposed	% of Total
Ayr Township	1,942	47	2.4%
Belfast Township	1,448	26	1.8%
Bethel Township	1,508	30	2.0%
Brush Creek Township	819	5	0.7%
Dublin Township	1,264	9	0.7%
Licking Creek Township	1,703	25	1.5%
McConnellsburg Borough	1,220	0	0.0%
Taylor Township	1,118	1	0.1%
Thompson Township	1,098	16	1.5%
Todd Township	1,527	14	0.9%
Union Township	706	2	0.3%
Valley-Hi Borough*	15	0	0.0%
Wells Township	477	0	0.0%
Fulton County	**14,845**	**176**	**1.2%**

Sources: United States Census 2010, National Lands Trust 2010

Impact on General Building Stock

For this analysis, the HAZUS-MH v4.2 dasymetric census blocks were used (refer to Section 4.1 for more information). In general, the built environment within the landslide hazard area and the population, structures, and infrastructure downslope are vulnerable to this hazard. Using the default general building stock, the replacement cost values of the U.S. Census blocks with their centroids in the hazard area were totaled to provide the exposed replacement cost value. Building footprints provided by Fulton County were used to estimate the number of structures within the landslide hazard area. Approximately $34.9 million in replacement cost is located in the landslide hazard area (1.5 percent) or an estimated 110 structures. Table 4.3.7-2 lists building stock exposure per municipality.

Table 4.3.7-2. Estimated General Building Stock Exposure to the Landslide Hazard Area

Municipality	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed			
			Number of Buildings	% of Total	RCV	% of Total
Ayr Township	1,139	$328,056,000	31	2.7%	$25,878,000	7.9%
Belfast Township	740	$181,485,000	14	1.9%	$3,945,000	2.2%
Bethel Township	853	$243,010,000	18	2.1%	$2,492,000	1.0%
Brush Creek Township	519	$110,481,000	4	0.8%	$1,015,000	0.9%
Dublin Township	697	$153,284,000	5	0.7%	$0	0.0%
Licking Creek Township	881	$203,625,000	16	1.8%	$1,042,000	0.5%
McConnellsburg Borough	538	$276,419,000	0	0.0%	$0	0.0%
Taylor Township	697	$141,644,000	1	0.1%	$0	0.0%
Thompson Township	572	$155,461,000	12	2.1%	$0	0.0%
Todd Township	858	$298,975,000	7	0.8%	$0	0.0%
Union Township	421	$106,265,000	2	0.5%	$0	0.0%
Valley-Hi Borough*	29	$5,827,000	0	0.0%	$0	0.0%
Wells Township	292	$58,946,000	0	0.0%	$544,000	0.9%
Fulton County	**8,236**	**$2,263,478,000**	110	1.3%	$34,916,000	1.5%

Source: HAZUS-MH v4.2; Fulton County 2019; USGS 2010
Notes:
% Percent
RCV Replacement cost value (structure and contents)

Critical Facilities and the Economy

To estimate exposure, the approximate hazard area was overlaid upon the essential and municipal facilities. In addition to critical facilities, a significant amount of infrastructure can be exposed to mass movements of geological material:

- *Roads* – Access to major roads is crucial to life-safety after a disaster event and to response and recovery operations. Landslides can block egress and ingress on roads, isolating neighborhoods, posing traffic problems, and causing delays of public and private transportation. This can result in economic losses for businesses.
- *Bridges* – Landslides can significantly impact road bridges. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, rendering them hazardous for use.
- *Power Lines* – Power lines are generally elevated above steep slopes but the towers supporting them can be subject to landslides. A landslide could trigger failure of the soil underneath a tower, causing it to collapse and ripping down the lines. Power and communication failures due to landslides can create problems for vulnerable populations and businesses.

Several other types of infrastructure may also be exposed to landslides, including water and sewer infrastructure. At this time, all critical facilities, infrastructure, and transportation corridors within the hazard areas are considered vulnerable until more information becomes available. There is a single communications facility in Bethel Township as the only critical facility in Fulton County within the landslide hazard area.

Geologic hazards 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). Estimated potential damages to general building stock can be quantified as discussed above. For the purposes of this analysis, general building stock damages are discussed further.

A landslide event alters the landscape. In addition to changes in topography, vegetation and wildlife habitats may be damaged or destroyed, and soil and sediment runoff will accumulate downslope, potentially blocking waterways and roadways and impacting quality of streams and other water bodies. Additional environmental impacts include loss of forest productivity. Considering both landslide hazard areas, the entire building stock is potentially exposed to a landslide event. These dollar value losses to Fulton County's total building inventory would impact Fulton County's tax base and the local economy.

All major roadways and transportation routes located in, and downslope of, the landslide hazard area may be vulnerable to a landslide event.

Impact on the Environment

The impact of landslides on the environment depends on the size and specific location of the event. Impacts include:

- Changes to topography
- Damage or destruction of vegetation
- Potential diversion or blockage of water in the vicinity of streams, rivers, etc.
- Increased sediment runoff both during and after event (PEMA 2018)

Future Growth and Development

Areas targeted for potential future growth and development within the next five years have been identified across Fulton County. Refer to Section 2.4 of this HMP for further details. New development within the landslide hazard areas are considered 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 could 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, potentially erode the local landscape, and impair slope stability, leading to an increase of landslide events in Fulton 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 Fulton County's vulnerability to landslide events must be considered as understanding of impacts of regional climate change increases.

Additional Data and Next Steps

More detailed landslide susceptibility zones can be generated so that communities can more accurately identify high hazard areas. A pilot study conducted for Schenectady County, New York, (described in the 2011 Draft New York State HMP) developed higher-resolution 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. Identifying historical damages to buildings and infrastructure incurred from landslides will also help with 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 Fulton County.

4.3.8 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 2013). An estimated 40 percent of the homes in Pennsylvania are believed to have elevated radon levels (Pennsylvania Department of Environmental Protection [PA DEP] 2017c).

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

4.3.8.1 Location and Extent

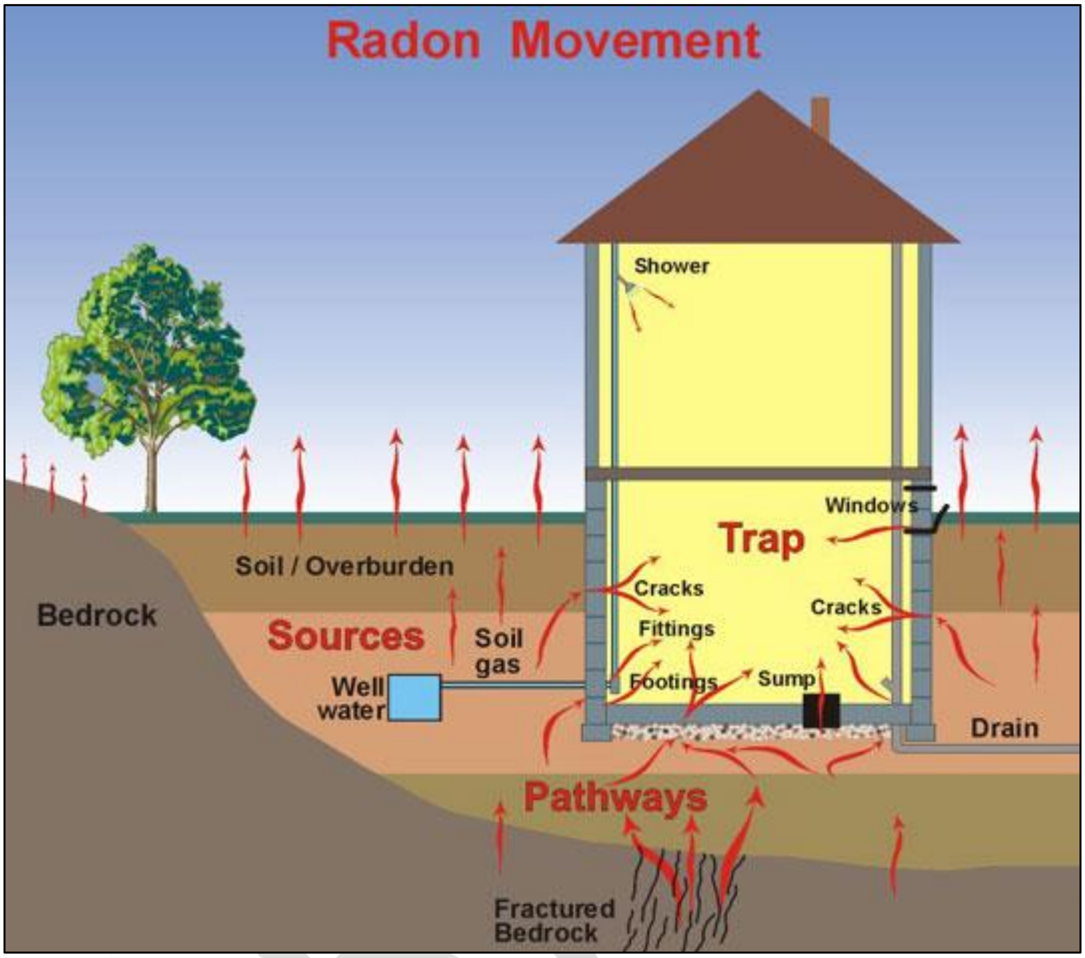
Radioactivity caused by airborne radon has been recognized for many years as an important component in the natural background radioactivity exposure of humans. However, it was not until the 1980s that the wide geographic distribution of elevated radon levels in houses and the possibility of extremely 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 2018).

Figure 4.3.8-1 illustrates radon entry points into a home.

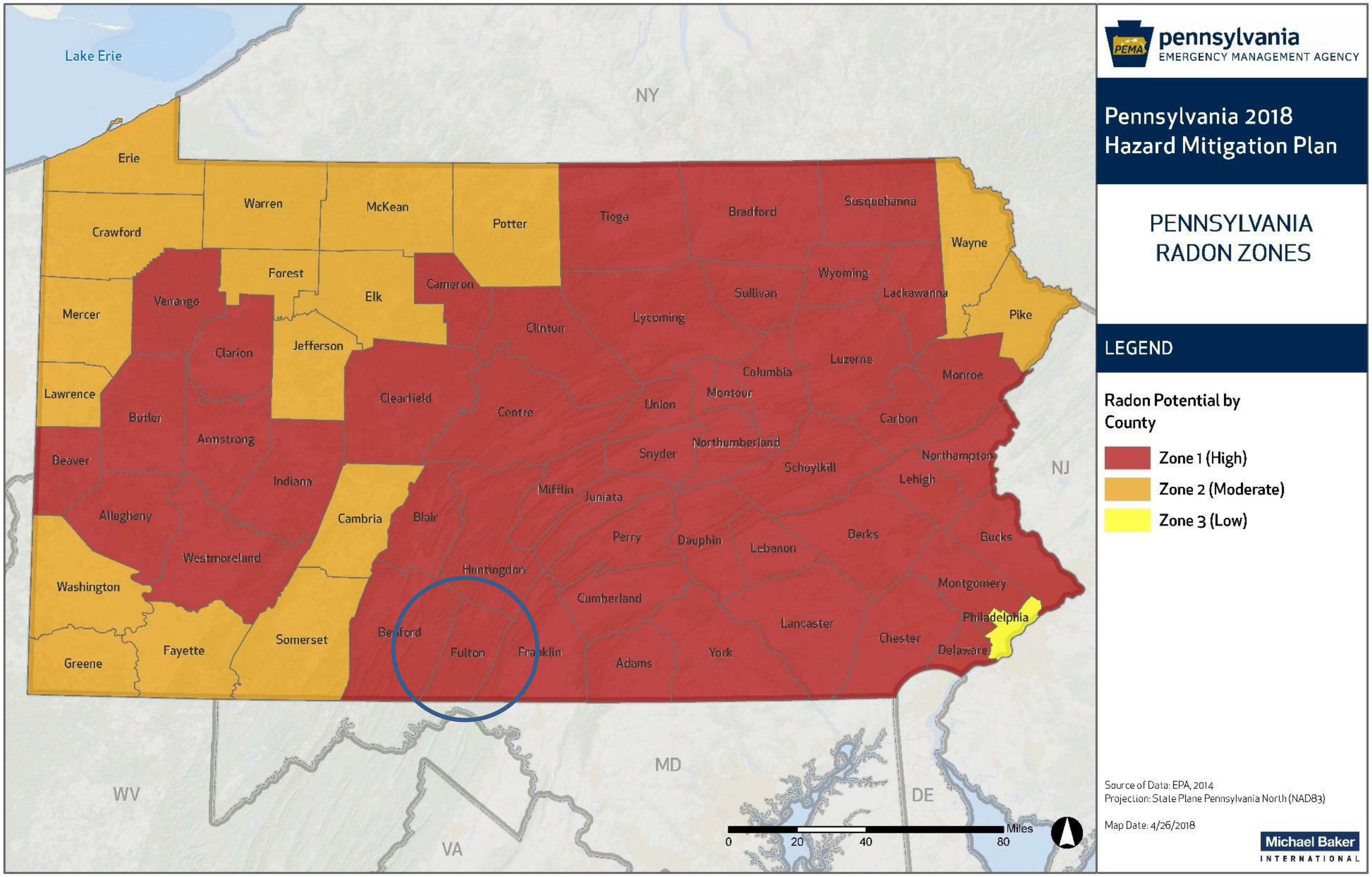
Figure 4.3.8-1. Sketch of Radon Entry Points into a House



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. Fulton County is in Zone 1 – High Radon Potential, as noted on Figure 4.3.8-2 below.

Figure 4.3.8-2. Radon Hazard Zones in Pennsylvania



Sources: PEMA 2018 (blue highlight added)

High radon levels were initially thought to be exacerbated in tightly sealed houses, although it is now recognized that rates of airflow into and out of houses, plus the location of air inflow and the radon content of air in the surrounding soil, are key factors 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 airflow, including cracks and channels, are important factors determining radon concentration in soil gas and its rate of flow into a house. Soil depth and moisture content, mineral host and form for radium, and other soil properties may also be important. 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:

- Areas of very elevated uranium content (above 50 parts per million [ppm]) around uranium deposits and prospects: 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.
- Areas of common rocks having higher than average uranium content (5 to 50 parts per million [ppm]): 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.
- Areas of soil or bedrock that have normal uranium content but properties that promote high radon levels in houses: This group is incompletely understood at present. Relatively high soil permeability can lead to high radon 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 2018).

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 Pennsylvania 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 2018).

4.3.8.2 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 approximately 21,000 lung cancer deaths every year, which includes an estimated 2,900 individuals who have never smoked. 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 4.3.8-1 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 4.3.8-1. 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 2 pCi/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 2016

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 4.3.8-1, 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 2018). The most likely scenario is a single household exposed to a very low concentration of radon, with no adverse health effects.

4.3.8.3 Past Occurrence

Current data on abundance and distribution of radon in Pennsylvania houses are considered incomplete and potentially biased, but a study was conducted testing the basements and the first floors of over 800,000 buildings throughout all 67 counties in Pennsylvania. A total of nearly 2 million data points were gathered and analyzed to determine radon concentrations. (PEMA 2018).

The PA DEP 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 data collected for this analysis through certified radon laboratories and tester. The data was compiled from January 1990 through December 2016 from a variety of house types. The total number of tests reported to the Bureau between 1990 and 2016 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 four zip codes within Fulton County to allow them to report the findings (summarized in Table 4.3.8-2). PA DEP does not publish results unless a zip code has had at least 30 tests conducted. PA DEP 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 PA DEP Radon Division recommends that ***all*** homeowners test for radon, regardless of test results within their respective zip codes. Despite a low average test result within a zip code, many homes in that zip code may have elevated radon levels.

Table 4.3.8-2. 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)
17229	Hustontown	Basement	32	64.7	10.7
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data
17233	McConnellsburg	Basement	105	72.1	13.7
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data
17238	Needmore	Basement	38	333.2	38.4
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data
17267	Warfordsburg	Basement	58	252.5	29.1
		First Floor	Insufficient Data	Insufficient Data	Insufficient Data

Source: PA DEP 2019

4.3.8.4 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 2018). 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 *highly likely* as defined by the Risk Factor Methodology probability criteria (discussed in Section 4.4).

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. This section evaluates and estimates the potential impact of the radon exposure hazard on Fulton 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 Fulton 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 Fulton County are vulnerable to radon exposure.

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).

PA DEP reports that 69 percent of structures within Westmoreland County are within the 4 pCi/L and above range with an average indoor radon level of 14 pCi/L. Excess human cancer risk posed by radon exposure at this elevated level is identified in Figure 4.3.8-1.

Impact on General Building Stock and Critical Facilities

While the entire general building stock and critical facility inventory in Fulton 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 Commonwealth 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 2018). Therefore, estimated radon mitigation costs for residential structures in Fulton County could exceed $8 million. However, 69 percent of households in the County have measured basement-level average radon levels exceeding 4 pCi/L, 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 2018).

Future Growth and Development

Because the entirety of Fulton 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 Fulton 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.

4.3.9 Subsidence and Sinkholes

This section provides a profile and vulnerability assessment for the subsidence and sinkhole hazard for Fulton County. Subsidence and sinkholes may be natural or related to underground mining activities. The predominant cause of subsidence and sinkholes in Fulton 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, instances of subsidence and sinkholes may occur in the future because of mining activity. Thus, information in this section will be presented to highlight the cause and its potential impacts of the hazard. Although underground mining is not considered a geologic hazard, it will be treated as such in this document because of its relationship 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] 2017). 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] 2018).

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, 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 2018).

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 Fulton County.

4.3.9.1 Location and Extent

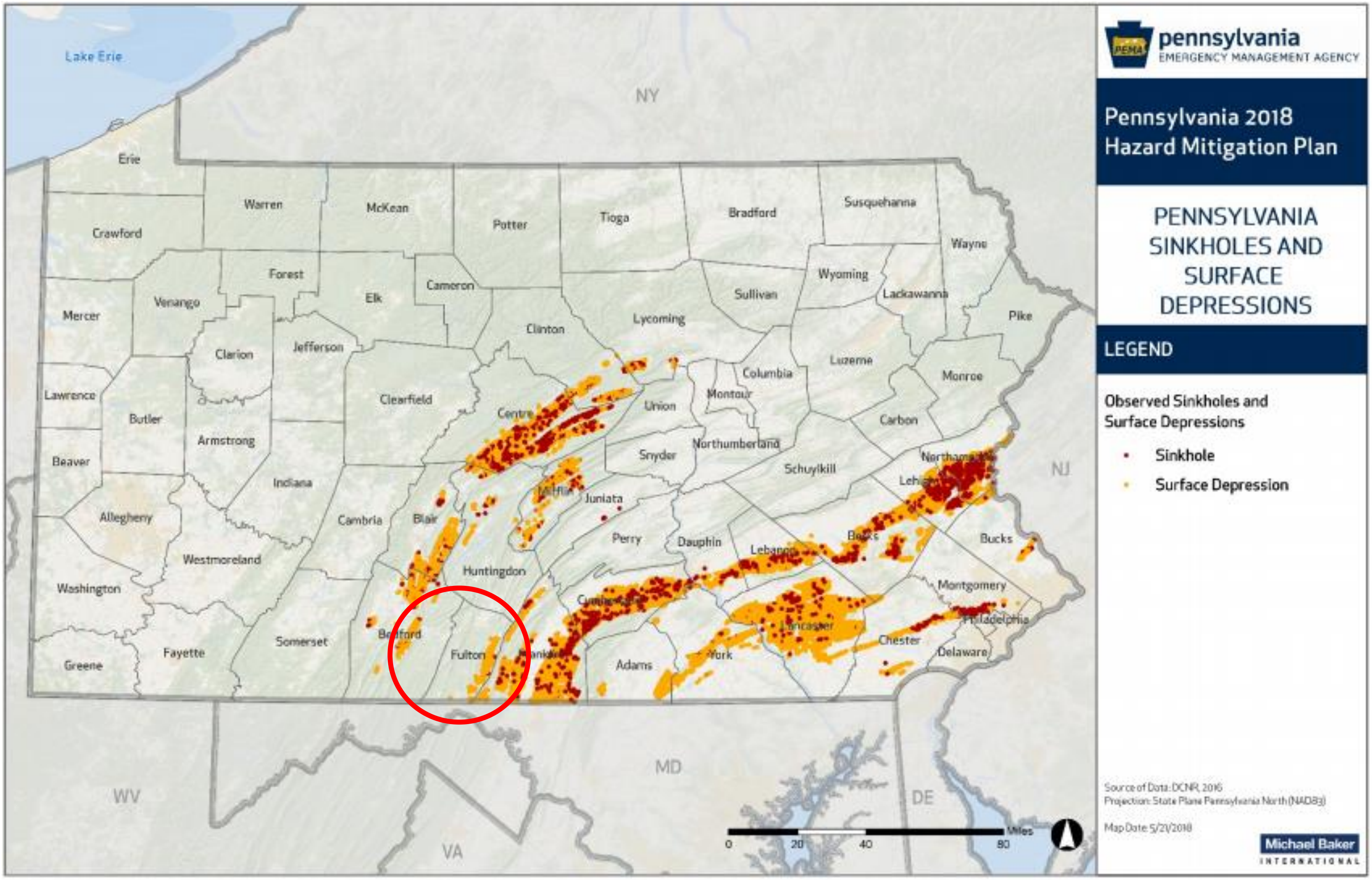
Approximately 17.7 percent of Fulton County (77.58 square miles) is underlain by carbonate bedrock (e.g., limestone). Fulton County has a very low susceptibility to sinkholes and subsidence attributable to abandoned underground mines; however, surface mines are present throughout the County.

Figure 4.3.9-1 highlights the areas of Pennsylvania subject to natural subsidence caused by the presence of limestone bedrock; Figure 4.3.9-2 more specifically illustrates the carbonate bedrock, abandoned mine areas, and digitized mine areas across Fulton County. The following municipalities have identified near-surface limestone within Fulton County:

- Ayr Township
- Bethel Township
- Dublin Township
- McConnellsburg Borough
- Thompson Township
- Todd Township

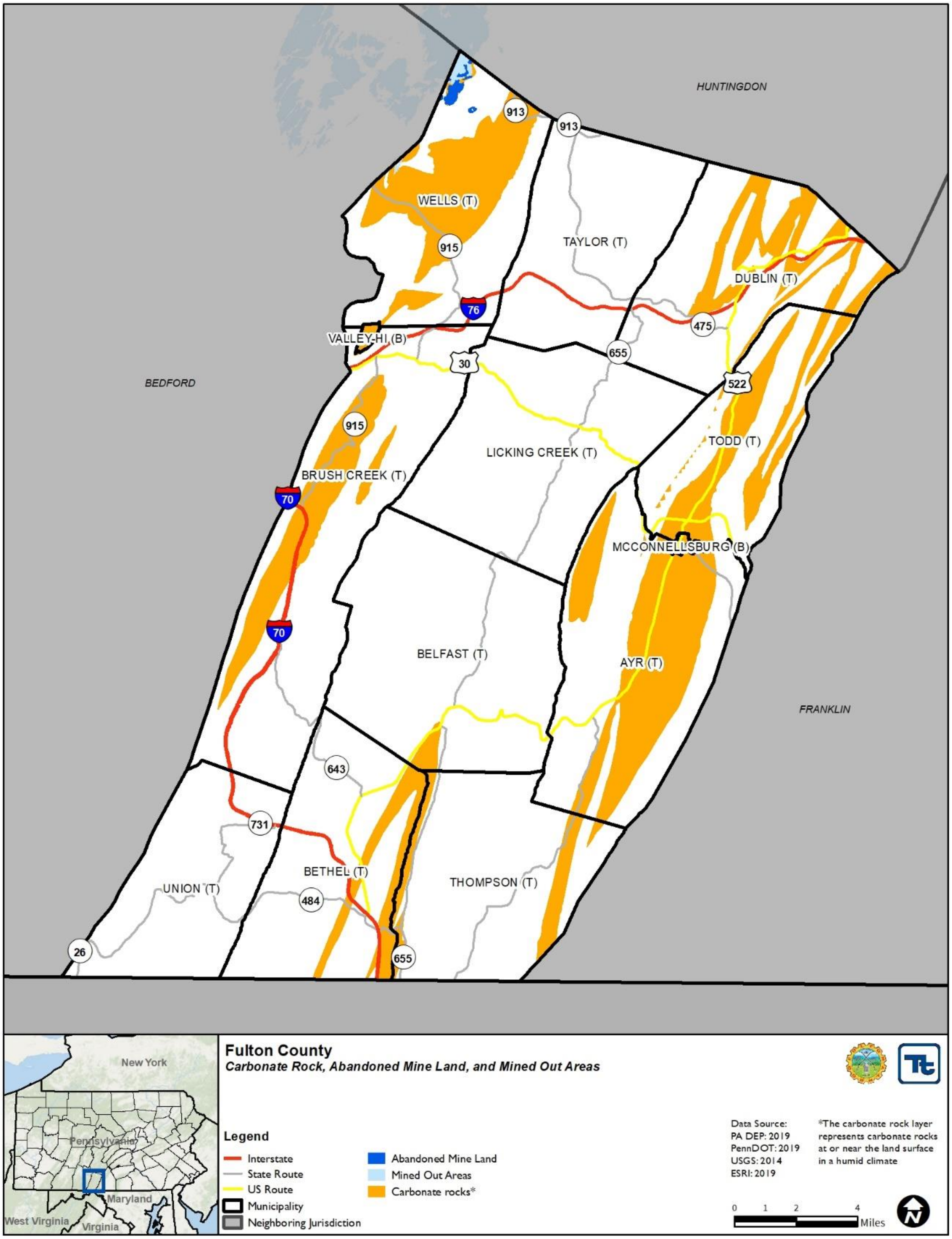
Fulton County has a very low susceptibility to sinkholes and subsidence attributable to abandoned mines; however, this does not mean such an event cannot occur. Figure 4.3.9-2 shows the approximate location of abandoned mine land problem areas created by past coal mining. Information illustrated in Figure 4.3.9-2 is based on a subset of data contained in the Office of Surface Mining Reclamation and Enforcement (OSMRE) Abandoned Mine Land (AML) Inventory. The AML Inventory data from July 2019 show 18 abandoned surface mines, 5 spoil areas, and 1 subsidence area within Fulton County (Pennsylvania Department of Environmental Protection [PADEP] 2019).

Figure 4.3.9-1. Inventoried Sinkholes and Surface Depressions in Pennsylvania



Source: PEMA 2018 (highlight added)

Figure 4.3.9-2. Abandoned Mine Lands, Mined Out Areas, and Carbonate Rock in Fulton County



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 earth-moving activities that cause changes in stormwater flow can trigger sinkhole events. Subsidence or sinkhole events may occur 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).

4.3.9.2 Range of Magnitude

Based on the geologic formations underlying parts of Fulton 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.

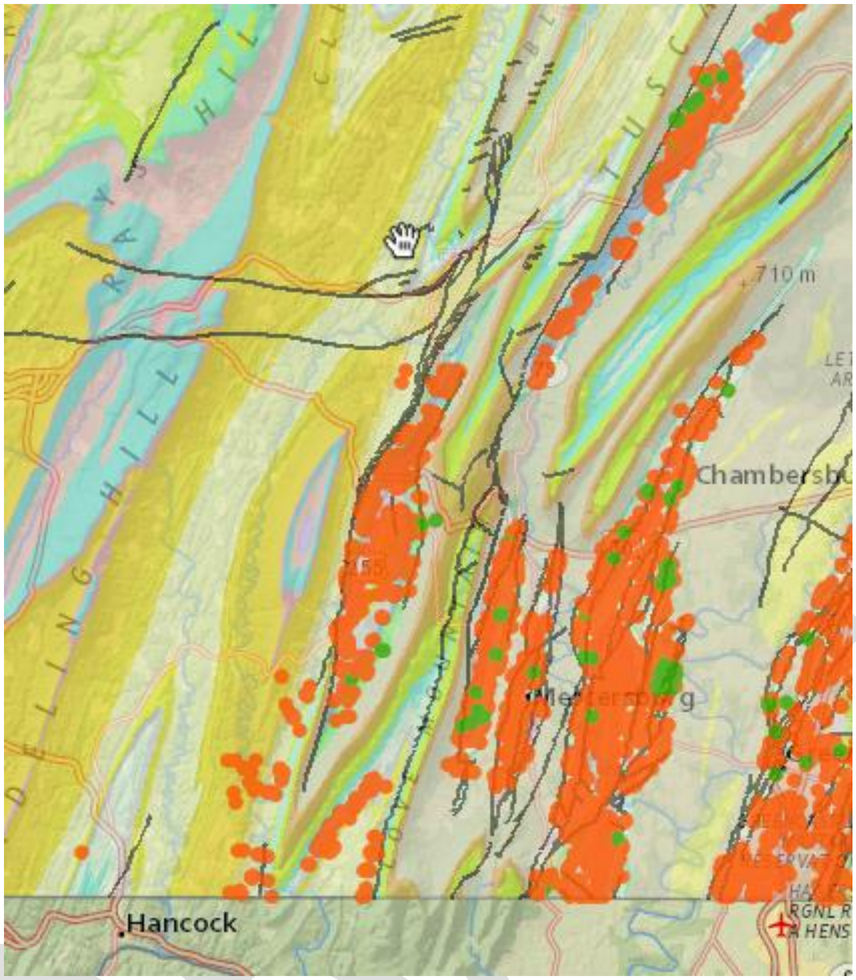
Sinkholes also may have negative effects on local groundwater. Groundwater in limestone and other similar carbonate rock formations can be easily polluted, because water moves readily from the earth's surface down through solution cavities and fractures, thus undergoing very little filtration. Contaminants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

The worst-case scenario for sinkholes in Fulton County would be a series of large sinkholes opening in Ayr Township. Long swaths of the Township have near-surface limestone, making it vulnerable to sinkholes. This series of sinkholes could close roads, cause power outages, prevent the delivery of emergency services, and cause injuries or death to the Township's residents.

4.3.9.3 Past Occurrence

The Pennsylvania Department of Conservation and Natural Resources (PA DCNR) Interactive Map (Figure 4.3.9-3) shows dozens of sinkholes and hundreds of surface depressions in Fulton County (PA DCNR, n.d.).

Figure 4.3.9-3. Sinkholes and Surface Depressions in Fulton County



Source: PA DCNR, n.d.
Note: 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.

4.3.9.4 Future Occurrence

Although sinkhole occurrence will continue to be a possibility in Fulton County, the probability of a sinkhole or subsidence event is difficult to estimate because of the low number of previous events. Areas to monitor for future sinkhole and subsidence events based on their geologic bedrock are listed above in Section 4.3.9.1.

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).

4.3.9.5 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 Fulton County in the following subsections:

- Impact on (1) life, health, and safety; (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

Approximately 17.7 percent of Fulton County (77.58 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 4.3.9-1 summarizes the municipalities potentially vulnerable to sinkholes and subsidence events based on the presence of carbonate bedrock.

Table 4.3.9-1. Municipalities Vulnerable to Sinkholes/Subsidence Events

Municipality	Carbonate Rock		Municipality	Carbonate Rock
Ayr Township	x		Taylor Township	
Belfast Township	x		Thompson Township	x
Bethel Township	x		Todd Township	x
Brush Creek Township	x		Union Township	
Dublin Township	x		Valley-Hi Borough	x
Licking Creek Township			Wells Township	x
McConnellsburg Borough	x			

Source: USGS 2014; PADEP 2014

Impact on Life, Health, and Safety

To estimate the number of individuals exposed to the hazard, the total population for each municipality was divided by the number of residential buildings to establish an average population per residential structure that intersects the carbonate bedrock area. Table 4.3.9-2 summarizes the Fulton County population exposed to this hazard by municipality (U.S. Census 2010). The 2010 U.S. Census data are also used to maintain consistency in data throughout vulnerability assessments throughout this hazard mitigation plan. (Note: Municipal boundaries do not align with the carbonate bedrock polygon in the spatial data, and these estimates are for planning purposes only.)

Table 4.3.9-2. Estimated Population Located over Carbonate Bedrock (U.S. Census 2010)

Municipalities	Total Population (2010 U.S. Census)	Estimated Population Exposed	Percent Total
Ayr Township	1,942	1,165	60.0%
Belfast Township	1,448	112	7.8%
Bethel Township	1,508	169	11.2%
Brush Creek Township	819	288	35.1%
Dublin Township	1,264	230	18.2%
Licking Creek Township	1,703	0	0.0%

Municipalities	Total Population (2010 U.S. Census)	Estimated Population Exposed	Percent Total
McConnellsburg Borough	1,220	1,208	99.0%
Taylor Township	1,118	0	0.0%
Thompson Township	1,098	75	6.9%
Todd Township	1,527	1,005	65.8%
Union Township	706	0	0.0%
Valley-Hi Borough	15	15	100.0%
Wells Township	477	454	95.1%
Fulton County	**14,845**	**4,721**	**31.8%**

Source: U.S. Census 2010; USGS 2014

Impact on General Building Stock

As noted above, no standard loss estimation models exist for the subsidence and 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 U.S. 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 4.3.9-3 lists the replacement cost value (RCV) (structure and contents) of general building stock (GBS) and number of structures located within the defined hazard area.

Table 4.3.9-3. Estimated General Building Stock Located over Carbonate Bedrock

Municipality	Total Number of Buildings	Total RCV	Carbonate Bedrock Area			
			Number of Buildings	% of Total	RCV	% of Total
Ayr Township	1,139	$328,056,000	676	59.4%	$208,651,000	63.6%
Belfast Township	740	$181,485,000	54	7.3%	$6,676,000	3.7%
Bethel Township	853	$243,010,000	100	11.7%	$20,208,000	8.3%
Brush Creek Township	519	$110,481,000	180	34.7%	$55,560,000	50.3%
Dublin Township	697	$153,284,000	125	17.9%	$37,533,000	24.5%
Licking Creek Township	881	$203,625,000	0	0.0%	$0	0.0%
McConnellsburg Borough	538	$276,419,000	538	100.0%	$276,419,000	100.0%
Taylor Township	697	$141,644,000	0	0.0%	$0	0.0%
Thompson Township	572	$155,461,000	40	7.0%	$1,195,000	0.8%
Todd Township	858	$298,975,000	566	66.0%	$269,306,000	90.1%
Union Township	421	$106,265,000	0	0.0%	$0	0.0%
Valley-Hi Borough	29	$5,827,000	29	100.0%	$5,827,000	100.0%
Wells Township	292	$58,946,000	280	95.9%	$58,402,000	99.1%
Fulton County	**8,236**	**$2,263,478,000**	**2,588**	**31.4%**	**939,777,000**	**41.5%**

Source: HAZUS-MH v4.2; USGS 2014; Fulton County 2019
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 and sinkholes. In addition to impacting buildings and facilities, subsidence can severely impact roads and infrastructure. Major roadways that serve the County include Interstate I-70, I-76; Routes US-30, US-522, and US-322; and multiple State Routes, including PA-475, PA-484, PA-655, PA-913, PA-915, and PA-928. These roadways are built in areas underlain by carbonate bedrock or underground coal mines. The following summarizes potential impacts to critical infrastructure:

- Roads—Access to major roads after a disaster is crucial to safety and to response operations. Depending on the size, events can block egress and ingress on roads, causing isolation for individual residents and potentially entire neighborhoods, traffic problems, and delays for transportation. These factors can result in economic losses for businesses.
- Bridges—Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- Power Lines—A subsidence event could trigger failure of the soil underneath a tower, causing it to collapse and ripping down the lines. Power and communication failures can create problems for vulnerable populations and businesses.

A number of critical facilities and utility assets are located in the hazard area and are also exposed to subsidence and sinkholes. Table 4.3.9-4 summarizes the number of critical facilities that are located within the identified hazard area, as identified by participants in the Fulton County Hazard Mitigation Plan (HMP) planning process.

Table 4.3.9-4. Number of Critical Facilities Located in the Identified Hazard Area (Carbonate Bedrock)

Municipality	Facility Types																				
	Commercial	Communications	County Office	Dam	Day Care	DPW	EOC	Fire	Hazmat	Hospital	Library	Municipal Park	Police	Polling Station	Post Office	Potable Water	Power	School	Senior	Shelter	Substation	Wastewater
Ayr Township	1	0	0	1	0	0	0	0	3	0	0	1	0	1	1	0	0	0	0	1	6	1
Belfast Township	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Bethel Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Brush Creek Township	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	2	1
Dublin Township	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Licking Creek Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
McConnellsburg Borough	0	2	4	0	0	0	1	2	1	0	1	1	0	0	1	1	0	0	2	0	9	0
Taylor Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thompson Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Todd Township	0	0	0	0	1	1	0	0	1	1	0	0	1	0	0	0	1	1	0	0	2	0
Union Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Valley-Hi Borough	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Wells Township	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	4	0
Fulton County	**1**	**4**	**4**	**3**	**1**	**1**	**1**	**2**	**5**	**1**	**1**	**5**	**1**	**1**	**4**	**3**	**2**	**1**	**2**	**1**	**26**	**2**

Source: USGS 2014; Fulton County 2019

Impact on the Economy

Subsidence and sinkholes can severely impact roads and infrastructure. As noted earlier, carbonate formations underlie almost 17.7 percent of the County. Major roadways that serve the County include Interstate I-70, I-76; Routes US-30, US-522; and multiple State Routes, including PA-475, PA-484, PA-655, PA-913, PA-915, and PA-928. Portions of each of these roadways are located in the identified subsidence and sinkhole hazard area. It is not possible to estimate potential future economic losses caused by subsidence and sinkhole events at this time.

Impact on the Environment

The presence of sinkholes can result in increased potential for groundwater contamination. Because of the porous nature of the areas in which they occur, sinkholes are sometimes used as instruments for enhancing groundwater recharge. However, if hazardous materials are spilled at a recharge point, groundwater can quickly be contaminated due to the lack of soil substrate that would normally slow migrating contaminants. Vegetation is usually damaged during abrupt subsidence events. However, regrowth takes place over time. Land subsidence can also result in more frequent and expansive flooding and changes in river canal and drain flow systems (PEMA 2018).

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 will cause sinkholes. Water-balance changes include over-withdrawal of groundwater, diverting surface water from a large area and to concentrate flow towards 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 have a direct impact on sinkhole creation.

The potential effects of climate change on Fulton County's vulnerability to subsidence and sinkhole events will need to be considered as more information develops regarding regional climate change impacts.

Additional Data and Next Steps

While it is not possible to predict when and where the next event may take place, the Fulton County emergency services, including local fire and police departments, are well-equipped and prepared to respond to emergencies as they arise. The status of subsidence and sinkhole risk in Fulton County will continue to be monitored, and ongoing and new mitigation efforts will continue to be developed.

4.3.10 Tornado, Windstorm

This section provides a profile and vulnerability assessment for the tornado and windstorm hazard.

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 rainstorms 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] 2015a).
- 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 2015a).
- 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 (Prociv 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). 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 4.3.10-1 describes wind classifications used by the National Weather Service (NWS).

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 2015).

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 Fulton County.

4.3.10.1 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] 2018).

Tornadoes

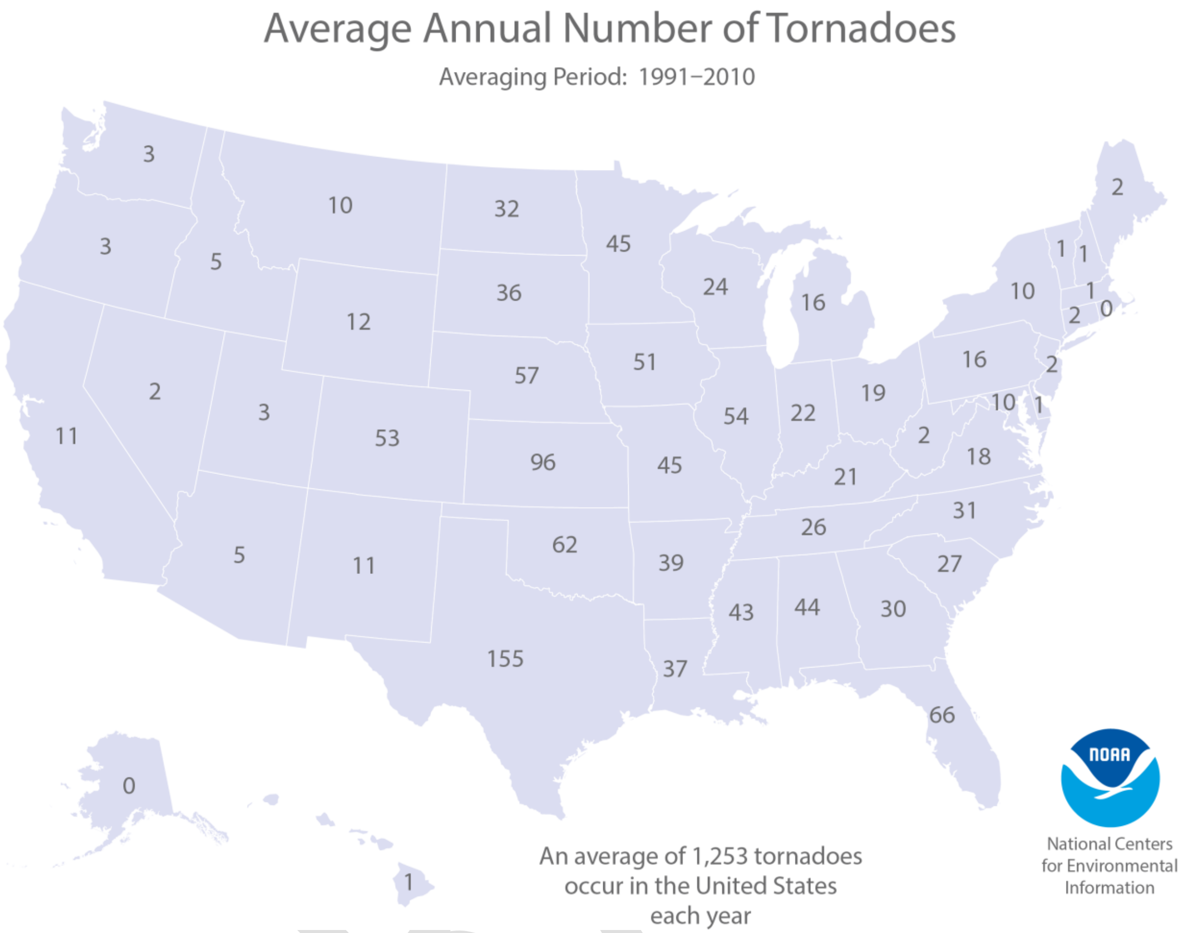
The United States experiences more tornadoes than any other country, with approximately 1,253 occurring in a typical year (NCEI, N.d). Tornadoes can occur at any time during the day or night but are most frequent during late afternoon into early evening, the warmest hours of the day, and most likely to occur during the spring and early summer months of March through June (PEMA 2018).

Tornado movement is characterized in two ways: direction and speed of spinning winds and forward movement of the tornado, also known as the storm track. Most tornadoes have wind speeds of 110 mph (175 km/h) or less, are approximately 250 feet (75 m) across, and travel a few miles (several kilometers) before dissipating. Some attain wind speeds of more than 300 mph (480 km/h), stretch more than a mile (1.6 km) across, and stay on the ground for dozens of miles (more than 100 km). Some tornadoes never touch the ground and are short-lived, while others may touch the ground several times (PEMA 2018).

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 4.3.10-1 shows the annual average number of tornadoes between 1981 and 2010 (NCEI, N.d). The Commonwealth of Pennsylvania experienced an average of 16 tornado events annually between 1981 and 2010.

Figure 4.3.10-1. Annual Average Number of Tornadoes in the United States, 1981 to 2010



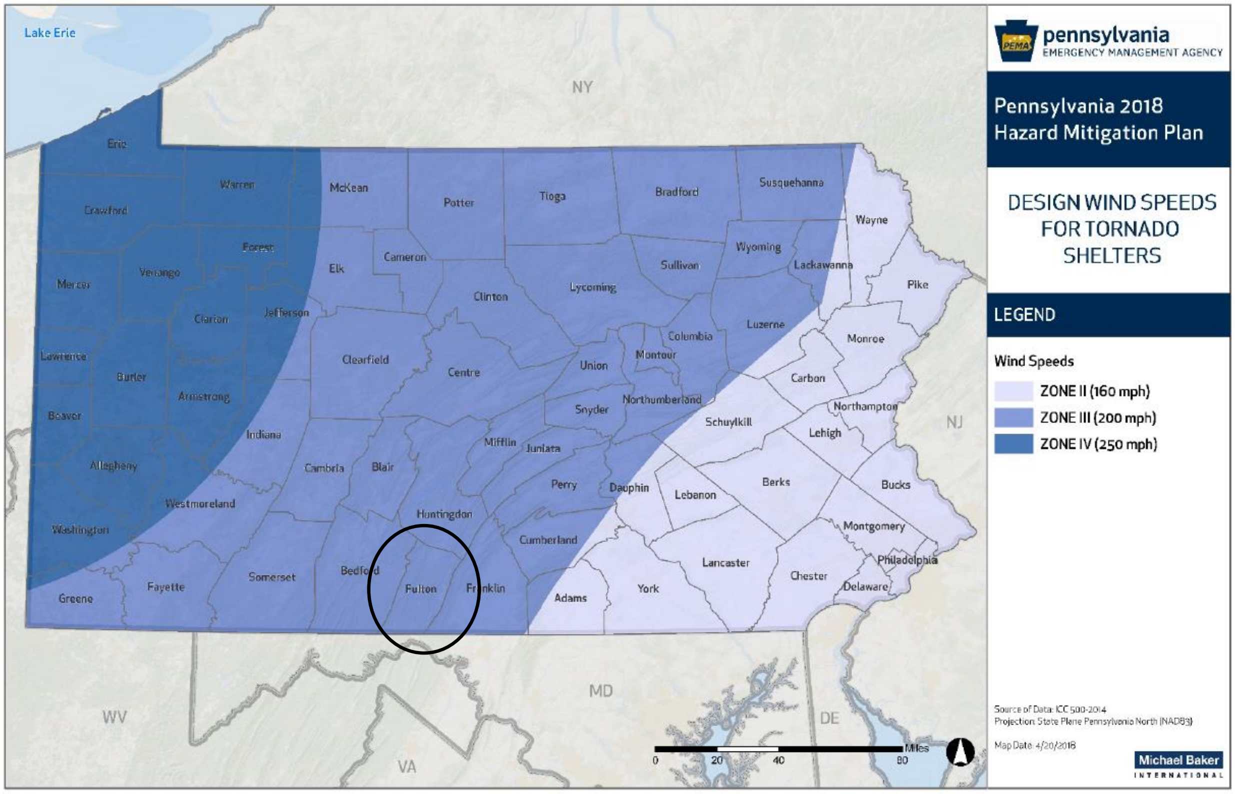
Source: NCEI, N.d.

Figure 4.3.10-2 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, Fulton County has a moderate risk for tornado. Details regarding historical tornado events are discussed in the Past Occurrences section (Section 4.3.10.3) of this profile.

Windstorms

According to the 2018 State Hazard Mitigation Plan (HMP), there are wind speed zones developed for the design of tornado shelters; refer to Figure 4.3.10-2 As displayed, Fulton County is located in wind speed zone III, meaning design wind speeds for shelters and critical facilities should withstand 3-second gusts up to 200 mph, regardless if the wind is from a tornado, hurricane, tropical storm or windstorm event. It should be noted that these windspeeds represent the strongest anticipated throughout the Commonwealth and are not the normal wind speeds expected statewide (PEMA 2018).

Figure 4.3.10-2. Design Wind Speeds for Tornado Shelters



Source: PEMA 2018
Note: The black oval indicates the approximate location of Fulton County.

Table 4.3.10-1. 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.
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 2012
mph Miles per hour

4.3.10.2 Range of Magnitude

The following provides details regarding the range of magnitude for tornadoes and windstorms.

Tornado

Each year, tornadoes account for $1.1 billion in damage and cause over 80 deaths nationally. While the extent of tornado damage is usually localized, the vortex of extreme wind associated with a tornado can result in some of the most destructive forces on earth. Rotational wind speeds can range from 100 mph to more than 250 mph. In addition, the speed of forward motion can range from 0 to 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 damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles (PEMA 2018).

Damage and deaths can be especially significant when tornadoes move through populated, developed areas. The destruction caused by tornadoes ranges from light to inconceivable depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction such as mobile homes (PEMA 2018).

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 had been in use for more than 30 years, the scale has limitations. The primary limitations are a lack of Damage Indicators (DI), 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 (Texas Tech University 2015).

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 DIs 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 DOD. 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 2016b). Table 4.3.10-2 displays each of its six categories of the EF Scale.

Table 4.3.10-2. Enhanced Fujita Damage Scale

EF Scale Number	Wind Speed (mph)	F-Scale Number	Type of Damage Done
EF0	65–85	F0-F1	**Light damage:** Chimneys are damaged, tree branches are broken, shallow-rooted trees are toppled.
EF1	86-110	F1	**Moderate damage:** Roof surfaces are peeled off, windows are broken, some tree trunks are snapped, unanchored mobile homes are overturned, attached garages may be destroyed.

EF Scale Number	Wind Speed (mph)	F-Scale Number	Type of Damage Done
EF2	111-135	F1-F2	**Considerable damage:** Roof structures are damaged, mobile homes are destroyed, debris becomes airborne, missiles are generated, large trees are snapped or uprooted.
EF3	136-165	F2-F3	**Severe damage:** Roofs and some walls are torn from structures, some small buildings are destroyed, nonreinforced masonry buildings are destroyed, most trees in forest are uprooted.
EF4	166-200	F3	**Devastating damage:** Well-constructed houses are destroyed, some structures are lifted from foundations and blown some distance, cars are blown some distance, large debris becomes airborne.
EF5	>200	F3-F6	**Extreme damage:** Strong frame houses are lifted from foundations, reinforced concrete structures are damaged, automobile-sized missiles become airborne, trees are completely debarked.

Source: PEMA 2018
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 4.3.10-3 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 4.3.10-3. 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: NWS 2016b

Since the EF Scale went into effect in February 2007, previous occurrences and losses associated with historical tornado events, described in Section 4.3.10.3, Past Occurrences, are classified based on the former Fujita Scale. Events after February 2007 are classified based on the Enhanced Fujita Scale.

Windstorms

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. Wind descriptions used by the National Weather Service are shown in the table below.

Table 4.3.10-4. NWS Wind Descriptions

Descriptive Term	Sustained Wind Speed (mph)
Strong, dangerous, high, damaging (high wind warning criteria	≥40
Very windy	30-40
Windy	20-30
Breezy (mild weather) brisk or blustery (cold weather)	15-25
None	5-15 or 10-20
Light/light and variable wind	0-5

Source: NWS 2011
mph Miles per hour

NWS issues site-specific high wind advisories, watches, and warnings when wind speeds may pose a hazard or may be life-threatening. The criterion for each of these varies from state to state. Wind warnings and advisories for Pennsylvania are as follows:

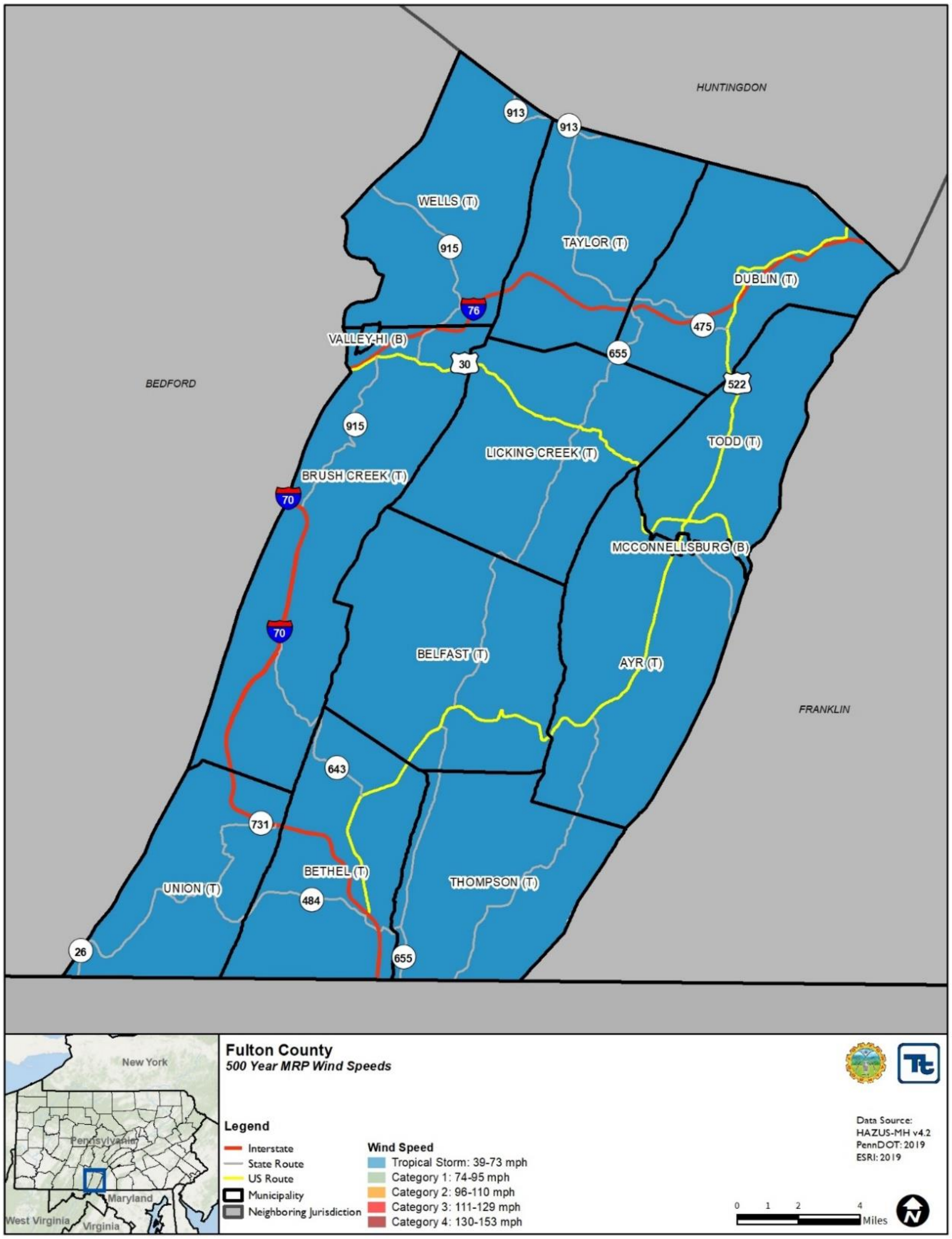
- *High Wind Warnings* are issued when sustained winds of 40 mph or greater are forecast for 1 hour or longer, or wind gusts of 58 mph or greater are forecast for any duration.
- *Wind Advisories* are issued when sustained winds of 30 to 39 mph are forecast for 1 hour or longer, or wind gusts of 46 to 57 mph are forecast for any duration (NWS 2015).

Mean Return Period

In evaluating the potential for hazard events of a given magnitude, a mean return period (MRP) is often used. The MRP provides an estimate of the magnitude of an event that may occur within any given year based on past recorded events. MRP is the average period of time, in years, between occurrences of a particular hazard event, equal to the inverse of the annual frequency of exceedance (Dinicola 2009).

Figure 4.3.10-3 shows the estimated maximum 3-second gust wind speeds that can be anticipated in Fulton County when associated with the 500-year MRP event. These peak wind speed projections were generated using Hazards U.S. Multi-Hazard (HAZUS-MH) model runs. HAZUS-MH v4.2 estimated the maximum 3-second gust wind speeds for Fulton County to be below 39 mph for the 100-year MRP event and not strong enough to be considered a tropical storm. The maximum 3-second gust wind speeds for Fulton County range from 66 to 67 mph for the 500-year MRP event (tropical storm). HAZUS-MH v4.2 did not estimate loss impacts associated with the 100-year MRP event, but the associated impacts and losses from the 500-year MRP wind event model run is reported in the Vulnerability Assessment.

Figure 4.3.10-3. Wind Speeds for the 500-Year Mean Return Period Event



4.3.10.3 Past Occurrence

Many sources provided historical information regarding previous occurrences and losses associated with tornado and windstorm events throughout the Commonwealth of Pennsylvania and Fulton 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 HMP.

According to NOAA's National Centers for Environmental Information (NCEI) storm events database, Fulton County experienced 80 tornado and windstorm events between August 1, 1950, and May 29, 2019. These events include high winds, strong winds, thunderstorm winds, and tornadoes. Total reported property damage as a result of these tornado and windstorm events was estimated at over $239,490. This total also includes damage to other counties.

According to NOAA's NCEI, there were five recorded tornadoes in Fulton County between 1950 and 2019. These tornadoes included two with an intensity of F/EF0 and 3 with an intensity of F/EF1. Fulton County's worst tornado event occurred on April 19, 2019, when an EF1 tornado caused damage around Knobsville. In addition to tornadoes, there have been 72 occurrences of thunderstorm wind or high winds within Fulton County between 1950 and 2019. On June 2, 2000, a thunderstorm occurred near Needmore, which blew five cars and an ambulance off of Route 70 near Exit 33, resulting in $25,000 in reported damages. A high wind event in Fulton County on December 12, 2000 resulted in $13,900 in reported damages.

Between 1954 and 2019, the Commonwealth of Pennsylvania experienced 50 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. Fulton County was included in nine of these declared disasters (FEMA 2017). Additionally, PEMA reports that in Pennsylvania there have been 11 confirmed tornadoes and two high windstorms, of which three resulted in major disaster declaration issued by the Governor and President. Fulton County was not identified as impacted in any of these events; however, it could be included under the high winds in April 1975, which had a statewide impact (PEMA 2018).

Based on all sources researched, windstorm and tornado events that have affected Fulton County and its municipalities between 1975 (first available data) and 2019 are identified in Table 4.3.10-5. With tornado and windstorm documentation for the Commonwealth of Pennsylvania being so extensive, not all sources have been identified or researched. Therefore, Table 4.3.10-5 may not include all events that have occurred throughout Fulton County.

Table 4.3.10-5. Tornado and Windstorm Events in Fulton County, 2009 to 2019

Dates of Event	Event Type	Location	Magnitude	Losses / Impacts
12/02/2009	High Wind	Fulton County	50 Kts.	Non-thunderstorm wind gusts between 50 and 60 mph toppled numerous trees and power lines across Fulton County. The high winds caused sporadic power outages to approximately less than 100 Allegheny Power customers. $25,000 in damages were reported.
02/06/2009	Thunderstorm Wind	Knobsville	50 Kts.	A severe thunderstorm snapped off about 30 trees near Cowans Gap State Park near the Fulton/Franklin County border. $5,000 in damages were reported.
7/29/2009	Thunderstorm Wind	Dickey's Mountain	60 Kts.	Thunderstorm winds estimated near 70 mph tore a portion of a metal roof from a large barn and knocked down several trees in Dickeys Mountain. $7,500 in damages were reported.
02/05/2010	Thunderstorm Wind	Dickey's Mountain	50 Kts.	Thunderstorm winds estimated near 60 mph toppled several trees on Creek Road just north of Route 928. $5,000 in damages were reported.
5/26/2011	Thunderstorm Wind	Cove Mills	50 Kts.	Thunderstorm winds estimated near 60 mph produced structural damage near Cove Mills. $5,000 in damages were reported.
5/26/2011	Thunderstorm Wind	Cove Mills	50 Kts.	Thunderstorm winds estimated near 60 mph knocked down numerous trees and utility wires in several communities surrounding Cove Mills. $10,000 in damages were reported.

Dates of Event	Event Type	Location	Magnitude	Losses / Impacts
01/06/2012	Thunderstorm Wind	Needmore	50 Kts.	Thunderstorm winds estimated near 60 mph knocked down trees and utility wires in Needmore. $5,000 in damages were reported.
6/29/2012	Thunderstorm Wind	Needmore	50 Kts.	Thunderstorm winds estimated near 60 mph knocked down trees in Needmore. $5,000 in damages in reported.
05/31/2015	Thunderstorm Wind	Gem	50 Kts.	Thunderstorm winds estimated near 60 mph knocked down trees and wires near the intersection of Great Cove and Timber Ridge Roads near Needmore. $1,000 in damages were reported.
06/16/2016	Tornado	Northcraft	EF-0	Tornado touched down near Barnes Gap in Fulton County. It was a small brief tornado that moved through a wooded area crossing Route 484 Buck Valley Road just northeast of Barnes Gap. Trees were snapped and uprooted in different directions indicating a cyclonic pattern. Much greater damage occurred from a 3-mile-wide swath over 5 miles long of scattered straight-line wind damage and hail from this storm. Peak winds were estimated at 80 mph. There were no injuries or fatalities.
04/08/2017	Tornado	Needmore	EF1	The tornado touched down near Pleasant Grove Road (State Road 3007) and traveled northeastward for about 5 minutes, snapping and uprooting several swaths of trees along its path. It was estimated that approximately 150 trees were snapped or downed by the tornado. $5,000 in damages were reported.
04/08/2017	Thunderstorm Wind	McConnellsburg	52 Kits.	A severe thunderstorm producing winds estimated near 60 mph knocked down trees and wires near McConnellsburg. $4.000 in damages were reported.
04/19/2019	Tornado	Fulton County	EF-1	The tornado touched down approximately one mile west-southwest of Knobsville, just west of East Dutch Corner Road. Trees were uprooted and snapped along the path of the tornado, and a home just off of Breezy Point Road received considerable damage, including the loss of a chimney and a porch roof. Peak winds were estimated at 100 mph. $25,000 in damages were reported.
04/19/2019	Thunderstorm Wind	Knobsville	61 Kts.	A severe thunderstorm producing winds estimated near 70 mph knocked down trees near Knobsville. $12,000 in damages were reported.
05/29/2019	Thunderstorm Wind	Burnt Cabins	52 Kts.	A severe thunderstorm producing winds estimated near 60 mph knocked down a barn and multiple pine trees near Burnt Cabins. $10,000 in damages were reported
05/29/2019	Tornado	Enid		An EF1 tornado touched down near Wells Tannery in Fulton County on the afternoon of May 29, 2019. The tornado produced maximum winds estimated near 100 mph along a path that was about 3/4 of a mile long, and a maximum path width of approximately 50 yards. $35,000 in damages were reported.

Source: FEMA 2017; NOAA-NCEI 2019; Fulton County 2019

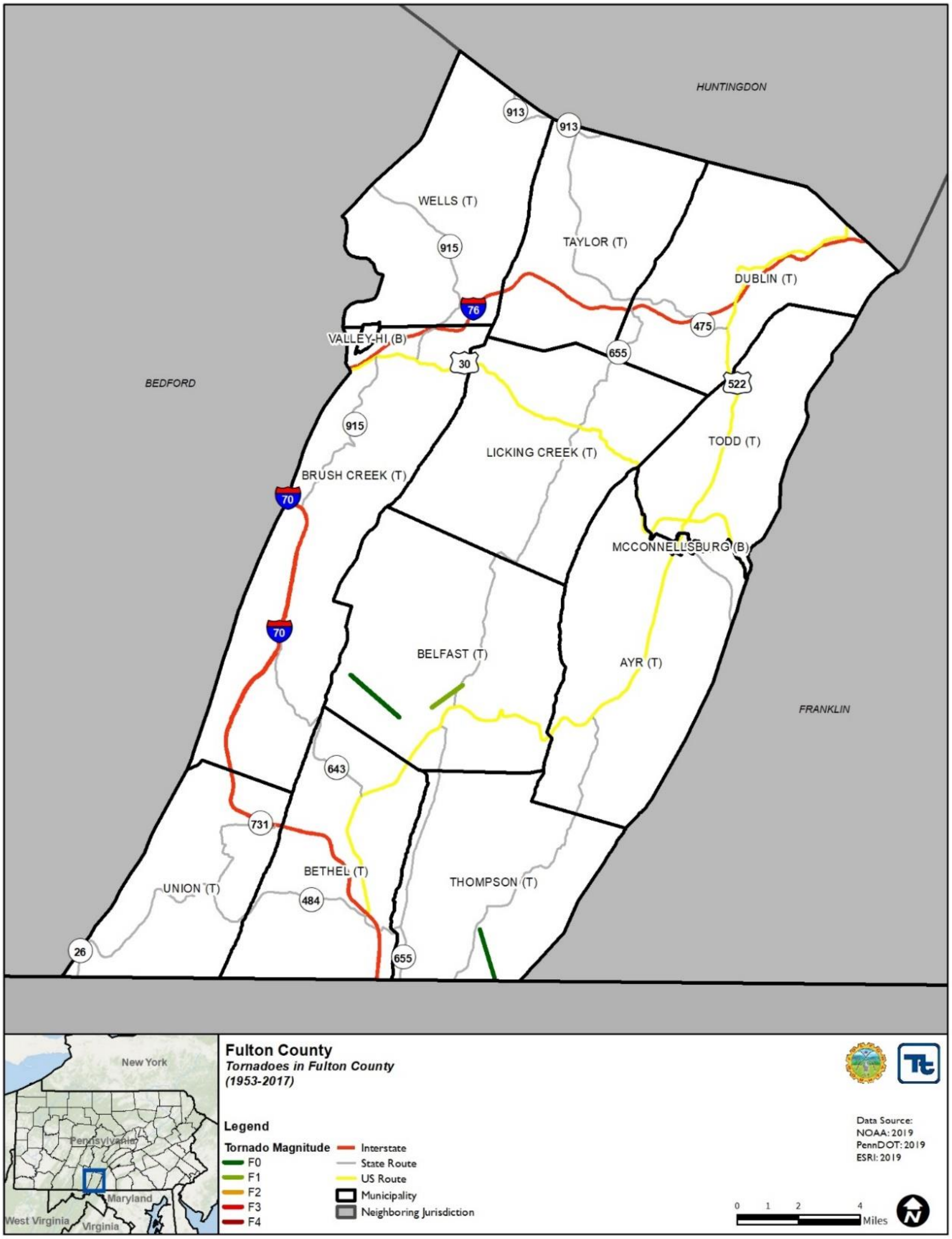
Notes:

(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	NCDC	National Climatic Data Center
K	Thousand ($)	NOAA	National Oceanic Atmospheric Administration
Kts.	Knots	PEMA	Pennsylvania Emergency Management Agency
M	Million ($)	Tstm	Thunderstorm
mph	Miles per hour		

Figure 4.3.10-4 shows the locations of tornadoes that have touched down in Fulton County between 1953 and 2017. This is the best available spatial data.

Figure 4.3.10-4. Tornado History in Fulton County (1953-2017)



4.3.10.4 Future Occurrence

For the 2019 HMP update, the most up-to-date historic data was collected to calculate the probability of future occurrence of tornado and windstorm events for Fulton County. Information from NOAA-NCEI storm events database, FEMA, and Fulton County. It should be noted that because there are multiple data sources that report information related to severe weather events, it is not possible to capture all possible data. Table 4.3.10-6 presents the probability of future occurrence of tornado events in Fulton County.

Table 4.3.10-6. Probability of Future Tornado and Windstorm Events

Hazard Type	Number of Occurrences Between 1975 and 2019	Recurrence Interval (in years) (# Years/ Number of Events)	Percent chance of occurrence in any given year
High Wind	12	3.75	26.7%
Strong Wind	1	45.0	2.2%
Thunderstorm Wind	61	0.73	100%
Tornado	6	7.5	13.3%
TOTAL	80	**0.56**	**100%**

Sources: NOAA-NCEI 2019

In Section 4.4, the hazards of concern identified for Fulton 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 Fulton County is considered *highly likely* (greater than 90 percent annual probability) as defined by the Risk Factor Methodology probability criteria (Section 4.4).

Fulton 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 Fulton County in the past. It is estimated that Fulton 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.

4.3.10.5 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:

- 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
- Effect of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time

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 two probabilistic hurricane events: the 100-year and 500-year 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.

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 Fulton County (U.S. Census 2010 population of 14,845 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. 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

Damage to buildings is dependent upon several factors, including wind speed, storm duration, path of the storm track or tornado, distance from the tornado funnel and building construction. Because of differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Generally, wood and masonry buildings, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. High-rise buildings are also very vulnerable structures. Mobile homes are the most vulnerable to damage, even if tied down, and offer little protection to people inside.

The U.S. Census Bureau defines manufactured homes as "movable dwellings, 8 feet or wider and 40 feet or longer, designed to be towed on its own chassis, with transportation gear integral to the unit when it leaves the factory, and without need of a permanent foundation (Census, 2010)." They can include multi-wides and expandable manufactured homes but exclude travel trailers, motor homes, and modular housing. Due to their lightweight and often unanchored design, manufactured housing is extremely vulnerable to high winds and will generally sustain the most damage.

Table 4.3.10-7 displays the number of manufactured housing units per municipality in Fulton County. Total counts are based on mobile/manufactured homes in the HAZUS-MH v4.2 default database. As noted below, Todd Township has the greatest number of manufactured homes.

Table 4.3.10-7. Manufactured Housing Units per Municipality in Fulton County

Municipality	Number of Manufactured Homes	Municipality	Number of Manufactured Homes
Ayr Township	134	Taylor Township	94
Belfast Township	107	Thompson Township	41
Bethel Township	139	Todd Township	188
Brush Creek Township	91	Union Township	37

Municipality	Number of Manufactured Homes	Municipality	Number of Manufactured Homes
Dublin Township	157	Valley-Hi Borough	7
Licking Creek Township	120	Wells Township	52
McConnellsburg Borough	62	**Fulton County**	**1,229**

According to HAZUS-MH's wind model, direct wind-induced damage (wind pressures and windborne debris) to buildings is dependent upon the performance of components and cladding, including roof covering (shingles, tiles, membrane), roof sheathing (wood frame construction only), windows, and doors and is modeled as such. Structural wall failures can occur for masonry and wood frame walls and uplift of whole roof systems due to failure at the roof/wall connections. Foundation failures (i.e., sliding, overturning and uplift) can potentially take place in manufactured homes.

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 v4.2. 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-MH v4.2 across the following wind damage categories: no damage/very minor damage, minor damage, moderate damage, severe damage, and total destruction.

Table 4.3.10-8 summarizes the definitions of the damage categories.

Table 4.3.10-8. 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

Qualitative Damage Description	Roof Cover Failure	Window Door Failures	Roof Deck	Missile Impacts on Walls	Roof Structure Failure	Wall Structure Failure
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-MH v4.2 estimates the 100-year MRP peak gust wind speeds for Fulton County to be less than 39 mph with no associated building stock damage. HAZUS-MH v4.2 estimates the 500-year MRP peak gust wind speeds for Fulton County to range from 66 to 67 mph. This wind speed equates to a *Tropical Storm* and approximately $640,000 in damage to the general building stock (structure only). This amount is less than 1 percent of the County's building inventory. Table 4.3.10-9 summarizes the building value (structure only) damage estimated for the 500-year MRP wind-only event by occupancy class.

Table 4.3.10-9. Estimated Building Replacement Value (Structure Only) Damaged by the 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
		500-Year Probable Loss	500-Year Probable Loss	500-Year Probable Loss
Ayr Township	$203,163,000	$102,862	$99,601	$719
Belfast Township	$111,757,000	$62,167	$59,835	$1,078
Bethel Township	$152,457,000	$77,574	$75,096	$1,419
Brush Creek Township	$70,479,000	$31,695	$31,123	$220
Dublin Township	$95,778,000	$39,983	$38,418	$757
Licking Creek Township	$129,459,000	$53,075	$51,518	$1,082
McConnellsburg Borough	$157,058,000	$50,882	$43,739	$5,008
Taylor Township	$87,204,000	$42,078	$40,371	$706
Thompson Township	$101,824,000	$61,250	$60,778	$242
Todd Township	$164,001,000	$58,207	$51,542	$2,123
Union Township	$69,402,000	$41,299	$40,876	$117
Valley-Hi Borough	$3,885,000	$1,598	$1,598	$0
Wells Township	$37,498,000	$16,875	$16,410	$212
Fulton County	**$1,383,965,000**	**$639,545**	**$610,904**	**$13,682**

Source: HAZUS-MH 4.2

Because of differences in building construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, regardless of their occupancy class, usually 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 $1.3 billion in total replacement cost value (structure) for the entire County, an estimated over $610,904 in residential building damage can be anticipated for the 500-year event. Residential building damage accounts for nearly 100-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, but HAZUS-MH v4.2 did not estimate any annualized losses for wind-only events in Fulton County.

Impact on Critical Facilities

HAZUS-MH v4.2 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 v4.2 estimates that there will be no structural losses to critical facilities in Fulton 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 the 100-year and 500-year MRP events.

At this time, HAZUS-MH v4.2 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 business interruption losses for Fulton County for the 100-year MRP and 500-year MRP events (<$1,000), which includes loss of inventory, income, relocation costs, rental costs, and lost wages.

Table 4.3.10-10. Estimated Debris Production for 100-Year 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
Ayr Township	0	1	0	0	0	288	0	158
Belfast Township	0	0	0	0	0	502	0	236
Bethel Township	0	0	0	0	0	286	0	190
Brush Creek Township	0	0	0	0	0	155	0	106
Dublin Township	0	0	0	0	0	90	0	116

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
Licking Creek Township	0	0	0	0	0	235	0	113
McConnellsburg Borough	0	1	0	0	0	3	0	49
Taylor Township	0	0	0	0	0	285	0	138
Thompson Township	0	0	0	0	0	185	0	99
Todd Township	0	0	0	0	0	122	0	130
Union Township	0	0	0	0	0	181	0	98
Valley-Hi Borough	0	0	0	0	0	2	0	2
Wells Township	0	0	0	0	0	97	0	79
Fulton County	**0**	**2**	**0**	**0**	**0**	**2,431**	**0**	**1,515**

Source: HAZUS-MH 4.2

Impact on the Environment

Tornado events are typically localized; therefore, environmental impacts are rarely widespread. Severe damage to plant species is likely from both tornado and windstorm events. This includes uprooting or total destruction of trees and increased threat to wildfire in areas of tree debris. Hazardous material facilities should meet design requirements for the wind zones identified in Figure 4.3.10-2 above (PEMA 2018).

Future Growth and Development

As discussed and illustrated in Section 2.4, areas targeted for future growth and development have been identified across Fulton 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

An increase in storms will produce more wind events and may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (Climate Central 2016). With an increased likelihood of strong winds and tornado events, all of the County's assets will experience additional risk for losses as a result of extreme wind events.

Additional Data and Next Steps

In time, HAZUS-MH will be released with modules that address straight-line wind and tornado events. As updated versions of HAZUS-MH are released, the County can run analyses for an overall picture of the wind damages and debris generated from tornado events. Over time, Fulton County can obtain additional data to support the analysis of this hazard. Data that will support the analysis would include additional detail on past hazard events and impacts, and an updated building inventory to include specific building information such as type of construction and details on protective features (for example, shutters and safe rooms).

4.3.11 Transportation Accident

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

Transportation hazards include hazardous materials in transit, vehicular accidents, aviation accidents, and roadways vulnerable to floods. 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 Fulton County include roadways, one commercial airport, and a few private airstrips. A major road accident in the County is probable; however, aviation accidents are unlikely. All County systems and supporting transportation resources provide services locally, regionally, and nationally. Transportation accidents defined below include incidents involving road and air travel.

- Vehicular Accidents: A vehicular accident is an 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 from 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 Fulton County is home to only one private airport, limiting the probability of aviation accidents, airport accidents and incidents have the potential to occur while the plane is 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, some of which 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 the 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).

Transportation accidents described here include incidents involving road and air travel. HazMat conveyance during transportation is an additional transportation threat to Fulton 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 HazMat 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 HazMat from transportation accidents are addressed in the Environmental Hazard profile (Section 4.3.4 [Environmental Hazards]). County residents have indicated concern over the potential for transportation accidents involving animal waste and other biological hazardous materials related to the transport, feeding, and associated care for animals in a Concentrated Animal Feeding Operation (CAFO), as there are multiple CAFO facilities in Fulton County. The potential impacts and associated concerns with CAFO facilities, including transportation accidents, are described in more detail in Section 4.3.4 (Environmental Hazards).

4.3.11.1 Location and Extent

Vehicular Accidents

Major roadways in Fulton County include I-70, the Pennsylvania Turnpike – I-76, U.S.-522, and U.S.-30. Fulton County has more than 685 miles of roadways, divided as listed in Table 4.3.11-1, and illustrated in Figure 4.3.11-1 on the following page.

Table 4.3.11-1. Fulton County Transportation Network

Category	Miles
Interstate Highway	38.9
Freeways/Expressways	0.0
Principal Arterials	24.2
Minor Arterials	48.7
Major Collectors	44.5
Minor Collectors	68.9
Local Roads	461.2
Total	**686.3**

Source: PennDOT 2017

Structurally deficient bridges pose a risk for transportation accidents. 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 4.3.11-2 lists the total number of bridges in Fulton County as well as the number of those that are structurally deficient (noted in parentheses).

Table 4.3.11-2. Bridges in Fulton County

On State Roads	On Local Roads
181 (20)	25 (9)

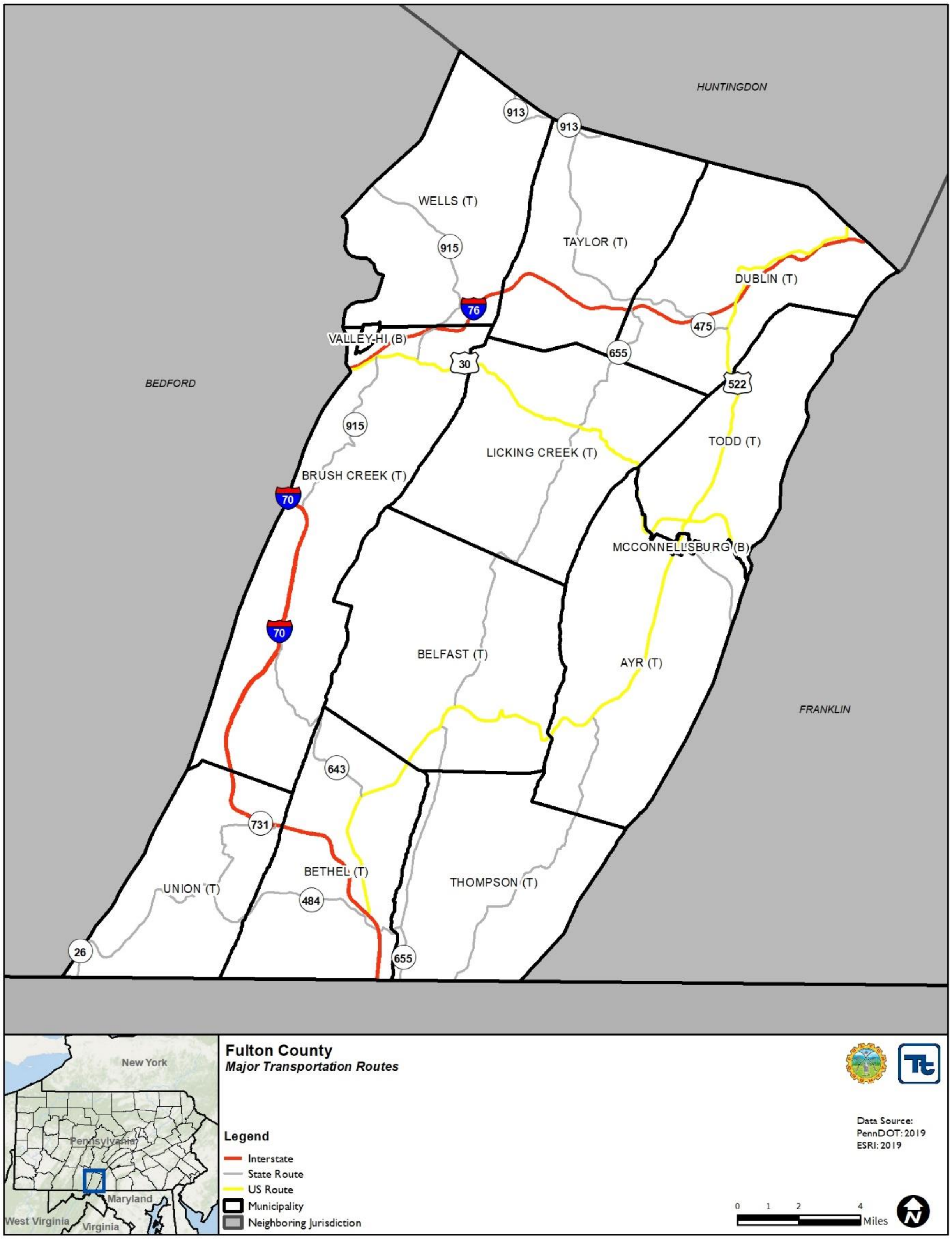
Source: PennDOT 2019

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, lack of 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).

County and local officials identified the following areas as especially problematic for transportation accidents:

- PA-915 near Slabtown Drive
- US-30 near South Valley Road
- I-70 in Brush Creek Township

Figure 4.3.11-1. Major Transportation Routes in Fulton County



Aviation Accidents

Fulton County has only one airport within its limits, and this airport, Flying R Airport – PN35, is privately owned and operated. Although Fulton County does not maintain any public airports, several Pennsylvania counties near Fulton do. The most notable are the Franklin County Regional Airport and the Bedford County Airport. Farther away 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 Altoona-Blair County Airport, the Blue Knob Valley Airport, and the Cove Valley Airport in Blair County; and the Somerset County Airport in Somerset County. In addition, the Harrisburg International Airport is a little less than 70 miles from McConnellsburg, PA. This airport may have associated air traffic patterns in the skies above Fulton 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 the National Transportation Safety Board (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* Date Unknown).

4.3.11.2 Range of Magnitude

Roadway accidents in Fulton 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 4.3.4).

Aircraft accidents can vary from a single-engine aircraft having a “hard landing” causing damage to the aircraft, to a crash of a small turboprop or jet aircraft, to a crash of a large jet (such as a Boeing 727). Other aircraft accidents could include helicopter or experimental aircraft crashes. Aviation accidents can also 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.

A worst-case transportation accident scenario within the County would be the overturn of a tractor-trailer carrying an extremely hazardous substance (described in Section 4.3.4) resulting in a massive release of its cargo on a major roadway. This incident would block traffic on Fulton 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 County facilities near the accident. The most likely transportation accident in the County would involve a single vehicle hitting an object and sustaining minimal damage.

4.3.11.3 Past Occurrence

Major roadway accidents (such as multi-vehicle accidents, those that close roads or bridges, or those involving school buses) are reported by Fulton County to PennDOT. Table 4.3.11-3 summarizes these accidents from 2013 to 2017. While this table lists accidents reported to the counties and Commonwealth, significantly more minor accidents are not reported.

Table 4.3.11-3. Summary of Major Roadway Accidents in Fulton County, 2013 to 2017

Year	Vehicle Accidents	Aircraft Accidents	Fatalities
2013	286	0	1
2014	246	0	9
2015	264	0	5
2016	228	0	2
2017	246	0	7
Total	**1,270**	**0**	**24**

Source: PennDOT 2018

Table 4.3.11-4 below describes the significant transportation accidents in Fulton County from 2015 to April 2019.

Table 4.3.11-4. Significant Accidents in Fulton County, 2015 - April 2019

Date(s) of Event	Event Type	Description	Location
08/29/2017	Vehicular Accident	Runaway cement truck into a camper and fence behind Sheetz.	McConnellsburg Borough
08/01/2018	Vehicular Accident	A freight truck hauling sand crashed on PA-915 at the bridge near Slabtown Dr.	Wells Township
10/01/2018	Vehicular Accident	A freight truck went over the embankment on PA-915 near 187 Slabtown Dr. with driver ejection.	Wells Township
12/03/2018	Vehicular Accident	A car accident occurred with a freight truck going into a pond on U.S.-30 near South Valley Road, there was 1 reported fatality.	Brush Creek Township
01/07/2019	Vehicular Accident	A 48-vehicle pile-up with a fuel spill occurred on I-70 due to icy conditions. A winter weather advisory was in effect at this time.	Brush Creek Township
02/19/2019	Vehicular Accident	A freight truck crashed on McQuait's Turn located at 10590 Waterfall Road.	Dublin Township
04/08/2019	Vehicular Accident	A freight truck hauling an oversized load rolled on U.S-30 near South Valley Road.	Brush Creek Township
04/17/2019	Vehicular Accident	A truck hauling alcohol crashed on PA-915. The driver was ejected, and the passenger was killed.	Wells Township

Source: Fulton County, 2019

4.3.11.4 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 countywide and municipality base maps.

Areas with certain characteristics that contribute to these hazards or increase vulnerability to these hazards can be identified.

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, Fulton County can expect the following each year:

- Approximately 1,270 major vehicle accidents. (The actual number of vehicle accidents in Fulton County may be much higher; however, this figure is based on vehicle accidents captured from PennDOT from 2013-2017.)
- No aircraft incidents.

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).

4.3.11.5 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 Fulton 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

Several types of County transportation rely on use of roadways. Hazards associated with transportation can include natural hazards affecting the roadway, type of 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 minimally or severely affect the County.

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. The number of people exposed to a hazard 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 Fulton County. Increased development in the County and region will lead to increased road traffic.

Impact on the Environment

Like the range of magnitude, the environmental impacts associated with transportation crashes can vary greatly. In the case of a simple motor vehicle crash or aviation crash, the environmental impact is minimal. However, if the crash involves any type of vehicle moving chemicals or other hazardous materials, the impact will be considerably larger and may include an explosion or the release of potentially hazardous material (PEMA 2018). For a complete discussion of the environmental impacts of hazardous materials releases, refer to Section 4.3.4.

Future Growth and Development

Increased development in Fulton County will lead to increased road traffic. Areas targeted for potential future growth and development in the next five to ten years have been identified across Fulton County (further discussed in Section 2.4 of this HMP). Any areas of growth could be potentially impacted by the transportation crashes hazard because the entire County is exposed and potentially vulnerable.

Effect of Climate Change on Vulnerability

The 2014 National Climate Assessment notes that the national transportation system is vulnerable to climate change impacts through infrastructure damages and electricity and communication outages (U.S. Global Change Research Program 2014). Damaged infrastructure and ineffective safety systems may lead to an increased risk of transportation crashes. Continued use of transportation that uses fossil fuels also adds to the impact of climate change through the release of greenhouse gas emissions. According to the U.S. Department of Transportation, 28% of total U.S. greenhouse gas emissions in 2012 came from the transportation sector (USDOT 2017).

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.

Fulton 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 reports 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 frequently transported materials can facilitate development of preparatory measures to respond to a release. Predicting costs needed to respond to a release, remediate the environment (see Section 4.3.4 for a discussion of environmental impacts due to transportation accidents), or repair damaged infrastructure would be useful for developing mitigation options.

4.3.12 Wildfire

This section provides a profile of and vulnerability assessment for the wildfire hazard. A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. Wildfires often begin unnoticed and can spread quickly, creating dense smoke 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.

4.3.12.1 Location and Extent

Wildfires take place in less developed or completely undeveloped areas, spreading rapidly through vegetative fuels. They can occur any time of the year but mostly occur during long, dry, hot spells. Any small fire, if not quickly detected and suppressed, can get 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. Wildfires in Pennsylvania can occur in open fields, grass, dense brush, and forests.

Wildfires can occur at any time of the year but are most likely in Fulton County during a drought. Wildfires can occur in fields, grass, and brush as well as in the forest itself. Under dry conditions or droughts, wildfires have the potential to burn forests as well as croplands.

The majority of Fulton County is forested (approximately 71.8%) and agricultural (approximately 22.6%) land. The majority of wildfires in Fulton County are relatively small in size, ranging from 0–200 acres. The greatest potential for wildfires is in the spring months of March, April, and May and the autumn months of October and November; 92% of all Pennsylvania wildfires occur in these two time periods. In the spring, bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris. In the fall, dried leaves are also fuel for fires (PEMA 2018).

Table 4.3.12-1. Land Use Summary for Fulton County

Land Use Category	Total Area (square miles)	Percent of Total
Agricultural	99.1	22.6%
Barren Land	0.9	0.2%
Forest	314.8	71.8%
Urban Built Up	22.4	5.1%
Water	0.4	0.1%
Wetland	0.6	0.1%
Total	**438.2**	**100.0%**

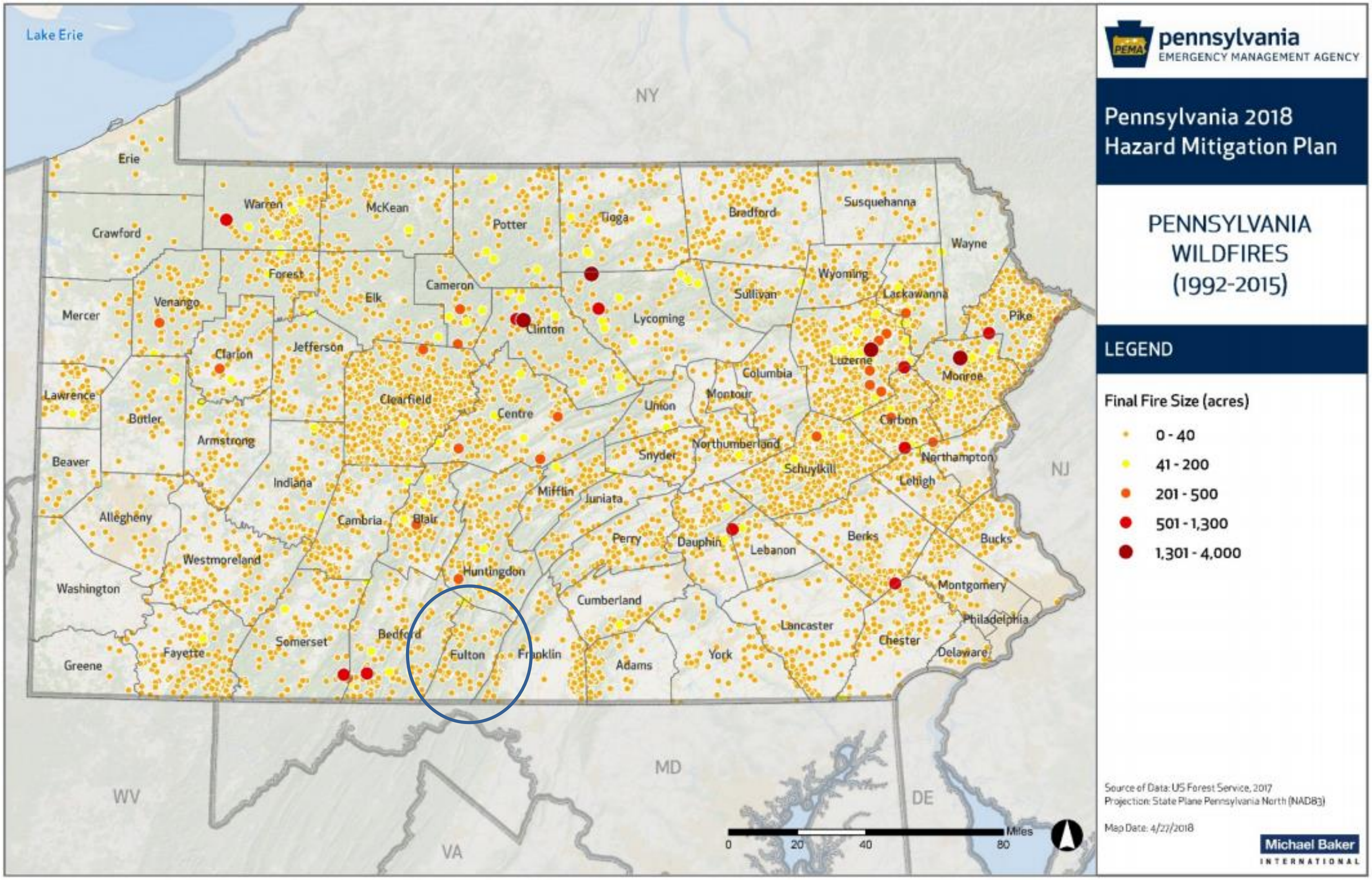
Source: USGS 2019

Figure 4.3.12-1 illustrates the land cover across Fulton County. As the figure shows, a majority of Fulton County is agricultural. Figure 4.3.12-2 shows the locations of wildfires throughout Pennsylvania between 1992 and 2015 that the United States Forest Service (USFS) has compiled based on reports from federal, state, and local agencies. Wildfires are known to be an under-reported event. Many wildfires occur every year and are suppressed by various agencies and departments and may not be accurately reported to the Department of Conservation and

Natural Resources (DNCR) Bureau of Forestry (BOF). Therefore, these locally controlled blazes may not be represented in BOF or USFS records.

Figure 4.3.12-1. Land Cover in Fulton County

Figure 4.3.12-2. Location and Size of Wildfire Events



Source: PEMA 2018

Note: Blue circle was added to highlight Fulton County's location within Pennsylvania.

According to the Pennsylvania 2018 State All-Hazard Mitigation Plan Update, areas of the Commonwealth that have large home developments built in volatile fuel types are at risk for catastrophic wildfires. Many areas of the state are at risk for large wildfires, but northeastern Pennsylvania is the most at risk for loss of life and/or property due to the number of homes at risk for wildfires (PEMA 2018).

Several tools are available to estimate fire potential location and extent, including but not limited to the WUI, Wildland Fire Assessment System, and PA DCNR Priority Landscape Analysis. These tools are discussed in further detail below.

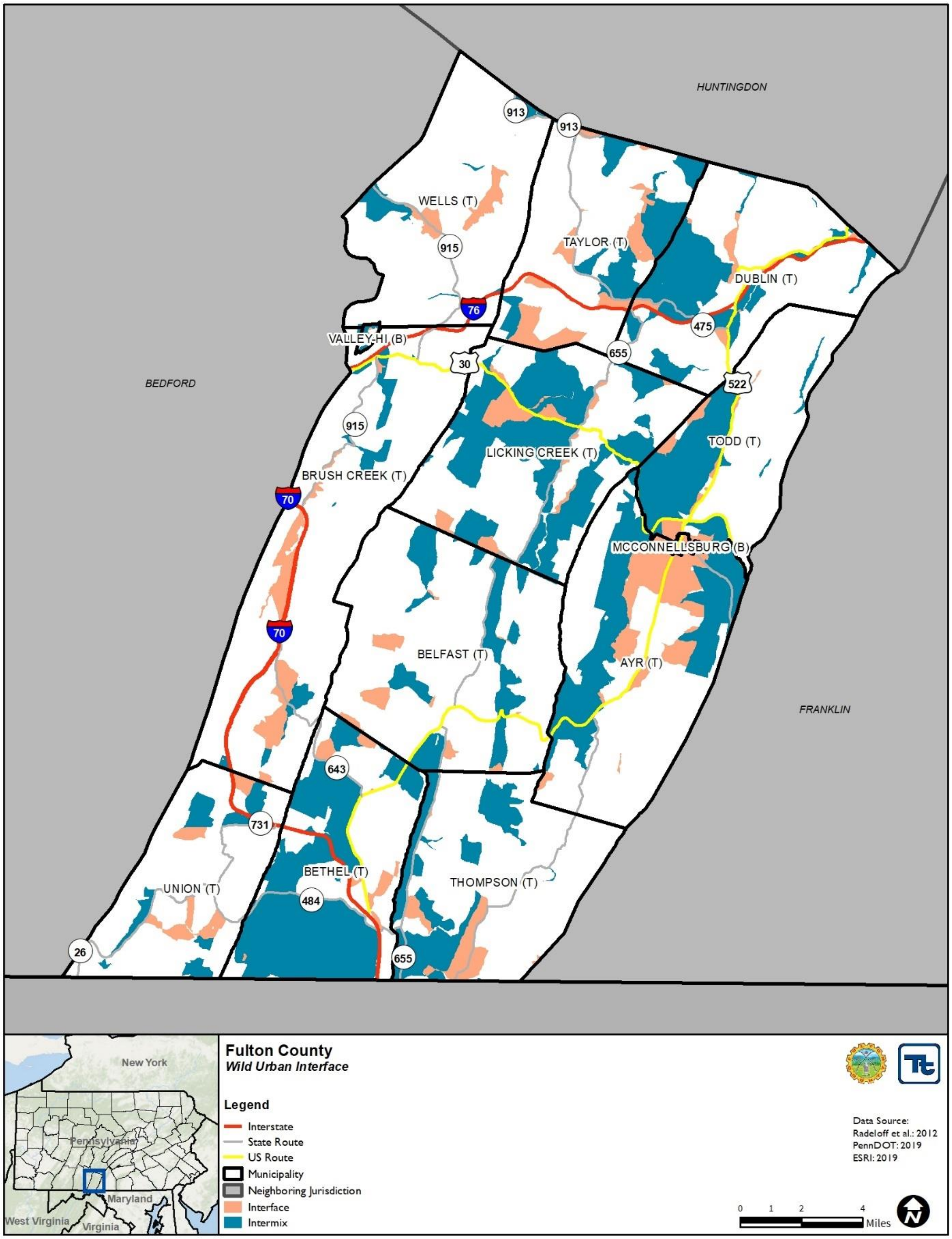
Wildland/Urban Interface (WUI)

The WUI is the area where houses and wildland vegetation coincide. The WUI is divided into two categories: intermix and interface. Intermix WUI are areas where housing and vegetation "intermingle." Intermix areas have more than one house per 40 acres and have more than 50 percent vegetation. Interface WUI are areas with 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 (Stewart et al. 2005).

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 (Stewart et al. 2005).

Concentrations of WUI can be seen along the east coast of the United States, including the area around Pittsburgh, Pennsylvania, and the eastern half of Pennsylvania. Fulton County is identified as having many areas of very low-density housing or no housing due to the large amount of forested area. Areas where recreation and tourism dominate are also places where WUI is common (Stewart et al. 2005). Figure 4.3.12-3 illustrates the WUI for Fulton County.

Figure 4.3.12-3. WUI for Fulton County



Wildland Fire Assessment System (WFAS)

The WFAS is an Internet-based information system maintained at the National Interagency Fire Center (NIFC) in Boise, Idaho, that provides a national view of weather and fire potential, including national fires danger, weather maps, and satellite-derived “Greenness” maps (U.S. Forestry Service [USFS] Date Unknown). Each day during the fire season, national maps of selected fire weather and fire danger components of the National Fire Danger Rating System (NFDRS) are produced by the WFAS (USFS 2012). The Fire Danger Rating level, described in Table 4.3.12-2 below, takes into account current and antecedent weather, fuel types, and both live and dead fuel moisture. 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 2012).

Table 4.3.12-2. 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 treetops) 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 2012

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 datasets were used for this analysis:

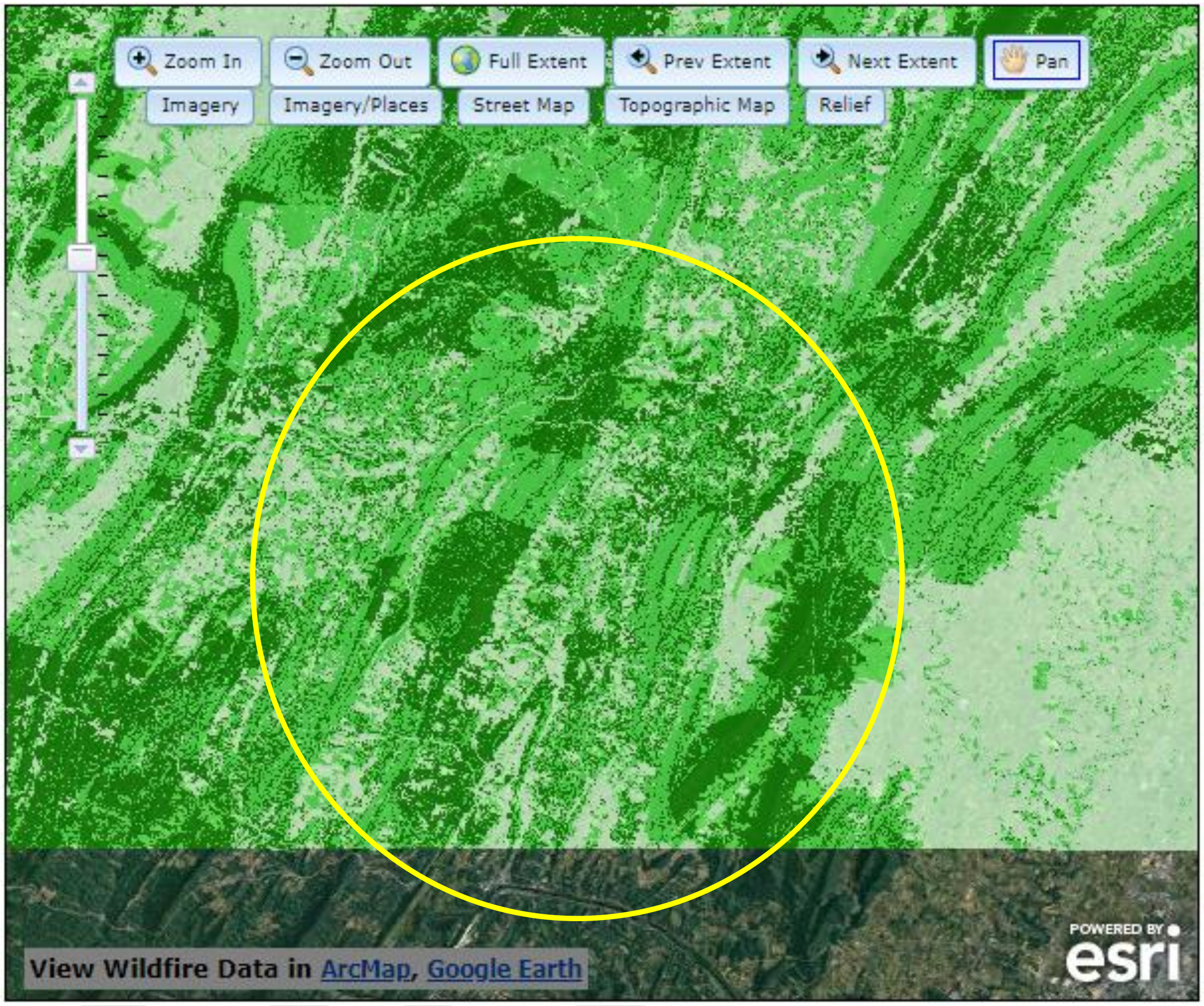
- 2002 WUI

- 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 wildland point origin occurrences are 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 2017b). Figure 4.3.12-4 illustrates the output for the wildfire priority landscapes model for Fulton County, though it was not possible to show the borders of Fulton County in PA DCNR's system.

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, the Commonwealth experience an average of 650 wildfires annually between 2008 and 2017 with an average fire size of 7 acres (PEMA 2018).

Figure 4.3.12-4. Wildfire Priority Landscapes in Fulton County



Source: PA DCNR 2017b

Notes: Low Priority = 0–0.21 (light green); Medium Priority = 0.21–0.35 (medium green); High Priority = 0.35–1 (dark green)
Fulton County's approximate location is within the yellow oval.

4.3.12.2 Range of Magnitude

Wildfire events in Fulton 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, crops, and wildlife. They often destroy property, valuable timber, forage, and recreational and scenic resources.

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

While some fires are not human-caused and are part of natural succession processes, a wildfire can kill people, livestock, fish, crops, and wildlife. They often destroy property, valuable timber, forage, and recreational and scenic values. The most significant environmental impact is the potential for severe erosion, silting of stream beds and reservoirs, and flooding due to ground-cover loss following a fire event. Wildfire can also have a positive environmental impact in that they burn dead trees, leaves, and grasses to allow more open spaces for new vegetation to grow and receive sunlight. Another positive effect is that it stimulates the growth of new shoots on trees and shrubs, and its heat can open pine cones and other seed pods.

The worst-case scenario for Fulton County is a multiple-acre fire occurring during a period of drought, which could cause the fire to spread rapidly. Severe property damage could occur because much of Fulton County is characterized by a WUI.

4.3.12.3 Past Occurrence

Wildfires are a constant threat in Fulton County. For the 2019 Hazard Mitigation Plan (HMP), only wildfires reported to PA DCNR from 2011 to August 2019 were reflected in the HMP. From 2011 to August 2019, there were 25 wildfires reported to PA DCNR. Table 4.3.12-3 shows the numbers of wildfire events in the county from 2011 to August 2019. Of all of Fulton County's jurisdictions, Brush Creek Township had the most wildfires between 2011 and August 2019. This data only includes fires reported to the BOF and does not include brushfires or wildfires that local or volunteer fire departments responded to.

Table 4.3.12-3. List of wildfire events reported in Fulton County from 2011 to August 2019

Municipality	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Ayr Township	0	1	1	0	0	0	0	**0**	**0**	**2**
Belfast Township	0	0	0	0	0	0	0	**0**	**1**	**1**
Bethel Township	0	0	0	0	0	0	0	**0**	**0**	**0**
Brush Creek Township	1	7	0	2	0	0	0	**0**	**0**	**10**
Dublin Township	0	0	0	1	0	1	0	**0**	**0**	**2**
Licking Creek Township	1	0	0	1	0	2	0	**0**	**0**	**4**
McConnellsburg Borough	0	0	0	0	0	0	0	**0**	**0**	**0**
Taylor Township	0	0	0	0	0	0	0	**0**	**0**	**0**
Thompson Township	0	0	0	0	0	0	0	**0**	**0**	**0**
Todd Township	0	0	0	1	0	1	1	**1**	**0**	**4**
Union Township	0	0	0	0	0	0	0	**0**	**0**	**0**
Valley-Hi Borough	0	0	0	0	0	0	0	**0**	**0**	**0**
Wells Township	0	0	0	0	0	1	1	**0**	**0**	**2**
Fulton County	**2**	**8**	**1**	**5**	**0**	**5**	**2**	**1**	**1**	**25**

Source: PA DCNR 2019
Note: Numbers listed in 2011 to August 2019 were based on wildfires reported to PA DCNR.
PA DCNR BOF is not responsible for the accuracy of the data shown above, and these numbers should be used for planning purposes only.

4.3.12.4 Future Occurrence

In Pennsylvania, wildfire events will continue to occur each year. However, the likelihood of one of those fires attaining significant size and intensity is unpredictable and highly dependent on environmental conditions and firefighting response. Weather conditions, particularly drought events, increase the likelihood of wildfires occurring. Additionally, invasive forest insects can increase the likelihood of wildfires occurring; insects that attack and kill trees increase the total wildfire fuel available in wooded areas. Climate change is also likely to increase the probability of future wildfires. Prolonged periods of drought caused by climate change can potentially increase the length of the wildfire season and provide a more favorable climate for ignition (PEMA 2018).

For the 2019 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of wildfire events for Fulton County. Data collected from the PA DCNR BOF was used to identify the number of wildfire events that occurred between 2011 and August 2019. Due to the fact that all brush or wildfires are likely not reported to Fulton County or the State, it is difficult to have a comprehensive record of wildfire incidents. The table below shows these statistics as well as the annual average number of events and the estimated percent chance of an incident occurring in a given year, using the PA DCNR BOF records from 2011 to August 2019. Based on these statistics, there is an estimated 100-percent chance of a wildfire event occurring in any given year in Fulton County.

Table 4.3.12-4. Probability of Future Wildfire Events

Number of Occurrences Between 2011 and August 2019	Rate of Occurrence or Annual Number of Events (average)	Percent Chance of Occurrence in Any Given Year
25	3.1	100%

Sources: PA DCNR BOF 2019

Based on available historical data, the future occurrence of wildfires in Fulton County can be considered *highly likely* as defined by the Risk Factor Methodology probability criteria (refer to Section 4.4). However, the likelihood of one of those fires attaining significant size and intensity is unpredictable and highly dependent on environmental conditions and firefighting response. Weather conditions like drought and wind can increase the likelihood of wildfires occurring. Any fire, without the quick response or attention of firefighters, forestry personnel, or visitors to the forest, has the potential to become a wildfire.

4.3.12.5 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 Fulton County, including:

- 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
- Effect of climate change on vulnerability
- Further data collections that will assist in understanding this hazard over time.

The WUI (interface and intermix) obtained through the SILVIS Lab, Department of Forest Ecology and Management, University of Wisconsin-Madison, defines the wildfire hazard area utilized for the 2019 HMP update. 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 what 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. In addition, the population living within and along the WUI may only have one ingress/egress to their communities, making them highly vulnerable in the event of an evacuation. In order to estimate the number of exposed individuals to the hazard, the total population for each municipality was divided by the number of residential buildings to establish an average population per residential structure which intersects the WUI. In addition to being available at the census block level, the 2010 U.S. Census data is the default demographic data in HAZUS-MH v4.2. The census block level provides a higher resolution of population distribution than American Community Survey spatial data, which is only available at the census tract level. The 2010 U.S. Census data is also used to maintain consistency in data through the vulnerability assessments throughout this hazard mitigation plan. Table 4.3.12-5 summarizes the estimated population exposed by municipality.

Table 4.3.12-5. Estimated Population Located within the WUI in Fulton County

Municipality	U.S. Census 2010 Population	Estimated Population Exposed	
		Population Exposed to Interface/Intermix	% of Total
Ayr Township	1,942	1,543	79.4%
Belfast Township	1,448	480	33.2%
Bethel Township	1,508	1,032	68.4%
Brush Creek Township	819	418	51.0%
Dublin Township	1,264	947	74.9%
Licking Creek Township	1,703	1,276	74.9%
McConnellsburg Borough	1,220	1,208	99.0%
Taylor Township	1,118	625	55.9%
Thompson Township	1,098	556	50.7%
Todd Township	1,527	1,332	87.2%
Union Township	706	306	43.3%
Valley-Hi Borough	15	15	100.0%
Wells Township	477	268	56.2%
Fulton County	**14,845**	**10,006**	**67.4%**

Source: U.S. Census 2010, Radeloff et al. 2012
Notes:
WUI Wildland-Urban Interface

Impact on General Building Stock

The most vulnerable structures to wildfire events are those within the WUI. 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 WUI was overlaid on the default building inventory available in HAZUS-MH to estimate the replacement cost of buildings in Fulton County potentially vulnerable to the wildfire hazard. The Replacement Cost Value (RCV) of the census blocks with their center in the WUI was totaled. To estimate the number of structures exposed to this hazard, the hazard area was overlaid on the building footprint spatial layer from Fulton County. Structures with their centroid in the hazard area were totaled. Table 4.3.12-6 summarizes the estimated building stock inventory exposed by municipality.

Table 4.3.12-6. Building Stock Replacement Value and Structures Located within the WUI in Fulton County

Municipality	Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Exposed			
			Number of Buildings - Interface/Intermix	% of Total	Estimated Structures Located in WUI (Interface + Intermix)	% of Total
Ayr Township	1,139	$328,056,000	907	79.6%	$271,587,000	82.8%
Belfast Township	740	$181,485,000	242	32.7%	$48,039,000	26.5%
Bethel Township	853	$243,010,000	573	67.2%	$143,191,000	58.9%
Brush Creek Township	519	$110,481,000	242	46.6%	$44,936,000	40.7%
Dublin Township	697	$153,284,000	483	69.3%	$106,106,000	69.2%
Licking Creek Township	881	$203,625,000	658	74.7%	$152,429,000	74.9%
McConnellsburg Borough	538	$276,419,000	517	96.1%	$250,091,000	90.5%
Taylor Township	697	$141,644,000	381	54.7%	$79,675,000	56.3%
Thompson Township	572	$155,461,000	277	48.4%	$81,153,000	52.2%
Todd Township	858	$298,975,000	652	76.0%	$250,520,000	83.8%
Union Township	421	$106,265,000	166	39.4%	$42,417,000	39.9%
Valley-Hi Borough	29	$5,827,000	28	96.6%	$5,827,000	100.0%
Wells Township	292	$58,946,000	156	53.4%	$35,818,000	60.8%
Fulton County	**8,236**	**$2,263,478,000**	**5,282**	**64.1%**	**$1,511,789,000**	**66.8%**

Source: HAZUS-MH v4.2; Stewart and Radeloff 2012; Fulton County 2019
Notes:
GBS General Building Stock
RCV Replacement cost value
WUI Wildland-Urban Interface

Impact on Critical Facilities

A number of critical facilities are located in the wildfire hazard area. Many of these facilities are the locations for vulnerable populations (schools) and responding agencies to wildfire events (fire and police). Table 4.3.12-7 summarizes the number of critical facilities identified by the county plan participants that are located within the wildfire hazard area.

Table 4.3.12-7. Number of Critical Facilities in the WUI in Fulton County

Municipality	Facility Types																				
	Commercial	Communication	County Office	Dam	Fire	Hazmat	Hospital	Library	Municipal Hall	Park	Police	Polling Station	Post Office	Potable Water	Power	School	Senior	Shelter	Substation	Wastewater Pump	Wastewater Treatment
Ayr Township	1	1	0	0	0	1	0	0	1	0	1	1	0	0	0	0	1	6	1	0	1
Belfast Township	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Bethel Township	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0
Brush Creek Township	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	0	0	0
Dublin Township	0	2	1	0	1	1	0	0	1	0	0	1	1	0	0	0	1	5	0	2	1
Licking Creek Township	0	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6	3	0	0
McConnellsburg Borough	0	1	0	0	2	1	0	1	0	0	0	0	0	0	0	1	0	9	0	0	0
Taylor Township	1	1	0	0	0	2	0	0	0	0	0	0	3	0	2	0	0	5	1	2	0
Thompson Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Todd Township	0	1	0	1	0	1	1	0	1	1	0	1	0	2	1	0	0	4	0	0	1
Union Township	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
Valley-Hi Borough*	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Wells Township	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	4	0	0	0
Fulton County	**3**	**15**	**1**	**4**	**3**	**7**	**1**	**1**	**5**	**1**	**1**	**5**	**5**	**2**	**3**	**1**	**2**	**49**	**5**	**5**	**3**

Source: Stewart and Radeloff 2012; Fulton County 2019

Notes:

WUI Wildland-Urban Interface

Impact on the Economy

Wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed businesses and decreases in tourism. Wildfire can also severely damage roads and infrastructure. Portions of Interstate I-70, I-76, US Routes US-30, US-522, and multiple State Routes, including PA-475, PA-484, PA-655, PA-913, PA-915, and PA-928 run through WUI areas. This factor should be considered for determine evacuation routes for Fulton County residents.

Impact on the Environment

Vegetation loss is often a concern, but it typically is not a serious impact since natural re-growth occurs with time. The most significant environmental impact is the potential for severe erosion, silting of stream beds and reservoirs, and flooding due to ground-cover loss following a fire event. Wildfires also have a positive environmental impact in that they burn dead trees, leaves, and grasses to allow more open spaces for new and different types of vegetation to grow and receive sunlight. Another positive effect of a wildfire is that it stimulates the growth of new shoots on trees and shrubs, and its heat can open pine cones and other seed pods (PEMA 2018).

Wildfires can increase the probability of other natural disasters, specifically floods and mudflows. Wildfires, particularly large-scale fires, can dramatically alter the terrain and ground conditions, making land already devastated by fire susceptible to floods. Lands impacted by wildfire increase the risk of flooding and mudflow in those areas. Normally, vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to absorb water, thus creating conditions perfect for flash flooding and mudflows. Flood risk in these impacted areas remains significantly higher until vegetation is restored, which can take up to five years after a wildfire (FEMA 2013).

Future Growth and Development

Areas targeted for potential future growth and development in the next 5 years have been identified across the Fulton County at the municipal level. It is anticipated that any new development and new residents in the WUI 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 2012).

Fire interacts with climate and vegetation (fuel) in predictable ways. Understanding the interactions of climate, fire, and vegetation interactions 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
- Complications from land-use change, invasive species, and an increasing WUI (USFS 2012)

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 conditions, in general, which are conducive to severe wildfires. Warmer temperatures will also increase the effects of drought and increase the number of days each year with flammable fuels and extending fire seasons and areas burned (USFS 2012).

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 indicate Pennsylvania may be at increased risk for wildfires, but it is unclear how large the increase in risk will be (Shortle et. al. 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 2012).

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 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 damages.

Fulton County may consider participating in Firewise, a program that teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action to prevent losses. In locations where homes are at risk to wildfires, the State's WUI Guidance Document is available to assist homeowners, community associations, local government, and developers to assess and mitigate the potential dangers of a wildfire. The guidance also provides information for developing an action plan in coordination with local emergency managers. Communities at risk for wildfires can adopt by local ordinance the "International Wildland-Urban Interface Code" of the Uniform Construction Code. Fulton County and municipalities may consider different landscape requirements in the WUI and consider updating the subdivision and zoning ordinances to indicate as such. Further, as indicated in the Saladyga and Standlee study, residents agree about the need for active flue management and an increase in wildfire prevention education, trash disposal and recycling programs, and fire management training and infrastructure.

4.3.13 Winter Storm

This section provides a profile and vulnerability assessment of the winter storm hazard in Fulton County. Winter storms occur, on average, approximately five times each year in Pennsylvania. From November through March, Pennsylvania is exposed to winter storms that move up the Atlantic coast or sweep in from the west. Every county in the Commonwealth is vulnerable 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) (NWS 2019).

4.3.13.1 Location and Extent

Winter storms are regional events, most of which impact a large area of the entire Commonwealth. In many cases, surrounding states and even the northeast region of the United States are affected by a single winter storm incident.

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 Centers for Environmental Information (NCEI) 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). NCEI has analyzed and assigned RSI values to over 500 storms since 1900 (NCEI 2011). Table 4.3.13-1 lists the five RSI ranking categories.

Table 4.3.13-1. 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: NCEI 2011

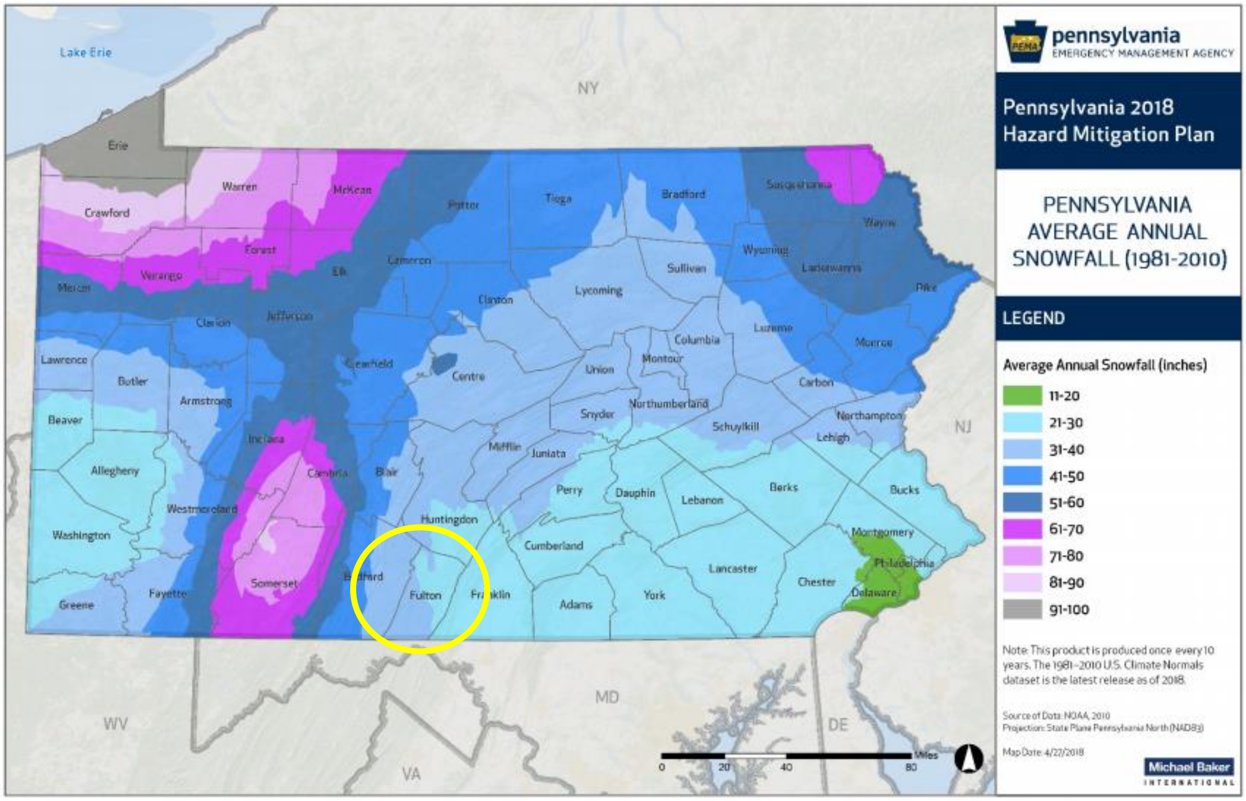
4.3.13.2 Range in Magnitude

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

All of Fulton County is susceptible to winter storms. Based on annual snowfall averages according to the 2018 State Hazard Mitigation Plan (HMP) (Figure 4.3.13-1), snowfall accumulation during the winter season in Fulton County ranges from 21 to 40 inches.

Figure 4.3.13-1. Pennsylvania Average Annual Snowfall



Source: Pennsylvania Emergency Management Agency (PEMA) 2018
Note: The yellow oval surrounds Fulton County.

The January 1996 snowstorm has been referred to as the "storm of the century," but the worst-case scenario of a winter storm in Fulton County occurred in January 1994. Specific snowfall totals for that storm were not available, but snowfall in the 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 Fulton 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, in some cases for several days at a time. The storm caused 185 injuries and approximately $5 million in damages across the State.

4.3.13.3 Past Occurrence

Many sources provided historical information regarding previous occurrences and losses associated with winter storm events throughout the Commonwealth of Pennsylvania and Fulton County. With so many sources reviewed for the purpose of this plan, loss and impact information for many events varied 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 2017, the Federal Emergency Management Agency (FEMA) declared that the Commonwealth of Pennsylvania experienced eight 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 Commonwealth, and therefore may have impacted many counties. However, not all counties were included in the disaster declarations. PEMA and other sources indicate that Fulton County has been declared as a disaster area as a result of six of the declarations for winter storm events (FEMA 2019).

According to the NOAA-NCEI storm events database, Fulton County experienced 53 winter storm events between January 07, 1996 and February 20, 2019. Based on all sources researched, known winter storm events that have affected Fulton County are listed in Table 4.3.13-2. Because winter storm documentation for the Commonwealth of Pennsylvania is so extensive, not all sources have been identified or researched. Therefore, Table 4.3.13-2 may not include all events that have occurred throughout Fulton County.

Table 4.3.13-2. Major Winter Storm Events in Fulton County between 1993 and 2019

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
3/13-17/1993	Severe Snow Fall and Winter Storm	EM-3105	Y	Eligible for Public Assistance
1/6-12/1996	Blizzard	DR-1085	Y	Eligible for Public Assistance
1/7/1996	Blizzard	N/A	N/A	On January 7, more than 2 feet of snow fell across much of the lower Susquehanna Valley with 12 to 18 inches falling across the central mountains from Johnstown and State College east to Wilkes-Barre. The storm was appropriately termed the Blizzard of '96. Snow began falling during the morning of January 7 and continued into the early morning of January 8. Transportation and commerce came to a halt as the cities of south central Pennsylvania were buried under the heavy snow. The storm had a major impact on commerce across south central Pennsylvania.
3/4/2001	Heavy Snow	N/A	N/A	$150,000 in property damage. Statewide.
1/6/2002	Heavy Snow	N/A	N/A	Central Pennsylvania.
10/29/2002	Ice Storm	N/A	N/A	$1 million in property damage. Multiple counties.
2/2003	Severe Winter Storm	N/A	Y	Governor's Proclamation of Disaster Emergency, Governor Edward G. Rendell; Pres-EM
2/14-19/2003	Snow Storm	EM-3180	Y	Eligible for Public Assistance
2/13/2007	Winter Storm	N/A	N/A	A major winter storm, the first of the season, struck central Pennsylvania from the early morning hours of February 13 through the afternoon hours of February 14, 2007. In Fulton County, a mix of sleet and freezing rain fell in addition to 6 to 7 inches of snow.
2/1/2008	Winter Storm	N/A	N/A	Fulton County emergency management reported over 0.25 inch of ice from freezing rain and sleet.
2/5-11/2010	Severe Winter Storms and Snow Storms	DR-1898	Y	Eligible for Public Assistance
12/14/2013	Winter Storm	N/A	N/A	Light snow started in the morning and became heavy at times through the afternoon and evening. Snow changed to sleet and then freezing rain/drizzle with a glaze of ice, topping storm total snow accumulations between 3 and 6 inches. The mixed wintry precipitation adversely impacted travel, especially along the Pennsylvania Turnpike and I-70 corridors.
3/19/2015	Heavy Snow	N/A	N/A	Snowfall amounts of 6 inches were reported across the county.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
1/22/2016	Winter Storm	DR-4267	N/A	Heavy snowfall amounts of 18 to 30 inches were observed across the county.
2/15/2016	Winter Storm	N/A	N/A	Light snow developed the afternoon of February 15 before quickly changing over to freezing rain. A quarter of an inch or more of ice accumulation was observed across the county.
3/13/2017	Winter Storm	N/A	N/A	A winter storm produced 7-12 inches of snow across Fulton County.
2/07/2018	Winter Storm	N/A	N/A	A winter storm produced snow, sleet, and 0.25 to 0.40 inches of freezing rain across Fulton County.
3/20/2018	Winter Storm	N/A	N/A	A winter storm produced 8-14 inches of snow in a 24-hour period across Fulton County.
11/15/2018	Winter Storm	N/A	N/A	A winter storm produced 6 to 11 inches of snow and sleet across Fulton County on November 15-16, 2018.
2/11/2019	Winter Storm	N/A	N/A	A Winter Storm produced 2 to 4 inches of snow and sleet, and greater than 0.25 of freezing rain across Fulton County from February 11-12, 2019.
2/20/2019	Winter Storm	N/A	N/A	A Winter Storm produced 6 to 8 inches of snow and sleet followed by greater than 0.25 of freezing rain across Fulton County on February 20-21, 2019.

Source: PEMA 2018; NCEI 2019.

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 2017 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

4.3.13.4 Future Occurrence

Apparently, given the history of winter storm events that have impacted Fulton 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 *highly likely*, according to Risk Factor Methodology probability criteria (further discussed in Section 4.4).

4.3.13.5 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 of Westmoreland 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 Fulton County, including:

- 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

In Fulton County, winter storms are a concern because of frequency, associated direct and indirect costs, delays caused by the storms, and impacts on people and facilities of the region.

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.

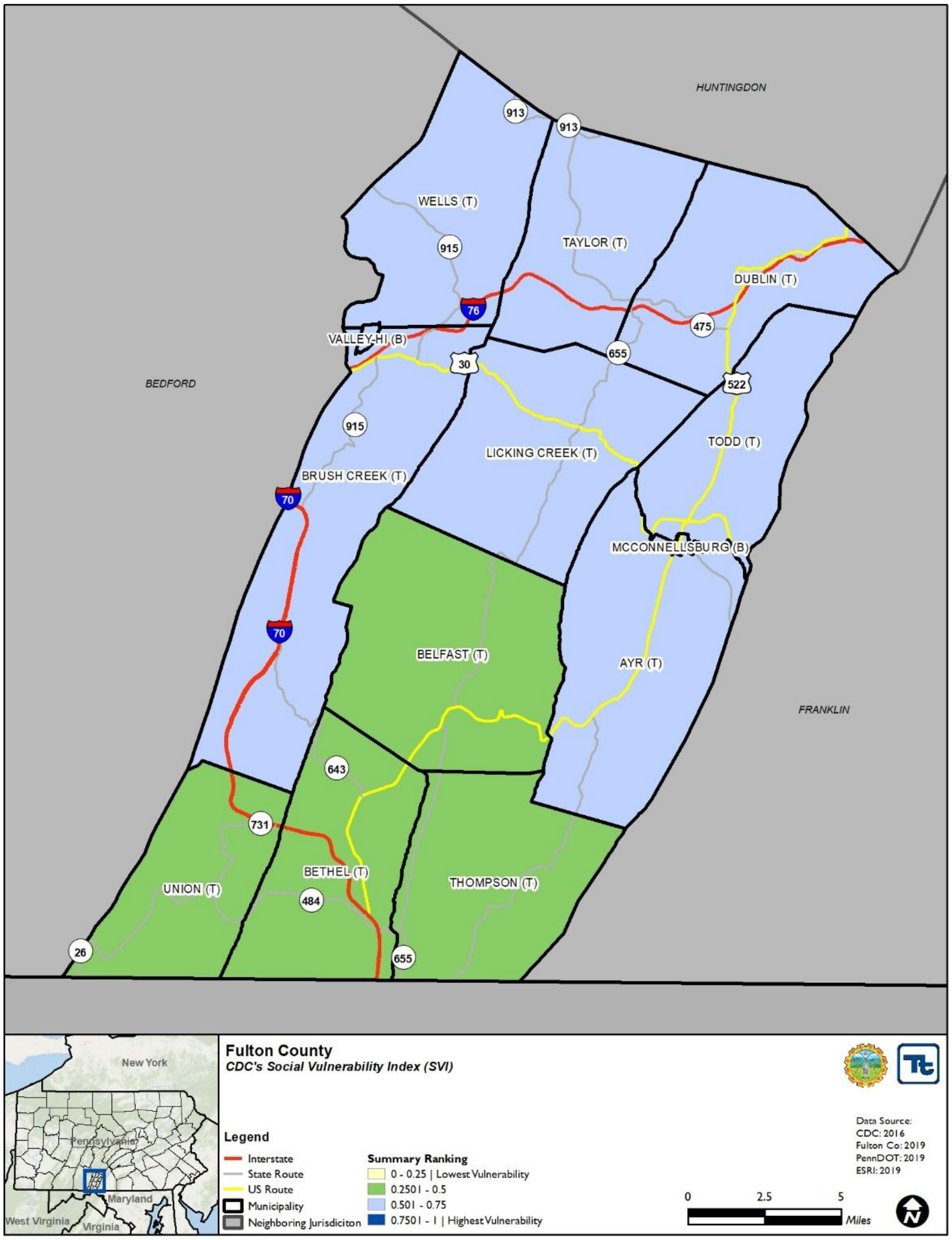
Heavy snow can immobilize a region and paralyze a city, shutting down air and rail transportation, stopping flow of supplies, and disrupting medical and emergency services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches (NSSL 2015c).

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 2015c).

For the purposes of this HMP, the entire population of Fulton 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 HMP 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).

According to the Centers for Disease Control and Prevention's (CDC) 2016 Social Vulnerability Index, populations in Ayr Township, Brush Creek Township, Dublin Township, Licking Creek Township, McConnellsburg Borough, Taylor Township, Todd Township, Valley-Hi Borough, and Wells Township are classified within a higher vulnerability ranking then Belfast Township, Bethel Township, Thompson Township, and Union Township. The vulnerable populations located in these municipalities may be more susceptible to impacts from severe winter storms. Figure 4.3.13-2 below displays the CDC Social Vulnerability Index for Fulton County.

Figure 4.3.13-2. CDC's Social Vulnerability Index 2016



Impact on General Building Stock

The entire general building stock inventory in Fulton 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 4.3.13-3 summarizes the estimated loss to Fulton County's total general building stock (structure only) as a result of 1-, 5-, and 10-percent loss. Given professional knowledge and the currently available information, the potential loss for this hazard is many times considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the following information should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Table 4.3.13-3. General Building Stock Exposure (Structure Only) and Estimated Losses from Winter Storm Events in Fulton County

Municipality	Total GBS (Structure Only)	1% of Total	5% of Total	10% of Total
Ayr Township	$203,163,000	$2,031,630	$10,158,150	$20,316,300
Belfast Township	$111,757,000	$1,117,570	$5,587,850	$11,175,700
Bethel Township	$152,457,000	$1,524,570	$7,622,850	$15,245,700
Brush Creek Township	$70,479,000	$704,790	$3,523,950	$7,047,900
Dublin Township	$95,778,000	$957,780	$4,788,900	$9,577,800
Licking Creek Township	$129,459,000	$1,294,590	$6,472,950	$12,945,900
McConnellsburg Borough	$157,058,000	$1,570,580	$7,852,900	$15,705,800
Taylor Township	$87,204,000	$872,040	$4,360,200	$8,720,400
Thompson Township	$101,824,000	$1,018,240	$5,091,200	$10,182,400
Todd Township	$164,001,000	$1,640,010	$8,200,050	$16,400,100
Union Township	$69,402,000	$694,020	$3,470,100	$6,940,200
Valley-Hi Borough	$3,885,000	$38,850	$194,250	$388,500
Wells Township	$37,498,000	$374,980	$1,874,900	$3,749,800
Fulton County	**$1,383,965,000**	**$13,839,650**	**$69,198,250**	**$138,396,500**

Source: HAZUS-MH v4.2

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 4.3.5). 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 Fulton County are discussed in Section 4.3.5.

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 shrubbery and trees due to heavy snow loading, ice build-up, and/or high winds, which can break limbs or even bring down large trees. An indirect effect of winter storms is the treatment of roadway surfaces with salt, chemicals, and other de-icing materials, which can impair adjacent surface and ground waters. Another important secondary impact for winter storms is building or structure collapses; if there is a heavy snowfall or a significant accumulation over time, the weight of the snow may cause building damage or even collapse (PEMA 2018).

Winter storms have a positive environmental impact as well; gradual melting of snow and ice provides excellent groundwater recharge. However, abrupt high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding (PEMA 2018).

Future Growth and Development

Areas targeted for potential future growth and development within the next 5 to 10 years have been identified across Fulton County at the municipal level and are further discussed in Section 2.4 of this HMP. Because Fulton 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 Commonwealth. 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 2015a). 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.

4.4 HAZARD VULNERABILITY SUMMARY

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

4.4.1 Methodology

A risk assessment is a process that involves measuring the potential loss of life, personal injury, economic losses, and property damage resulting from identified hazards. It allows planning personnel to address and reduce hazard impacts and emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. Results of the risk assessment are used in subsequent mitigation planning processes, including determining and prioritizing mitigation actions that reduce each jurisdiction's risk to a specified hazard. Past, present, and future conditions must be evaluated to assess risk most accurately for the county and each jurisdiction. The process focuses on the following elements:

- **Hazard Identification** – Using all available information to determine the types of hazards that might affect a jurisdiction
- **Profile Each Hazard** – Understanding each hazard in terms of:
  - Location – geographic area most affected by the hazard
  - Extent – severity of each hazard
  - Range of magnitude
  - Previous occurrences and losses
  - Probability of future hazard events
- **Vulnerability Assessment**
  - Exposure identification – Estimating the total number of assets in the jurisdiction that are likely to experience a hazard event if it occurs by overlaying hazard maps with the asset inventories.
  - Vulnerability identification and loss estimation – Assessing the impact of hazard events on the people, property, environment, economy, and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.

The following summarizes the asset inventories, methodology, and tools used to support the risk assessment process.

Asset Inventories

Fulton County assets were identified to assess potential exposure and loss associated with the hazards of concern. For the Hazard Mitigation Plan (HMP) update, Fulton County assessed the vulnerability of the following types of assets: population, buildings and critical facilities/infrastructure, and the environment. Some assets are more vulnerable because of their physical characteristics or socioeconomic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate without details about specific individual personal or public properties.

Population

As discussed in Section 2, County Profile, research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. For the purposes of this planning process, vulnerable populations in Fulton County include children, elderly, low-income, and non-English speakers.

The 2010 U.S. Census block data layers were used to estimate exposure and potential impacts to the general population. The 2010 U.S. Census demographic data available in the Federal Emergency Management Agency's (FEMA) Hazards U.S.-Multi-Hazard (HAZUS-MH) v4.2 model was used to estimate potential impacts to the elderly (over 65 years of age) and populations with income below the poverty threshold. The 2012-2016

American Community Survey (ACS) was utilized to examine population data for residents who are non-English speaking.

U.S. Census blocks do not follow the boundaries of the hazard areas, possibly leading to gross overestimates or underestimates of exposed populations from use of centroids or intersects of Census blocks with these zones. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate.

Buildings

The default general building stock data in HAZUS-MH v4.2 (based on the 2010 U.S. Census and RSMeans 2016 valuations) was used for the HAZUS-MH v4.2 analysis and hazard exposure analysis at the municipal level. The building inventory was used to estimate losses to the county's total replacement cost value from a hazard event. Replacement cost value is the current cost of returning an asset to its pre-damaged condition using present-day cost of labor and materials. Total replacement cost value consists of both the structural cost to replace a building and the estimated value of the contents of a building. The occupancy classes available in HAZUS-MH v4.2 were condensed into the following categories to facilitate the analysis and the presentation of results: residential, commercial, industrial, agricultural, religious, governmental, and educational. Residential loss estimates address both multi-family and single-family dwellings. To estimate the number of structures in the county exposed to the hazard areas, Fulton County's spatial building footprint layer was utilized. Building footprints with their centroid in a hazard area were totaled to estimate exposure.

The HAZUS-MH v4.2 Census blocks do not follow the boundaries of the hazard areas, possibly leading to gross overestimates or underestimates of exposed building stock from use of centroids or intersects of Census blocks with these zones. Limitations of these analyses are recognized, and thus the results are used only to provide a general estimate.

Critical Facilities

The critical facility inventory, which includes essential facilities, utilities, transportation features, and user-defined facilities as outlined in Section 2, was updated beginning with all Geographic Information System (GIS) data provided by the Fulton County Planning and Mapping Department. To protect privacy and the security of assets, information is presented in aggregate, without details about specific individual properties or facilities. The default inventory in HAZUS-MH v4.2 was updated with the critical facility inventory generated for this plan.

New Development

McConnellsburg Borough has remained the population, industrial, and commercial center of Fulton County resulting in a growth that has expanded from the borough into the neighboring rural townships. Growth is expected to occur in five distinct geographic areas due to the transportation network and availability of public sewer services. The five areas include McConnellsburg, Warfordsburg, Hustontown, Fort Littleton, and Crystal Spring (Fulton County 2015). The 2018 ACS estimates that Fulton County has seen construction of 40 housing units from 2014 to 2018 (ACS 2018).

In addition to anticipated sporadic residential development, Fulton County has over 140 acres available in six designated growth areas. All six of the identified growth areas are located within the FEMA flood hazard zone, the high susceptibility/moderate incidence landslide hazard area, and/or the environmental hazard area. The county has noted the location of these hazard areas in relation to the growth areas to ensure that the planning and development process considers these factors. The county intends to discourage development within vulnerable areas, areas with high population density, and the Special Flood Hazard Area (SFHA); or encourage higher regulatory standards at the local level. Section 4.4.4 below provides more details about the growth hazard areas.

Methodology

To address the requirements of the Disaster Mitigation Act of 2000 and better understand potential vulnerability and losses associated with hazards of concern, Fulton County used standardized tools, combined with local, state, and federal data and expertise to conduct the risk assessment. Three different levels of analysis described below were used depending on the data available for each hazard:

1. **Historical Occurrences and Qualitative Analysis** – This analysis includes an examination of historical impacts to understand potential impacts of future events of similar size. In addition, potential impacts and losses are discussed qualitatively using best-available data and professional judgment.
2. **Exposure Assessment** – This analysis involves overlaying available spatial hazard layers, or hazards with defined extent and locations, with assets in GIS to determine which assets are located in the impact area of the hazard. The analysis highlights which assets might be affected by the hazard. If the center of each asset is located in the hazard area, it is deemed exposed and potentially vulnerable to the hazard.
3. **Loss estimation** – The FEMA HAZUS modeling software was used to estimate potential losses for the following hazards: flood, earthquake, and hurricane (wind). In addition, an examination of historical impacts and an exposure assessment was conducted for these spatially-delineated hazards.

The risk assessment analytical data are summarized in Table 4.4-1.

Table 4.4-1. Summary of Risk Assessment Analyses

Hazard	Data Analyzed			
	Population	General Building Stock	Critical Facilities	Environment
Dam Failure	Q	Q	Q	Q
Drought	Q	Q	Q	Q
Earthquake	H	H	H	Q
Environmental Hazard	E	E	E	Q
Flood, Flash Flood, Ice Jam	E, H	E, H	E	Q
Hailstorm	Q	Q	Q	Q
Landslide	E	E	E	Q
Radon Exposure	Q	Q	Q	Q
Subsidence/Sinkhole	E	E	E	Q
Tornado, Windstorm	Q	H	H	Q
Transportation Accident	Q	Q	Q	Q
Wildfire	E	E	E	Q
Winter Storm	Q	Q	Q	Q

Notes: E – Exposure analysis; H – HAZUS analysis; Q – Qualitative analysis

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. or HAZUS. HAZUS was developed in response to the need for more effective national, state, and community-level planning and the need to identify areas that face the highest risk and potential for loss. HAZUS was expanded into the multi-hazard (MH) methodology HAZUS-MH with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a GIS-based software tool that applies engineering and scientific risk calculations, which have been 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 the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct potential for physical damage to building stock, critical facilities, transportation systems, and utility systems. To generate this information, HAZUS-MH uses default HAZUS-MH-provided data for inventory, vulnerability, and hazards, which can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (e.g., inundation, fire, threats posed by hazardous materials and debris) and direct economic and social losses (e.g., casualties, shelter requirements, and economic impact) depending on the hazard and available local data. HAZUS-MH's open-data architecture can be used to manage community GIS data in a central location. The use of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. More information on HAZUS-MH is available at http://www.fema.gov/hazus.

In general, probabilistic analyses were performed to develop expected/estimated distribution of losses (mean return period [MRP] losses) for the flood, wind, and seismic hazards. The probabilistic model generates estimated damages and losses for specified return periods (e.g., 100- and 500-year). For annualized losses, HAZUS-MH calculates the maximum potential annual dollar loss resulting from various return periods averaged on a "per year" basis. It is the 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, the estimated cost of a hazard each year is calculated. HAZUS-MH analysis levels are described in Table 4.4-2.

Table 4.4-2. Summary of HAZUS-MH Analysis Levels

HAZUS-MH Analysis Levels	
Basic	A basic estimate of earthquake, flood, and hurricane wind losses is produced based on national databases and expert-based analysis parameters included in the HAZUS software.
Advanced	More accurate loss estimates are produced by including detailed information on local hazard conditions and/or by replacing the national default inventories with more accurate local inventories of buildings, essential facilities, and other infrastructure.

Source: FEMA 2019

Earthquake

A probabilistic assessment was conducted for Fulton County for the 500-year MRPs through a Level 2 analysis in HAZUS-MH v4.2 to analyze the earthquake hazard and provide a range of loss estimates. The probabilistic method uses information from historical earthquakes and inferred faults, locations, and magnitudes and computes the probable ground shaking levels that might be experienced during a recurrence period by Census tract.

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 uncertainty in loss estimates produced by the HAZUS Earthquake Model, possibly at best by 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 man-made structures, and soft soils amplify ground shaking. One contributor to the site amplification is the velocity at which the rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reductions Program (NEHRP) has developed five soil classifications defined by their shear-wave velocity that impact 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.

NEHRP soil classifications were not available for Fulton County at the time of this analysis. Damages and losses due to liquefaction, landslide, or surface fault rupture were not included in this analysis.

In addition to the probabilistic scenarios cited, an annualized loss run was conducted to estimate annualized general building stock dollar losses and the impact on critical facilities in the county for the 500-year MRP earthquake event.

Environmental Hazard

To determine potential impact on Fulton County, a 0.25-mile buffer was placed around the identified major roadways and rail lines, and the designated vulnerability radius of each of the county's 11 Superfund Amendments and Reauthorization Act (SARA) Title III planning facilities was used to define the hazard area. The primary roadways in Fulton County are listed as follows:

- Pennsylvania Turnpike (I-76)
- Interstate 70 (I-70)
- U.S. Highway 522 (US-522)
- U.S. Highway 30 (US-30)
- PA State Highway 16 (PA-16)

Populations and features of the built environment within these areas might be directly or indirectly affected by a potential environmental hazard. The hazard area was overlaid upon the 2010 U.S. Census population data in GIS (U.S. Census 2010).

The vulnerability radius for each hazard facility is determined by the Fulton County Local Emergency Planning Committee, and each radius is shown in Appendix I.

Flood, Flash Flood, Ice Jam

The 1- and 0.2-percent annual chance flood events were examined to evaluate Fulton County's flood risk. These flood events are generally those considered by planners and evaluated under federal programs such as the National Flood Insurance Program.

The effective Fulton County FEMA Digital Flood Insurance Rate Maps (DFIRM) (dated February 18, 2011) were used to evaluate exposure. The FEMA Risk Map 1-percent annual chance flood depth grid, dated February 2011, was incorporated into HAZUS-MH v4.2 to estimate potential losses for the county. The depth grid was integrated into HAZUS-MH, and the model was run to estimate potential losses at the Census block level using the HAZUS-MH v4.2 default building inventory for the 1-percent annual chance flood event.

DFIRM flood boundaries, default general building stock inventory, updated critical facility inventories, and 2010 U.S. Census population data were used to estimate exposure to the 1-percent annual chance flood events. A HAZUS-MH v4.2 riverine flood analysis was performed. The updated critical facility inventories were incorporated into HAZUS-MH v4.2, replacing the default essential facility (police, fire, schools, etc.) and utility inventories. The HAZUS-MH v4.2 riverine flood model was run to estimate potential losses in Fulton County for the 1-percent and 0.2-percent annual chance flood event. HAZUS-MH v4.2 calculated the estimated potential losses to the population (default 2010 U.S. Census data) and potential damages to the general building stock and critical facility inventories based on the depth grid generated and the default HAZUS-MH v4.2 damage functions in the flood model.

Landslide

Unlike the flood, wind, and earthquake hazards, no standard loss estimation models or methodologies have been established for the landslide hazard.

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 making inquiries to planning and engineering departments of local governments (National Atlas 2018).

To estimate Fulton County's vulnerability, a 2010 Steep Slope Landslide GIS layer from the National Land Trust was used to coarsely define the general landslide susceptible area. For the purposes of this assessment, steep slope areas with a slope angle greater than 25 percent are considered the hazard zone. Therefore, 17.5 percent (or 76.9 square miles) of Fulton County is located within the landslide hazard area. The future occurrence of landslides can be considered *unlikely* as defined by the Risk Factor Methodology probability criteria (further discussed in Section 4.4.2 below).

Subsidence/Sinkhole

There is no standard loss estimation model available for the mine subsidence hazard. To determine the assets that are exposed to this hazard, available and appropriate spatial data delineating the extent of Pennsylvanian rock and anthracite fields (Pennsylvania Bureau of Topographic and Geologic Survey 2015) were overlaid upon the asset data (population, buildings, critical facilities). The assets with centers located in the hazard area are reported as exposed and potentially vulnerable to mine subsidence events. Approximately 17.7 percent of Fulton County (77.58 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. Fulton County has a very low susceptibility to sinkholes and subsidence attributable to abandoned mines; however, this does not mean such an event cannot occur. The limitations of this analysis are recognized and are only used to provide a general estimate of exposure

Tornado and Windstorm

A HAZUS-MH v4.2 probabilistic analysis was performed to analyze the wind hazard losses for Fulton County. The probabilistic hurricane hazard activates a database of thousands of potential storms that have tracks and intensities reflecting the full spectrum of Atlantic hurricanes observed since 1886 and identifies those with tracks associated with Fulton County. HAZUS-MH v4.2 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 the modeling of wind force across various types of land surfaces. Annualized losses and the 100-year and 500-year MRPs were examined for the wind/severe storm hazard. Default demographic and general building stock data in HAZUS-MH v4.2 and the updated critical facility inventories were used for the analysis.

There is currently a FEMA-acknowledged issue with importing user-defined facilities in HAZUS-MH v4.2; however, 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.

Wildfire

The Wildland-Urban Interface (Interface and Intermix) obtained through the SILVIS Laboratory, Department of Forest Ecology and Management, University of Wisconsin–Madison, was referenced to delineate wildfire hazard areas. The University of Wisconsin – Madison wildland fire hazard areas are based on the 2010 Census and 2006 National Land Cover Dataset and the Protected Areas Database. For this risk assessment, the high-, medium-, and low-density interface areas were combined and used as the “Interface” hazard area, and the high-, medium-, and low-density intermix areas were combined and used as the “Intermix” hazard areas.

The asset data (population, building stock, and critical facilities) presented in Section 2, County Profile, was used to support an evaluation of assets exposed and the potential impacts and losses associated with this hazard. Available and GIS data were overlaid on the hazard area to identify what 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.

Winter Storm

All asset inventories (population, building stock, and critical facilities) in Fulton County are exposed and vulnerable to the winter storm hazard. In Fulton County, winter storms are a concern because of frequency, associated direct and indirect costs, delays caused by the storms, and impacts on people and facilities of the region. In Section 2, County Profile, this HMP 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).

Given professional knowledge and the currently available information, the potential loss to building stock from this hazard is often considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the building stock exposure and information presented in Section 4.3.13 (Winter Storm hazard profile) should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Full functionality of critical facilities such as those used by police, fire, and medical services personnel 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.

Qualitative Analyses

For many of the hazards evaluated in this risk assessment, historical data are not adequate to model future losses at this time. Where GIS data were not available, a qualitative analysis was conducted for the following hazards using the best-available data and professional judgment. Multiple federal, state, and academic sources were used to evaluate these hazards:

- Dam Failure
- Drought
- Hailstorm
- Radon Exposure
- Transportation Accident

Limitations

For this risk assessment, the loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the 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
- 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 two 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, Fulton County will collect additional data to update and refine existing inventories used to assist in estimating potential losses.

Potential economic loss is based on the present value of the general building stock utilizing best-available data. The county acknowledges significant impacts could occur to critical facilities and infrastructure as a result of these hazard events, causing great economic loss. However, monetized damage estimates to critical facilities and infrastructure and economic impacts were not quantified and require more detailed loss analyses. In addition, economic impacts to industries such as tourism and the real-estate market were not analyzed.

4.4.2 Ranking Results

As discussed in Section 4.2, Hazard Identification, a comprehensive range of natural and non-natural hazards that pose significant risk to Fulton County were selected and considered in this plan. However, the communities in Fulton 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 those hazards that pose the greatest risk to their community and direct their attention and resources accordingly to manage risk effectively and efficiently.

To this end, a relative hazard risk ranking process was conducted for the county using 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 (PEMA 2013).

Table 4.4-3 identifies the five risk assessment categories, the criteria and associated risk level indices used to quantify their risk, and the suggested weighting factor (weight value) applied to each risk assessment category. Table 4.4-4 shows the five risk assessment categories' values for each of Fulton County's hazards and each hazard's RF.

Table 4.4-3. 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 4.4-4. Risk Ranking for Fulton County

HAZARD RISK	HAZARDS	RISK ASSESSMENT CATEGORY					RISK FACTOR (RF)
		PROBABILITY	IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Flood, Flash Flood, and Ice Jam	3	4	4	3	4	3.6
	Winter Storm	4	3	4	1	4	3.4
	Transportation Accidents	4	2	2	4	2	2.8
	Environmental Hazards	3	2	2	4	3	2.6
	Drought	3	1	4	1	4	2.5
MODERATE	Dam Failure	1	3	2	4	3	2.3
	Earthquake	2	1	4	4	1	2.2
	Tornado Wind	4	1	1	4	1	2.2
	Subsidence/Sinkhole	3	1	1	4	4	2.2
	Radon Exposure	4	1	1	3	1	2.1
LOW	Wildfire	3	1	1	4	1	1.9
	Hailstorm	2	1	2	3	1	1.7
	Landslide	1	1	1	4	4	1.6

Based on these results, there are five high-risk hazards, five moderate-risk hazards, and three low-risk hazards in Fulton County. Mitigation actions were developed for all high-risk, moderate-risk, and low-risk hazards (further discussed in Section 6.4). The threat posed to life and property for moderate-risk and high-risk hazards is considered significant enough to warrant the need for establishing hazard-specific mitigation actions. Mitigation actions related to future public outreach and emergency service activities are identified to address low-risk hazard incidents.

A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. Table 4.4-5 lists the different municipalities in Fulton County and whether they believe their risk is greater than (>), less than (<), or equal to (=) the RF assigned to the county as a whole. Municipal officials' responses were then reviewed and updated (as appropriate) by the Steering Committee.

Table 4.4-5. Jurisdictional Risk by Municipality

Municipality	Dam Failures	Drought	Earthquake	Environmental Hazards	Flooding/Flash Flood/Ice Jam	Hailstorm	Landslide	Radon Exposure	Subsidence/Sinkholes	Tornado/Windstorm	Transportation Accidents	Wildfire	Winter storm
	2.3	2.5	2.2	2.6	3.6	1.7	1.6	2.1	2.2	2.2	2.8	1.9	3.4
Ayr Township	>	=	=	=	=	=	=	=	=	=	=	=	=
Belfast Township	=	=	=	=	=	=	=	=	=	=	=	=	=
Bethel Township	=	=	=	=	=	=	=	=	=	=	=	=	=
Brush Creek Township	<	>	=	>	=	=	=	=	=	=	>	=	=
Dublin Township	>	=	=	=	=	=	=	=	=	=	>	=	=
Licking Creek Township	=	=	=	=	<	=	<	=	=	=	=	=	=
McConnellsburg Borough	<	<	=	=	<	=	<	=	=	=	=	<	=
Taylor Township	<	=	=	>	=	=	<	=	>	=	<	>	=
Thompson Township	<	=	=	=	<	=	<	=	=	=	=	=	=
Todd Township	>	=	=	>	=	=	=	=	=	=	>	>	=
Union Township	<	=	=	>	=	=	>	=	=	=	>	>	=
Valley-Hi Borough	>	=	=	=	=	=	=	=	=	=	=	=	=
Wells Township	=	=	=	=	<	=	=	=	=	=	>	>	=

4.4.3 Potential Loss Estimates

Potential loss estimates for hazard events help a community understand the monetary value of what might be at stake during a hazard event. Estimates are considered *potential* in that they generally represent losses that could occur in a countywide hazard scenario. Localized events could yield lower losses, while regional events could yield higher losses.

The data utilized to conduct the vulnerability assessment came from a variety of sources as noted throughout each hazard profile and Appendix A. As summarized in the Methodology subsection the 2010 U.S. Census demographic data, HAZUS-MH v4.2 default building inventory and its associated replacement cost value of the structures and contents, and the comprehensive critical facility inventory update in HAZUS-MH v4.2 were used for Fulton County.

Potential loss estimates provided in Section 4.3, Hazard Profiles, were either based on historical losses, current-condition losses, and/or predictive losses by performing spatial analyses in GIS and hazard probabilistic modeling. In summary, HAZUS-MH v4.2 was used to estimate potential losses for the earthquake, flood, and hurricane (tornado, windstorm). For many of the hazards evaluated, historical data are not adequate to model future losses at this time. For 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). Spatial analyses were conducted to assess potential exposure for hazards of concern with delineated hazard areas: environmental hazards; flood, flash flood, and ice jam; landslide; subsidence and sinkhole; and wildfire. Where GIS data are not available for some hazards, a qualitative analysis was conducted using the best-available data and professional judgment.

4.4.4 Future Development and Vulnerability

Risk and vulnerability to natural and human-caused hazard events are not static. Risk will increase or decrease as counties and municipalities see changes in land use and development, as well as changes in population. Population change (in terms of total and demographics) and the age of the housing stock continue to be the main indicators of vulnerability change in Fulton County.

Fulton County experienced a 2.59-percent increase in population from 2000 to 2017, as summarized in Section 2 of this HMP. According to the U.S. Census for Population Projections, the population in Fulton County is projected to increase over the coming decades. The range of projected change in population varies from a 26.67 percent population decrease in Valley-Hi Borough to a 32.36 increase in population in Brush Creek Township (U.S. Census 2018).

Continued analysis of the age structure in Fulton County will provide deeper understanding of future vulnerability to at-risk populations. Approximately 17.1 percent of Fulton County's population is age 65 or older (ACS 2017). As these residents continue to age in the county, they might have increased access and functional needs. For example, many residents in this age bracket might be unable to drive; therefore, development of special evacuation plans for them will be necessary. They might also have hearing or vision impairments that could hinder their reception of emergency instructions. Both older and younger populations are at higher risks for contracting certain diseases. Fulton County's combined under-5-years-of-age and over-65 populations constitute approximately 23.2 percent of its population (ACS 2017).

Approximately 0.8 percent of Fulton County's population lives in group quarters, which are communal settings that can include inmates in a prison, students in a dorm, or elderly or mentally disabled in group-care homes. Many residents living in group quarters have special needs. It is important to ensure that each group-quarter facility has an emergency plan to account for the unique needs of its residents during a hazard event.

Less than 1 percent of Fulton County's population is not proficient in English. Future hazard mitigation strategies should consider addressing language barriers to ensure that all residents can receive emergency instructions.

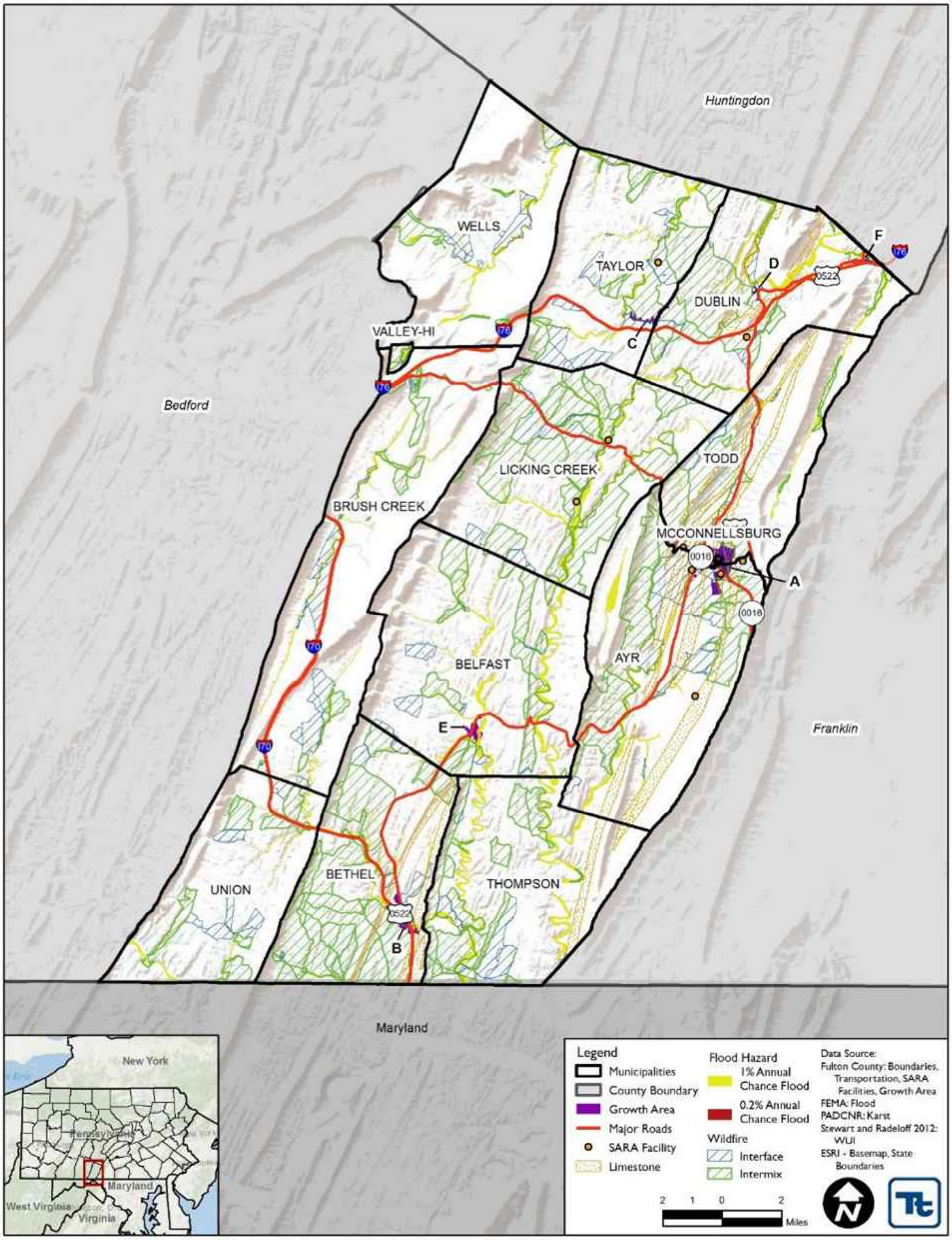
In addition, remote and sparsely-populated municipalities face higher vulnerability to hazards because they do not have as easy access to care facilities or response personnel. For instance, sparsely-populated municipalities such as Wells Township face increased vulnerability to tornadoes, windstorms, and winter storms due to isolation, access issues, and longer emergency response times.

The aging housing stock in Fulton County is another source of current and future vulnerability in many hazard events. According to the Alleghenies Ahead Joint Comprehensive Plan (Alleghenies 2018), 7,112 structures in Fulton County were built earlier than 1939 (19.8 percent of the building stock). As discussed throughout Section 4, Risk Assessment, Fulton County can experience strong gusts of wind during windstorms, tornadoes, hurricanes, tropical storms, or Nor'easters. The structure of these older houses can cause them to be at greater risk of destruction under these strong wind conditions. These structures might also be at risk during flooding and winter storm events if the materials are either not strong enough to withstand the pressure or weight of the precipitation or are liable to leak, causing further risk of destruction to the house.

While any development increases the risk of damage and loss to natural hazards, a number of factors indicate that this increase in risk is low and mitigated by existing federal, state, county, and local regulations, policies, and programs. A total of 11 municipalities in Fulton County have adopted subdivision regulations, and two municipalities have adopted local zoning regulations. The Fulton County Planning and Mapping Department reviews and reports on subdivisions, land developments, comprehensive plans, and municipal land use ordinance amendments. This broad range of planning review services is separated into two areas of activity: subdivision and land development reviews, and community planning reviews. Most types of reviews are presented to the commission for its consideration at a public meeting prior to them being forwarded on to the respective municipalities and/or applicants.

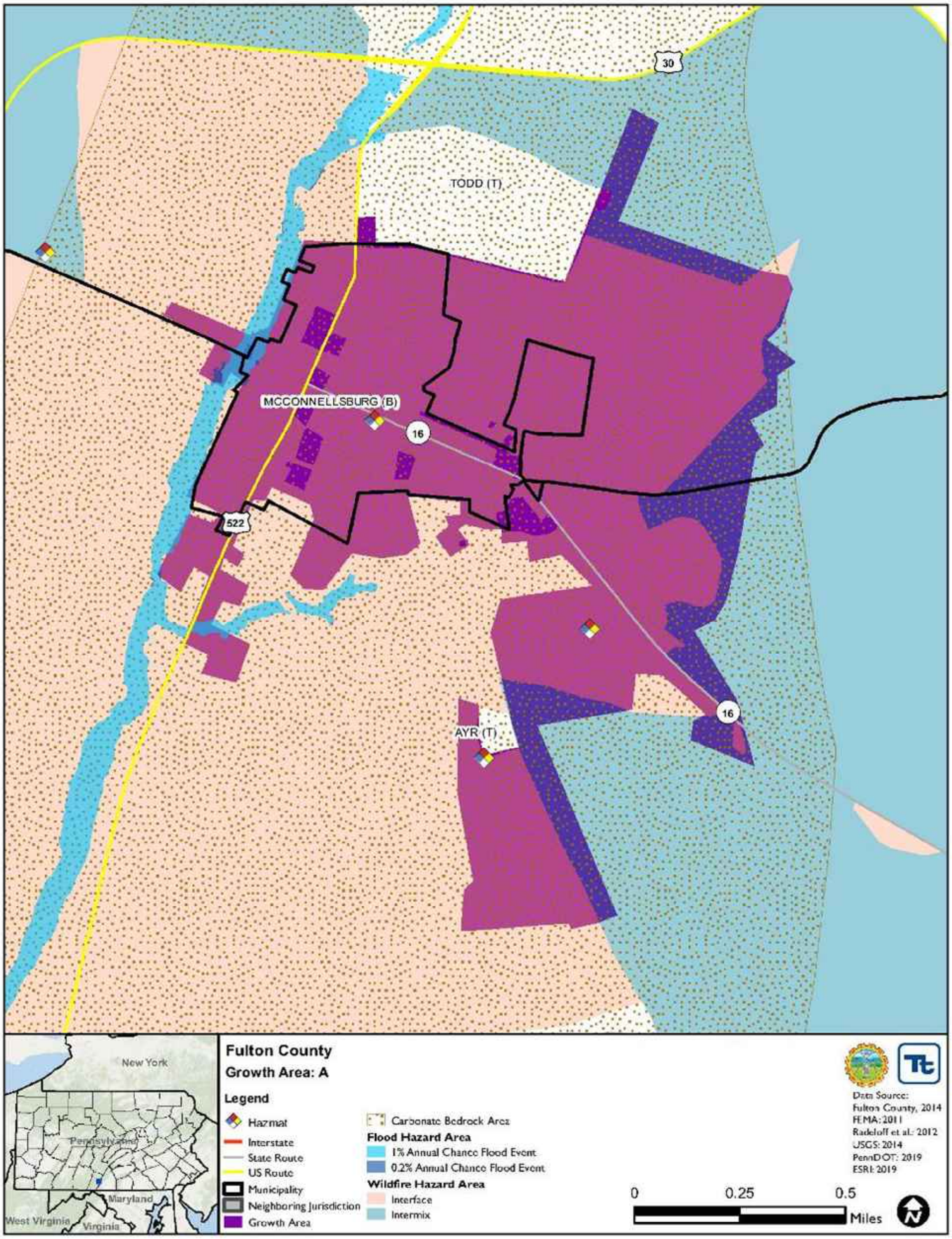
Fulton County and its municipalities identified areas of potential new urban growth. According the Alleghenies Ahead Joint Comprehensive Plan (Alleghenies 2018), Fulton County is in the process of working with landowners to leverage the Interstate 70 corridor and attract new business and development in Warfordsburg. Fulton County has also already initiated leveraging state grants for improvements and revitalization to downtown McConnellsburg. As urban growth is planned, it should be compared with identified hazard areas to determine hazard vulnerability. In Fulton County's 2015 HMP, six geographic hazards and growth areas were identified as A-F and are mapped below. All the growth areas, except Growth Area E, are in the interface and intermix wildfire hazard area. Growth Area A is the only area located within both the 0.25-mile buffer of a major road and 0.10-mile buffer of a SARA Title III Facility. Growth Areas A, B, and F are located above limestone formations in the subsidence and sinkhole hazard area. Figure 4.4-1 through Figure 4.4-7 show the Fulton County growth areas.

Figure 4.4-1. Fulton County Growth Areas and Hazards



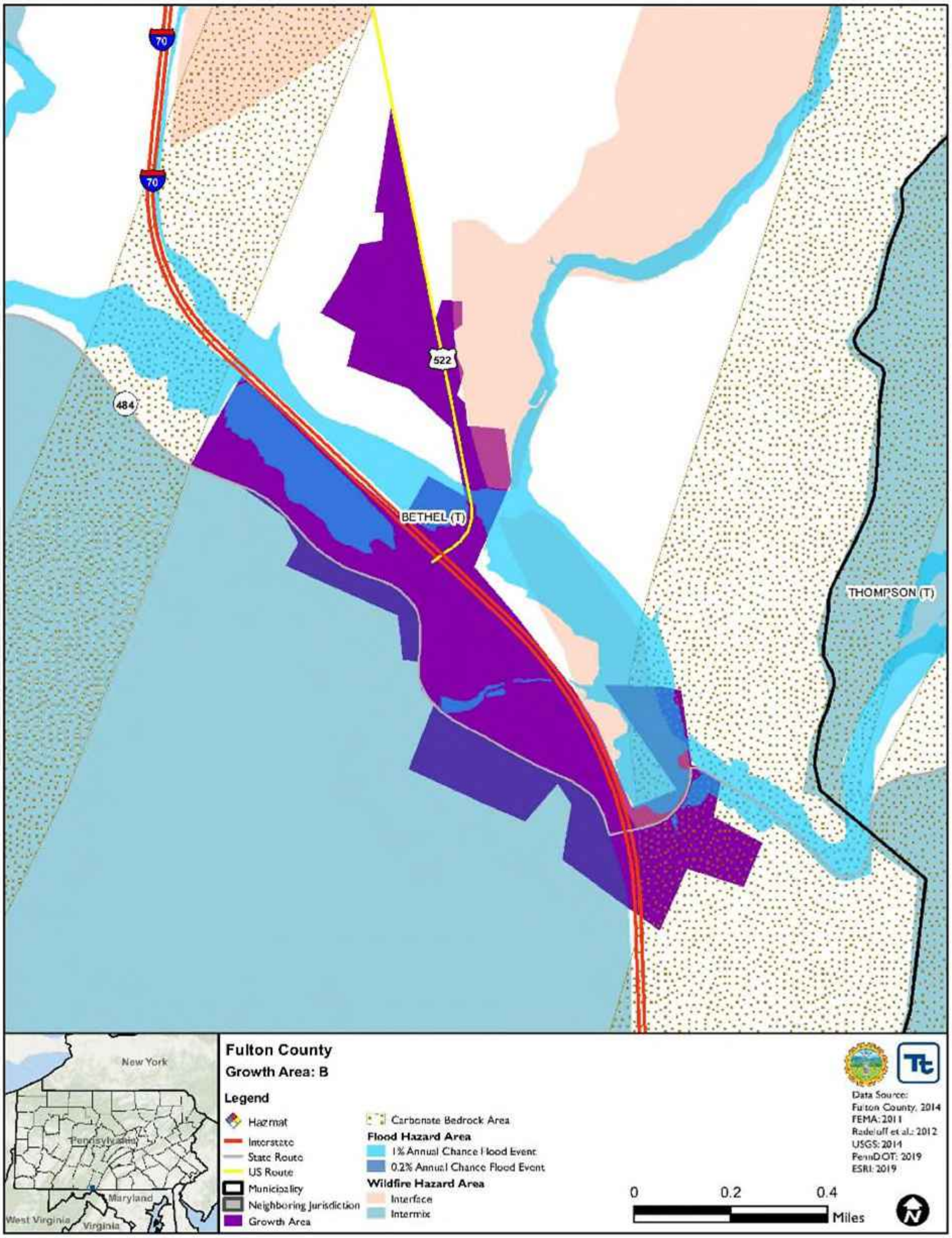
Source: Fulton County Planning Commission 2019

Figure 4.4-2. Fulton County Growth Area A and Hazards



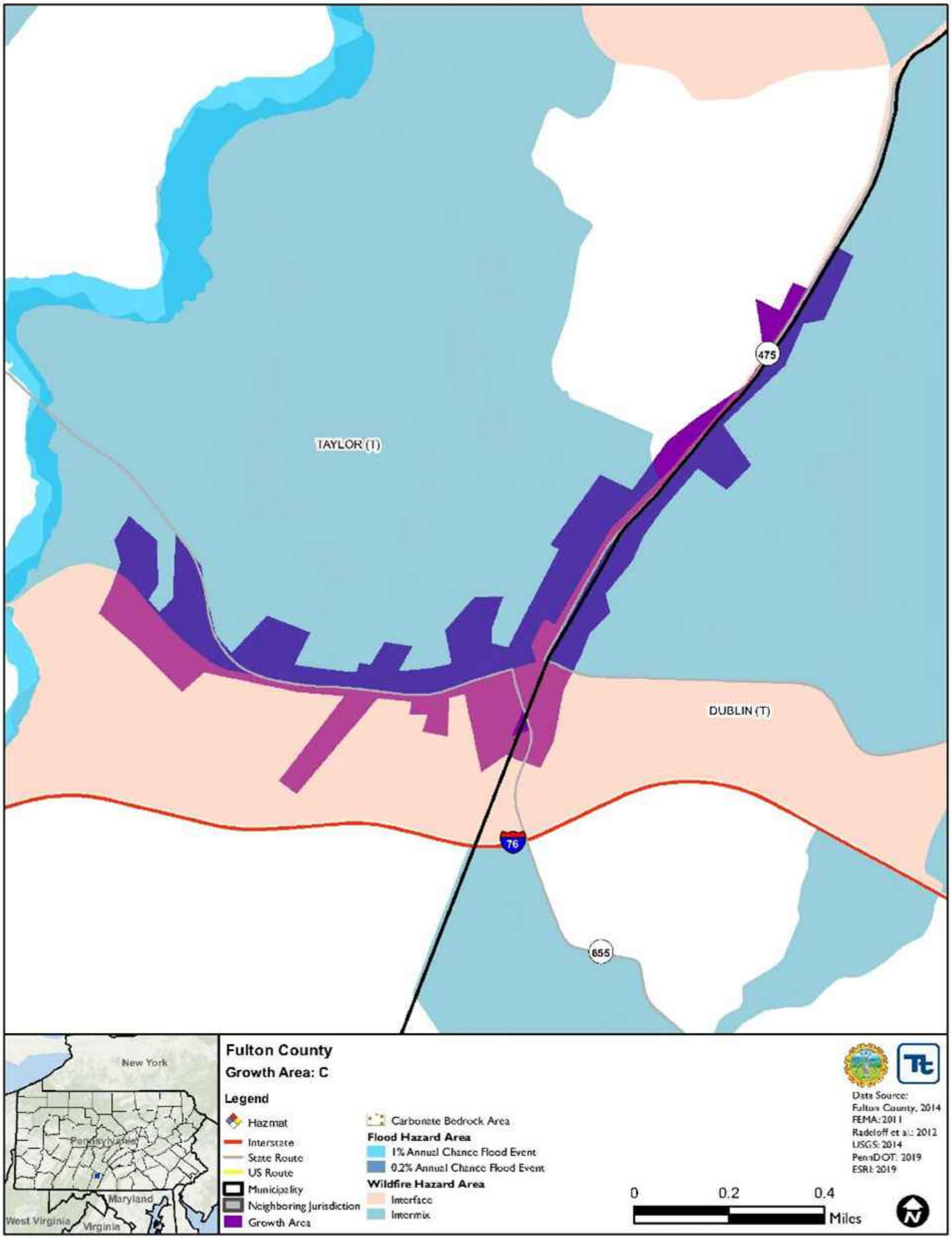
Source: Fulton County Planning Commission 2019

Figure 4.4-3. Fulton County Growth Area B and Hazards



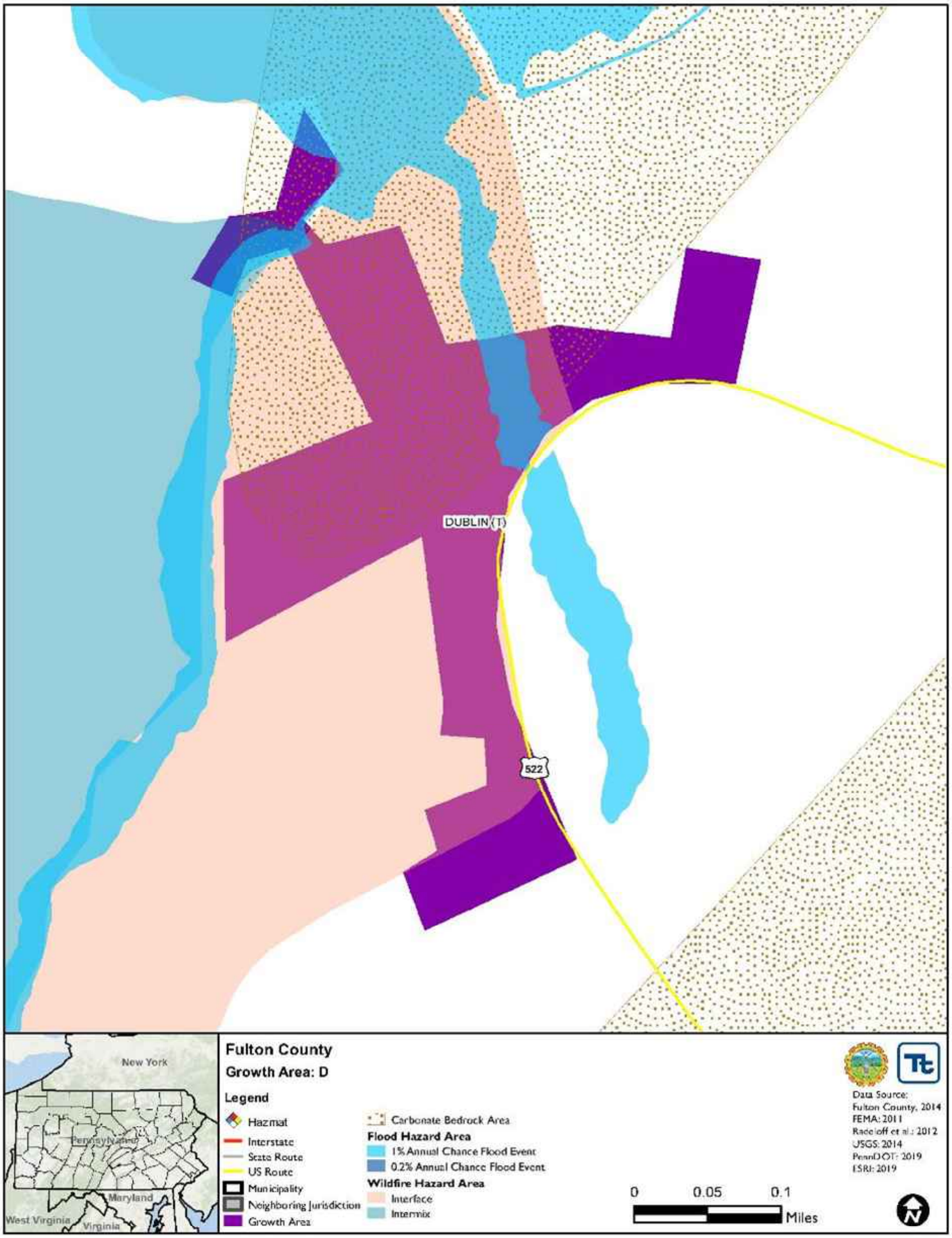
Source: Fulton County Planning Commission 2019

Figure 4.4-4. Fulton County Growth Area C and Hazards



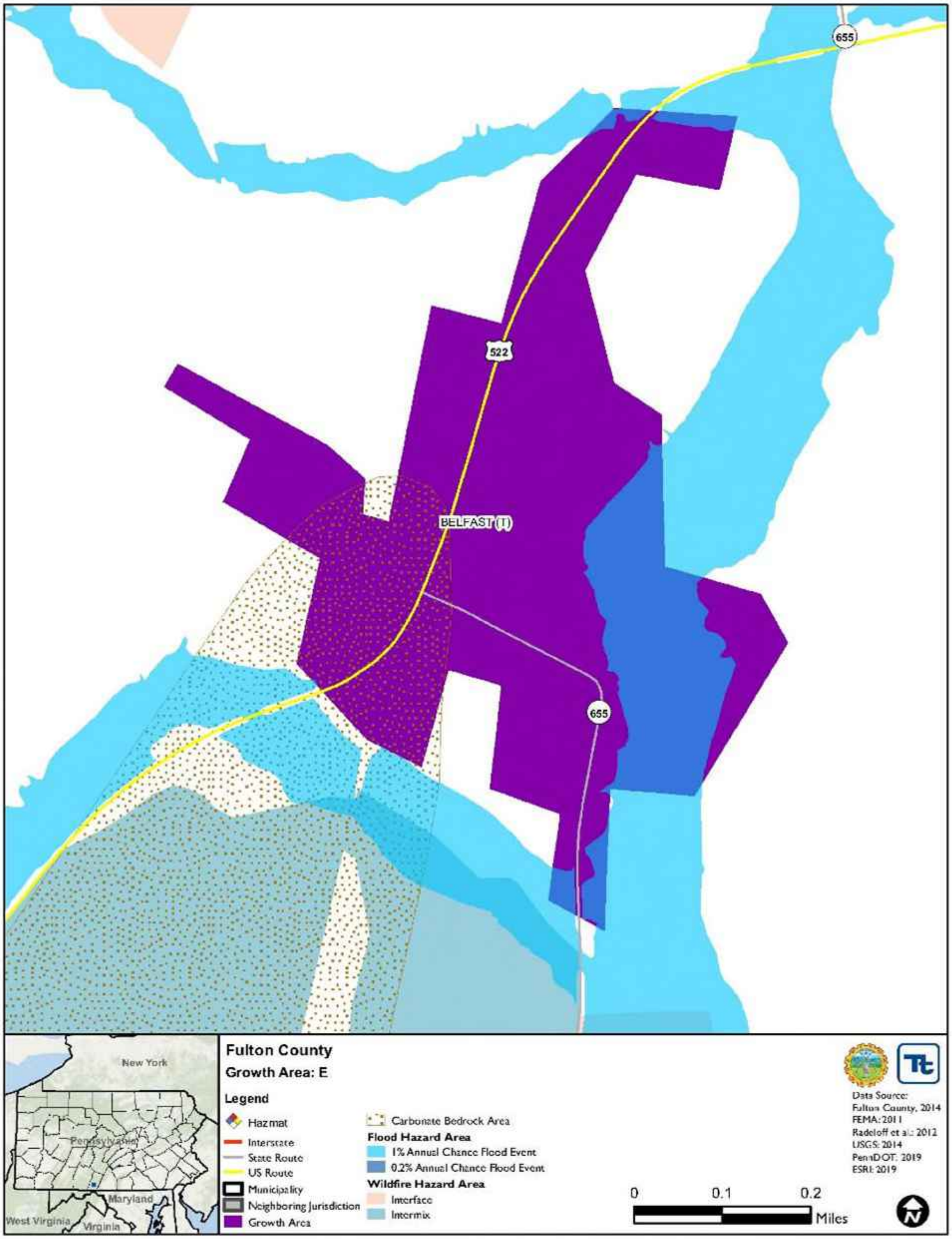
Source: Fulton County Planning Commission 2019

Figure 4.4-5. Fulton County Growth Area D and Hazards



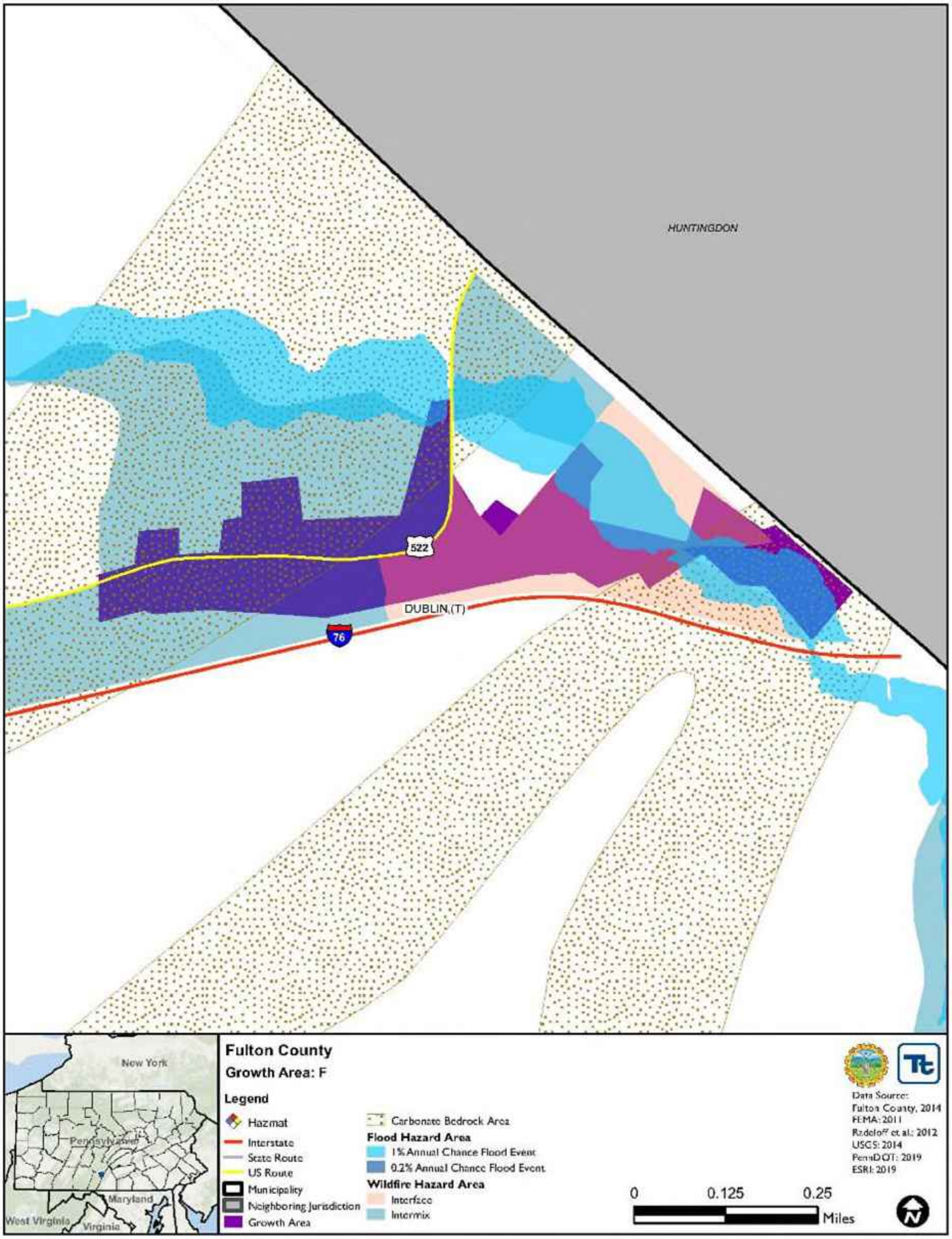
Source: Fulton County Planning Commission 2019

Figure 4.4-6. Fulton County Growth Area E and Hazards



Source: Fulton County Planning Commission 2019

Figure 4.4-7. Fulton County Growth Area F and Hazards



Source: Fulton County Planning Commission 2019

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 is developed and buildings are constructed.
- **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 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 these hazards, 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 (PEMA 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. Technical/technological resources also include specific requirements established by law, regulation, or ordinance.
- **Informational resources** include materials about disasters and hazard mitigation and planning and 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.

The following sections describe and summarize the federal, state, county, and local capabilities to address hazard risks in Fulton County.

5.1 UPDATE PROCESS SUMMARY

During the plan update process, Fulton 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 2013). The survey was provided to each of the municipal planning points of contact at the Steering Committee Kickoff Meeting. Completed Capability Assessment Surveys, whether completed by hand or electronically, are provided in Appendix D.

Fulton 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 Fulton County communities.

This Capability Assessment section describes and summarizes the federal, state, county, and local capabilities to address hazard risks in Fulton County.

5.2 CAPABILITY ASSESSMENT FINDINGS

A jurisdiction's ability to effectively manage natural hazard risks is directly related to its level of hazard mitigation capabilities. As such, mitigation strategies developed in coordination with Fulton County's municipalities have a direct effect on establishing new capability functions in the community or strengthening existing capabilities.

Fulton County and most of its municipalities updated and completed the Capability Assessment Survey (Appendix D). If municipalities did not update or partially update their capabilities information, the same information provided by those municipalities for the 2015 Hazard Mitigation Plan (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 National Flood Insurance Program (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

Fulton 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.

Fulton County participated in a six-county comprehensive plan, "Alleghenies Ahead - Joint Comprehensive Plan" which is slated to guide Fulton County until 2028. The comprehensive plan was adopted in 2018 and the Fulton County Action Plan specifically addresses the following plan elements:

- Broadband and Cellular Service
- Collaboration and Coordination
- Business and Workforce Development
- Agriculture
- Recreational Amenities and Natural Assets

Each plan element includes a profile, trends, inputs, and outputs and action items.

- Action items for broadband and cellular service include establishing a regional broadband and cell service task force, performing an inventory of all infrastructure inventory, implementing a customer survey and identifying anchor customers, hiring a telecommunications project manager at SAPDC, and conducting broadband outreach and aggregation.
- Action items for collaboration and coordination include conducting outreach and education about local and regional best practices in problem solving and service delivery, identifying and approaching potential candidates for merger or consolidation, ascertaining legal and financial guidance for collaboration, and creating a satellite office for SAPDC in Fulton County.
- Action items for business and workforce development include reconstructing/revamping the Fulton County economic development organization responsible for countywide business development, working with land owners to leverage the Interstate 70 corridor and attract new business/development in Warfordsburg, leveraging state grants for improvements to downtown McConnellsburg, and developing "Main Street," and a downtown revitalization initiative.
- Action items for agriculture include ensuring agriculture is represented in the county economic development agency, actively recruiting new processing facilities to locate in Fulton County, developing a public campaign to educate and raise public awareness and appreciation of county farmers, and collaborating with agricultural lenders to provide low interest loans to farmers.
- Action items for recreational amenities and natural assets include conducting a trail feasibility study for a county-wide north-south trail, coordinating and cooperating with other Southern Alleghenies counties and chamber of commerce and tourism agencies to market both private and public recreational and cultural destinations, and coordinating with Bedford County on The Old Pennsylvania Pike.

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 June 2010, Fulton County developed the Act 167 Scope of Study for Fulton County Stormwater Management Plan (Fulton County Planning Commission 2017). This Plan is the result of Phase II of the Act 167 Plan and includes:

- A summary of county watershed characteristics
- An inventory of relevant problems and recommendations
- A proposed scope of study, schedule, and budget for completion of the Phase 2 Plan project

The plan is designed to provide consistency in stormwater management planning, regulation, and implementation; provide an integrated stormwater management plan; provide useable technical information in a geographic information system (GIS) format; and provide technical information for future hydrologic and hydraulic analysis and regulatory activities.

An Act 167 Stormwater Management Plan for the Cove Creek Watershed was previously completed in 1993.

According to Section 11(b) of Act 167, municipalities subject to the Stormwater Management Plan must enact or amend and implement such ordinances as necessary to regulate development in a manner consistent with the Stormwater Management Plan. Municipalities are encouraged to use the model ordinance included in the plan.

Open Space and Natural Resource Planning

Fulton County has prepared several plans with the goal of preserving open space for recreational and environmental purposes. These plans are included as chapters in the Alleghenies Ahead Joint Comprehensive Plan (Fulton County Planning Commission 2018) and the Fulton County Greenways and Open Space Network Plan (2007).

Transportation Planning

Fulton County participates in the Southern Alleghenies Planning and Development Commission (SAPDC). The SAPDC serves as the state-designed Rural Planning Organization (RPO) for six member counties. The RPO is responsible for developing a long-range transportation plan, the transportation improvement program (TIP) and other transportation-related documents and reports.

Informational Resources

Fulton County has a variety of informational resources available, including websites, brochures, pamphlets, workshops, and public service announcements (PSAs).

- The Planning & Mapping Department has an informational website located at https://www.co.fulton.pa.us/planning-commission.php
- The County's website is located at https://www.co.fulton.pa.us/
- Information on hazard mitigation and preparedness was referenced at the websites for Federal Emergency Management Agency (FEMA) (www.fema.gov) and PEMA (https://www.pema.pa.gov/).
- Fulton County Emergency Management Agency website is located at https://www.co.fulton.pa.us/ema.php

Fulton County Emergency Management

The Fulton County Emergency Management Agency (EMA) maintains a strong emergency management capability that supports Fulton 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, 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 services (EMS) 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), and text messages. Each county in Pennsylvania operates a 9-1-1 Public Safety Answering Point (PSAP). Personnel at these PSAPs would need to coordinate their efforts during a regional hazard event. Computerized mapping of streets with address information is critical for emergency response purposes. The 9-1-1 center is also used to alert citizens during an emergency.

Emergency Operations Center

In the event of an impending emergency or disaster, Fulton County would activate its EOC. When activated, the EOC is in constant communication with the 9-1-1 center to ensure coordination of activities. The EOC is located within the EMA in McConnellsburg Borough.

The EMA capabilities fall under two categories: emergency service measures and emergency response planning. These capabilities are described below.

Emergency Operations Plan

The Pennsylvania Emergency Management Services Code, Title 35, requires all political jurisdictions in the Commonwealth to have an Emergency Operations Plan (EOP), an Emergency Management Coordinator (EMC), and an EOC.

The Fulton County EOP documents the County's emergency preparedness planning. The EOP includes County-specific emergency response procedures during significant emergency events. Fulton County's EOP complies with the National Incident Management System (NIMS) and is updated every 2 years. The updated risk assessment information from this HMP will be incorporated into subsequent updates to the EOP.

Mutual Aid Agreements

Fulton 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. Fulton County is also part of a larger county consortium, the South-Central Mountains 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 SCMRTF also provides all-hazards preparedness, mitigation, prevention, response, and recovery services to citizens in its purview. This intergovernmental agreement is between the following counties:

- Bedford
- Blair
- Centre
- Fulton
- Huntingdon
- Juniata
- Mifflin
- Snyder

Regional Planning Initiatives

Fulton 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
- 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 aid and assistance.
- Each local organization of emergency management shall have a coordinator 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

Fulton County has formal mutual aid agreements in place with its municipalities.

Emergency Operations Centers

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 or the Commonwealth (e.g., law enforcement coverage by the Pennsylvania State Police [PSP]) to respond.

Monitoring Systems

The municipalities may also be equipped with several systems to monitor emergency information and warnings, including the Radio Amateur Civil Emergency Service (RACES) and the National Weather Service (NWS).

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 is provided 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 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 damage.

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 buildings and their contents damaged by floods (FEMA 2002).

NFIP-participating communities in Fulton County are required to adopt a flood damage prevention ordinance (also sometimes called a "floodplain" or "floodplain management ordinance") and update this ordinance whenever the regulatory NFIP Flood Insurance Rate Maps (FIRM) are officially updated. The Pennsylvania Department of Community and Economic Development (PA DCED) (Commonwealth-coordinating agency for the NFIP) and PEMA provide support to municipalities by providing suggested text for floodplain management ordinances.

All of the County's municipalities except for Valley-Hi Borough participate in the NFIP. The FIRMs for Fulton County's municipalities were made effective in February 2011. All participating municipalities have adopted a floodplain ordinance, and all municipalities have adopted a stormwater management ordinance besides Valley-Hi Borough.

The floodplain administrators of individual municipalities are often either the code enforcement officer or zoning officer for the municipality, and they enforce the floodplain ordinances locally. Throughout Fulton County, all municipalities enforce the Uniform Construction Code, and only McConnellsburg Borough and Thompson Township enforce zoning regulations. Rather than using a specific Floodplain Development Permit, the County's municipalities include a space for applicants to state whether the proposed development is located in the floodplain on zoning and/or building permit applications. The permit application reviewer confirms whether the property in question is in the floodplain. If it is, the municipal floodplain administrator reviews the proposed development against the municipality's floodplain management ordinance. The floodplain administrator conducts similar reviews of any revisions to the permit application until all requirements are met. As the proposed activity is conducted, the floodplain administrator works with the code enforcement officer and/or zoning officer to conduct inspections and ensure that the proposed activity is carried out as it was permitted.

NFIP-participating communities in Fulton 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. Floodplain administrators provide information about mapping to their residents using established outreach methods such as municipal websites, newsletters, and mailings. At the time of this plan update, the Fulton County FEMA Digitized Flood Insurance Rate Maps (DFIRM) (dated February 2011) were used to evaluate exposure and determine potential future losses.

Floodplain administrators also use established outreach methods to provide information about flood insurance to residents and business owners. They can provide information on the availability of flood insurance, how to get a flood insurance policy, and how to determine the appropriate level of coverage.

Municipal participation in and compliance with the NFIP is supported at the federal level by FEMA Region III and the Insurance Services Office, Inc. (ISO) and at the commonwealth level by the PA DEP, PA DCED, and PEMA. The County's Planning Commission supports flood mitigation efforts, associated training, and public education and awareness programs.

Flood hazard risk management in Fulton County is further supported by the Act 167 County-Wide Stormwater Management Plan (see above). Ideally, this plan will continue to reduce the effects of flooding in certain areas of the County.

Additional information on the NFIP program and its implementation within the County can 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 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 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 reductions in insurance premiums. Class 1 requires the most credit points and gives the largest premium reduction; Class 10 communities receive 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, no Fulton County municipalities participate in the CRS Program. 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 Capability Assessment 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 Fulton 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	Other
Fulton County	X	X	-	-	X	N/A	N/A	N/A	-	-	-	X	X	X	-	-	-	-	-	-	-	-
Ayr Township	X	X	-	-	-	X	-	X	-	-	X	-	-	X	-	-	-	-	-	X	-	X*
Belfast Township	X	X	-	-	-	X	-	X	-	-	X	X	X	X	-	-	-	-	-	X	-	-
Bethel Township	X	X	-	-	-	X	-	X	-	-	X	X	X	X	-	-	-	-	-	-	-	-
Brush Creek Township	X	X	-	-	-	X	-	X	-	-	X	X	-	X	-	-	-	-	X	X	-	-
Dublin Township	X	-	-	-	-	X	-	X	-	-	X	-	-	X	-	-	-	-	-	X	-	-
Licking Creek Township	X	X	-	-	X	X	-	X	-	-	X	X	X	X	-	-	-	-	-	X	-	X*
McConnellsburg Borough	X	X	-	-	-	X	-	X	X	X	X	X	X	X	-	-	-	-	-	X	-	-
Taylor Township	X	X	-	-	-	X	-	X	-	-	X	-	-	X	-	-	-	-	-	-	-	-
Thompson Township	X	-	-	-	-	X	-	X	-	X	-	X	X	X	X	X	X	X	X	X	X	X
Todd Township	X	X	-	-	-	X	-	X	-	-	X	X	-	X	-	-	-	-	-	X	-	-
Union Township	X	X	-	-	-	X	-	X	-	-	X	X	X	X	-	-	-	-	X	X	-	-
Valley-Hi Borough	-					-	-	-														
Wells Township	X	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 "Other" capability is Agricultural Security Areas.
COOP: Continuity of Operations

"N/A" indicates 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 to effectively execute mitigation activities. Common examples of skillsets 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 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 Fulton County.

Federal and Commonwealth Capabilities

Federal agencies that can provide technical assistance for mitigation activities include but are not limited to:

- U.S. Army Corps 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 to:

- Pennsylvania Department of Community and Economic Development
- Pennsylvania Department of Conservation and Natural Resources
- Pennsylvania Department of Environmental Protection
- Pennsylvania Emergency Management Agency
- 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 Managers	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
Fulton County	X	-	-	X	N/A	-	X	X	-	-	-
Ayr Township	-	-	X	-	X	-	-	-	-	-	-
Belfast Township	-	-	X	-	X	-	-	-	-	-	-
Bethel Township	-	-	X	X	X	X	-	-	-	-	-
Brush Creek Township	-	-	X	X	X	X	-	-	-	-	-
Dublin Township	-	-	-		X	-	-	-	-	-	-
Licking Creek Township	-	-	X	X	X	-	-	-	-	-	-
McConnellsburg Borough	-	X	X	X	X	-	-	-	-	-	-
Taylor Township	-	-	X	X	X	-	-	-	-	-	-
Thompson Township	X	X	X	X	X	X	X	X	X	X	-
Todd Township	-	-	-	-	X	-	-	-	-	-	-
Union Township	X	X	X	X	X	-	-	-	X	-	-
Valley-Hi Borough	-	-	-	-	-	-	-	-	-	-	-
Wells Township	-	-	-	X	X	-	-	-	-	-	-

Notes:
"X" indicates that the municipality currently has this capability in place.
"-" indicates no capability is currently in place.
"N/A" indicates not applicable
Blank space indicates no response was received from the municipality.

5.2.3 Financial 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 levels 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

The Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (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 Native American 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 for ranking and submission 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 located 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 Program

The Flood Mitigation Assistance 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. 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 Program

The Pre-Disaster Mitigation (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. If the President of the United States declares an event a major disaster, general types of assistance may be provided, including the following:

- Individual Assistance – Provides help for homeowners, renters, businesses, and some nonprofit 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 and $40,000 to cover losses to personal property. For businesses, loans may be made to repair or replace disaster damage to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Nonprofit 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 nonprofit 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.

U.S. Department of Housing and Urban Development Community Development Block Grants

The U.S. Department of Housing and Urban Development (HUD) Community Development Block Grants (CDBG) are federal funds intended to provide low- and moderate-income citizens with decent housing, a suitable living environment, and expanded economic opportunities. Eligible entities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, housing 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.

Additional Federal Resources

Weatherization Assistance Program: Minimizes the adverse effects of high-energy costs on low-income, elderly, and disabled 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 an emergency to be declared by the President 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 floodplain easements. The program is designed to implement recovery measures.

Commonwealth Hazard Mitigation Funding Opportunities

Commonwealth programs that may provide financial support for mitigation activities include but are not limited to:

- Community Conservation Partnerships Program
- Community Revitalization Program
- Flood Mitigation 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 non-point 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 Fulton 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 try 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.

Special Purpose Taxes

Communities may exercise their taxing authority to raise funds for any project they see fit. This includes special taxes to fund mitigation measures. Spreading the cost of a community project among the community's taxpayers helps provide the greatest public good for relatively low individual cost.

Gas/Electric Utility Fees

In the same way that special taxes can be levied to fund mitigation projects, a community can also finance a project by dedicating a portion of homeowner gas and electric utility fees to upgrade and maintain the related infrastructure. Burying transmission lines to protect them from the effects of winds and ice storms is expensive. These fees help to offset that cost.

Water/Sewer Fees

Water Authorities and Fees

Water authorities are multipurpose authorities with water projects, many of which operate both water and sewer systems. The financing of water systems for lease back to the municipality is among the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities or to construct, extend, or improve a system. The primary source of revenue is user fees based on metered usage.

The cost of constructing or extending water supply lines can be funded by special assessments against abutting property owners. Tapping fees also help fund water system capital costs. Water utilities are directly operated by municipal governments and by privately owned public utilities regulated by the Pennsylvania Public Utility Commission. The PA DEP has a program to assist with consolidation of small individual water systems to make system upgrades more cost effective.

Sewer Authorities and Fees

Sewer authorities include multipurpose authorities with sewer projects. The authorities issue bonds to finance acquisition of existing systems or to finance construction, extension, and improvements. Sewer authority operating revenues originate from user fees. The fee frequently is based on the amount of water consumed, and payment is enforced by the ability to terminate service or the imposition of liens against real estate. In areas with no public water supply, flat rate charges are calculated on average use per dwelling unit.

Stormwater Utility Fees

Stormwater utility fees are assessed and collected to offset the cost of maintaining and upgrading stormwater management structures such as drains, retention ponds, and culverts.

Development Impact Fees

Development impact fees are one-time fees assessed to offset the cost of providing public services to a new development. They may be dedicated to providing new water or sewer infrastructure, roads, parks and recreational areas, libraries, schools, etc. The new infrastructure may be less vulnerable to hazard impacts.

General Obligation, Revenue, and/or Special Tax Bonds

Jurisdictions may simply decide to dedicate general fund or similar financing to implement hazard mitigation projects.

Partnering Arrangements or Intergovernmental Agreements

Intergovernmental cooperation is one manner of accomplishing common goals, solving mutual problems, and reducing expenditures. Fulton County contains 13 municipalities. Each of these municipalities conducts its daily operations and provides various community services according to local needs and limitations. Each municipality varies in staff size, resource availability, fiscal status, service provision, constituent population, overall size, and vulnerability to the identified hazards.

Table 5-3. 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
Fulton County	-	-	-	-	-	-	-	-	-	-
Ayr Township	-	-	-	-	-	-	-	-	-	-
Belfast Township	-	-	-	-	X	-	-	-	-	X*
Bethel Township	-	X	-	-	X	-	-	-	-	-
Brush Creek Township	-	-	-	-	-	-	-	-	-	-
Dublin Township	-	-	-	-	-	-	-	-	-	-
Licking Creek Township	-	X	-	-	-	-	-	-	-	-
McConnellsburg Borough	-	X	-	-	-	-	-	-	-	-
Taylor Township	-	-	-	-	-	-	-	-	-	-
Thompson Township	X	X	X	X	X	X	X	X	X	X
Todd Township	-	X	-	-	X	-	-	-	-	-
Union Township	-	-	-	-	-	-	-	-	-	-
Valley-Hi Borough										
Wells Township	-	-	-	-	-	-	-	-	-	-

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.
"*" indicates fees generated from Agricultural Security Areas.

5.2.4 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 Fulton County, are available at the municipal offices. County and municipality maps, tax maps, and property assessment records are available at the Assessment Office and online at http://www.courthouseonline.com and using the online GIS Web Tool located on the County website. Deeds are available at the Prothonotary's Office and online at http://www.infoconcountyaccess.com.

Library Education Tools

Libraries have educational materials, available upon request, which are used at public speaking events or County meetings, when appropriate. Educational materials include 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, families, individuals, neighborhoods, and schools
- Pandemic brochures

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.

- *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.

- Emergency management courses are provided through the County EMA to local coordinators and elected officials; these courses include Basic Orientation, Duties and Responsibilities of the Local Emergency Management Coordinator (LEMC), and Damage Assessment.

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 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.

Municipalities participating in this planning effort were provided with a Capability Assessment Survey. Table 5-4 summarizes the responses of the municipalities based on education and outreach capabilities. Copies of the individual municipal responses are found in Appendix D.

Table 5-4. Education and Outreach Capability

Municipality	Firewise Communities Certification	StormReady Certification	Natural Disaster or Safety-Related School Programs	Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Public-private partnership initiatives addressing disaster-related issues	Local citizen groups or nonprofit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Other
Fulton County	-	X	X	-	-	-	-
Ayr Township	-	X	-	-	-	-	-
Belfast Township	-	X	-	-	-	-	-
Bethel Township	-	X	-	-	-	-	-
Brush Creek Township	-	X	-	-	-	-	-
Dublin Township	-	X	-	-	-	-	-
Licking Creek Township	-	X	-	-	-	-	-
McConnellsburg Borough	X	X	-	-	-	-	-
Taylor Township	-	X	-	-	-	-	-
Thompson Township	X	X	X	X	X	X	-
Todd Township	-	X	-	-	-	-	-
Union Township	-	X	-	-	-	Union Township Transportation and Economic Development Committee	-
Valley-Hi Borough		X					
Wells 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 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, Financial Capability, and Education and Outreach 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	Financial Capability	Education and Outreach Capability
Fulton County	M	M	L	M
Ayr Township	M	M	M	M
Belfast Township	L	L	L	L
Bethel Township				
Brush Creek Township	M	H	M	M
Dublin Township	M	M	M	L
Licking Creek Township	M	M	L	L
McConnellsburg Borough	M	M	L	L
Taylor Township			L	
Thompson Township	M	H	M	M
Todd Township	M	M	M	L
Union Township	M	M	L	L
Valley-Hi Borough				
Wells Township	M	M	L	M

Note:
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.

5.2.6 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 Fulton County, many existing plans and programs support hazard risk management; thus, it is critical that this HMP integrate and coordinate with, and complement, those mechanisms.

The intention of the Steering Committee and participating jurisdictions is to incorporate mitigation planning as an integral component of daily government operations. Steering Committee 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 Steering Committee 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 County and municipal comprehensive plans, and the County and municipal EOPs 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.

As noted in Section 6 of this plan, Fulton County has made a concerted effort to reduce its vulnerability to natural and non-natural hazards in its planning and in its daily operations since the Fulton County HMP was last updated in 2015. 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 HMP 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 blueprints) 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, the Alleghenies Ahead Joint Comprehensive Plan, the 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 and will use 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:

- Fulton County Children and Youth Services
- Emergency Management Agency
- Planning and Mapping
- Sheriff's Office

Additional administrative measures may include the creation of paid or unpaid internships to assist in HMP maintenance.

The Fulton 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 is performed, and changes are made where necessary. The risk assessment information presented in the 2015 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 Steering Committee.

The Fulton County Board of Commissioners and each municipality's planning commission is responsible for maintaining and updating Fulton County's Joint Comprehensive Plan, which covers all 13 municipalities.

The administrative practices described above will continue through the development of subsequent Fulton County updates to the regional comprehensive plan using the information in this updated HMP. In return, the Fulton County sections of the regional comprehensive plan, located on the Fulton 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 Fulton 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 – Enforce higher standards or restrictions in hazard areas. Restrict allowable development in hazard areas.
- Building Codes – Enforce codes or higher standards 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.
- NFIP – Continue to participate in this program and explore participation in CRS Program.
- Stormwater Management – Continue to implement stormwater management plans and ordinances. Stormwater management plans/ordinances are developed for nine municipalities with another currently under development.
- HMP Plan Coordination – Review all above-mentioned plans to ensure they are consistent with the HMP before making any formal changes (amendments) to master plans, zoning, ordinances, capital improvement plans, or other mechanisms that control development.

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
- 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
  - Growing Greener
- Regional
  - Appalachian Regional Commission
  - Southern Alleghenies Planning and Development Commission
- 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

To provide broader support and understanding of hazard mitigation, opportunities for partnerships will be encouraged, as listed below.

Existing Committees and Councils

- Local Government Committees:
  - Fulton County Agricultural Land Preservation Board (https://conservationtools.org/)
  - Fulton County Conservation District (https://www.fultoncountyconservationdistrict.org/)
  - Fulton Industrial Development Association (http://www.fultonida.com/)
  - Fulton County Housing Authority (https://www.lowincomehousing.us/cty/pa-fulton)
  - Fulton County Local Emergency Planning Committee (https://www.co.fulton.pa.us/lepc.php)

Creative Partnerships for Funding and Incentives

- Public-private partnerships, including utilities and businesses
- State cooperation
- In-kind resources

Working with other Federal and Commonwealth Agencies

- U.S. Army Corps of Engineers (USACE)
- U.S. Department of Agriculture (USDA)
- U.S. Department of Transportation (USDOT)
- U.S. Geological Service (USGS)

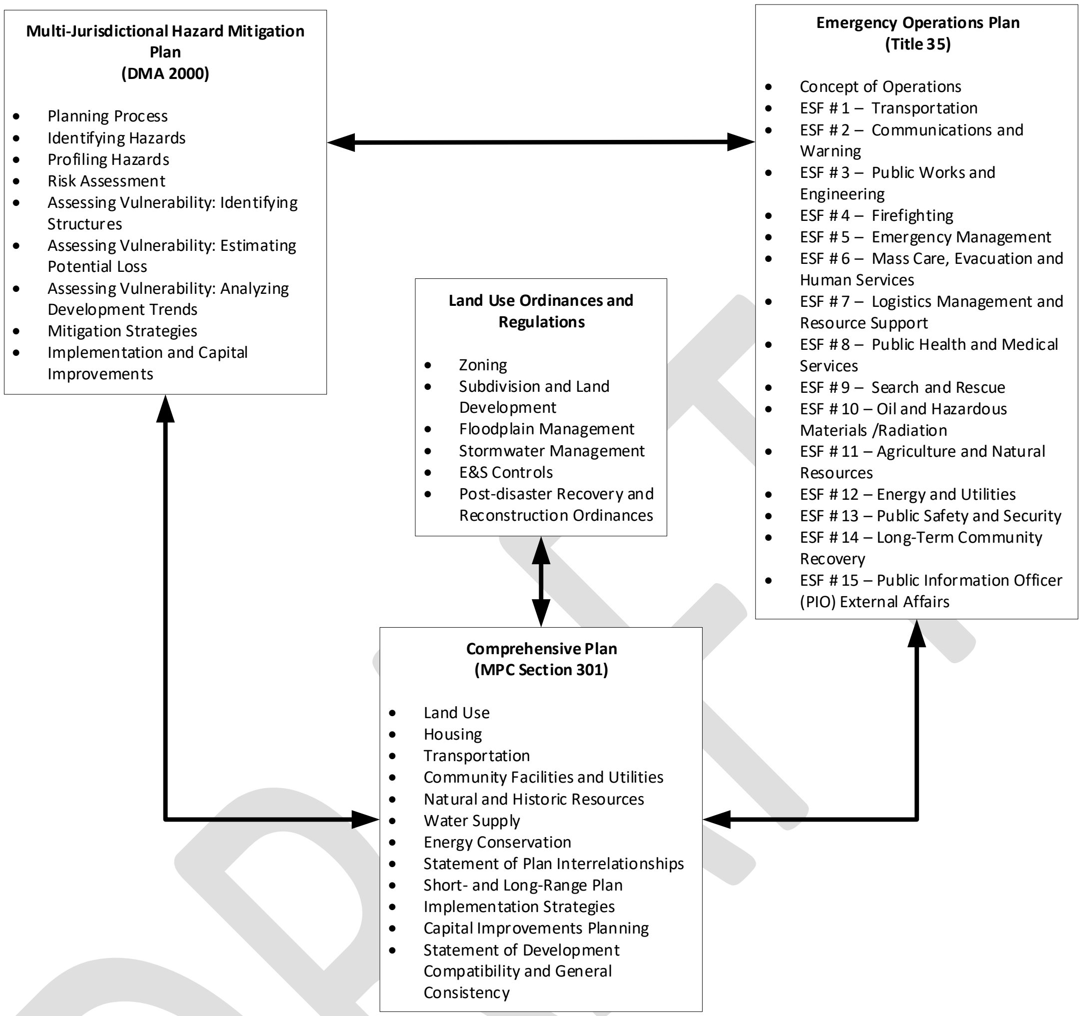
- U.S. Department of Homeland Security (DHS)
- Federal Emergency Management Agency (FEMA)
- National Oceanic and Atmosphere Administration (NOAA)
- National Weather Service (NWS)
- Pennsylvania Department of Transportation (PennDOT)
- Pennsylvania Department of Environmental Protection (PA DEP)
- PEMA
- Pennsylvania State Police (PSP)

American Red Cross

Watershed Associations

- Chesapeake Bay Foundation (https://www.cbf.org/)
- Susquehanna River Basin Commission (https://www.srbc.net/)
- Potomac Conservancy (https://potomac.org/)

Figure 5-1. Plan Interrelationships



Note:
E&S Erosion and Sedimentation
MPC Municipal Planning Code

During the plan evaluation process, the Steering Committee 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.

SECTION 6 MITIGATION STRATEGY

This section describes the process by which the Fulton County Steering Committee 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 Fulton County's population, economy, and general building stock.

This section provides a summary of the 2020 HMP update process, outlines the mitigation goals and objectives set forth in the 2020 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 2015 Fulton County HMP were examined in each of the annual review meetings conducted by Fulton County. For the 2020 update, the Steering Committee first examined the 2015 goals and objectives through the dispersal of the Mitigation Strategy 5-Year Plan Review Worksheet (Mitigation Review Worksheet). During the 5-year review, Steering Committee members were afforded the opportunity to comment on the goals, objectives, and actions that were listed in the existing HMP.

The general mitigation planning approach used to develop this plan is based on (1) the Federal Emergency Management Agency (FEMA) publication, "Local Mitigation Planning Handbook" (FEMA 2013), and (2) the Pennsylvania Emergency Management Agency's (PEMA) All-Hazard Mitigation Planning Standard Operating Guide (SOG) (PEMA 2013). The process steps are summarized below:

1. **Review of Existing Mitigation Plan Goals, Objectives, and Mitigation Action Plan:** Existing mitigation goals and objectives and the 2015 HMP mitigation actions were first examined at the Steering Committee Kickoff Meeting in May 2019 and revisited during the Mitigation Strategy Workshop in January 2020. These meetings were open to members of the Steering Committee and stakeholders. The Steering Committee thoroughly reviewed and updated the mitigation goals and objectives, utilizing the latest information gathered through the hazard profiles, vulnerability assessments, and the risk assessment. The mitigation goals and objectives were also compared to the Pennsylvania HMP goals and objectives. The updated goals and objectives were then presented at the Mitigation Strategy Workshop for final review and approval. Plan participants continued to review and provide progress on the 2015 mitigation actions throughout the planning process.
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 Steering Committee and planning partners.
3. **Mitigation Strategy Prioritization and Implementation:** The potential mitigation actions were qualitatively evaluated and are 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 municipal-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, and in detail specifically in Section 3, Planning Process.

This section summarizes past mitigation goals and past mitigation action status and provides an update of mitigation strategies and additional past mitigation accomplishments.

6.1.1 Review of the Past Mitigation Goals

The mitigation goals and objectives identified in the 2015 version of the HMP are listed below:

- **Goal 1:** Prevent hazards from impacting the community.
  - **Objective 1A:** Work with the municipalities to create and/or update land use regulations (e.g., zoning, subdivision, and land development).
  - **Objective 1B:** Address areas of roadways that are vulnerable to hazard impacts.
- **Goal 2:** Protect the people, property, and environment in hazard areas.
  - **Objective 2A:** Examine property protection measures and their applicability to the community.
  - **Objective 2B:** Identify hazard areas in which property protection measures would be most effective.
- **Goal 3:** Maintain and enhance emergency services capabilities in the community.
  - **Objective 3A:** Ensure adequate communications capabilities among emergency response organizations.
  - **Objective 3B**: Continue to train municipal Emergency Management Coordinators, relevant personnel, and interested members of the community on hazard protection, preparedness, and response.
  - **Objective 3C:** Ensure adequate water supply to fight urban and wildland fires.
- **Goal 4:** Protect natural resources within the hazard areas.
  - **Objective 4A:** Continue working with the Conservation District to ensure that the county's natural resources are protected.
  - **Objective 4B**: Maintain environmental education programs that the conservation and extension offices conduct, and perhaps create new ones.
- **Goal 5:** Ensure that stakeholder groups have necessary information to mitigate against hazard impacts.
  - **Objective 5A:** Continue StormReady program participation.
  - **Objective 5B:** Update and maintain the county website with current information from all departments.

Table 6-1 shows the results of the Steering Committee review of the 2015 goals and objectives for the 2020 HMP update.

Table 6-1. Steering Committee Evaluation of 2015 Goals and Objectives

2015 Fulton County Hazard Mitigation Plan Goals and Objectives		Evaluation
Goal 1	**Prevent hazards from impacting the community.**	Updated to new Goal 2
Objective 1A	Work with the municipalities to create and/or update land use regulations (e.g., zoning, subdivision, and land development).	Updated to new Objective 2A
Objective 1B	Address areas of roadways that are vulnerable to hazard impacts.	Updated to new Objective 2B
Goal 2	**Protect the people, property, and environment in hazard areas.**	Updated to new Goal 1
Objective 2A	Examine property protection measures and their applicability to the community.	Updated to new Objective 1A
Objective 2B	Identify hazard areas in which property protection measures would be most effective.	Updated to new Objective 1B
Goal 3	**Maintain and enhance emergency services capabilities in the community.**	Incorporated into new Goal 3
Objective 3A	Ensure adequate communications capabilities among emergency response organizations.	Kept Objective

2015 Fulton County Hazard Mitigation Plan Goals and Objectives		Evaluation
Objective 3B	Continue to train municipal Emergency Management Coordinators, relevant personnel, and interested members of the community on hazard protection, preparedness, and response.	Kept Objective
Objective 3C	Ensure adequate water supply to fight urban and wildland fires.	Kept Objective
Goal 4	**Protect natural resources within the hazard areas.**	Deleted
Objective 4A	Continue working with the Conservation District to ensure that the county's natural resources are protected.	Deleted
Objective 4B	Maintain environmental education programs that the conservation and extension offices conduct, and perhaps create new ones.	Deleted
Goal 5	**Ensure that stakeholder groups have necessary information to mitigate against hazard impacts.**	Updated to new Goal 4
Objective 5A	Continue StormReady program participation.	Deleted
Objective 5B	Update and maintain the county website with current information from all departments.	Deleted

6.1.2 Past Mitigation Action Status and Update of Mitigation Strategies

In the 2015 HMP, Fulton County identified 52 actions and initiatives to support an improved understanding of hazard risk and vulnerability, to enhance mitigation capabilities, and/or to reduce vulnerability of infrastructure. Progress on the 2015 mitigation actions was evaluated during the annual review meetings and throughout the 2020 update process.

Fulton County provided the Steering Committee with a Mitigation Action Plan Review Worksheet identifying all of the county and municipal actions and initiatives from the 2015 HMP. 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.

The results of the completed Mitigation Action Plan Review Worksheet are provided in Table 6-2. 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" or "In Progress/Not Yet Complete" have been carried forward in the updated mitigation strategies identified in Table 6-4 (unless otherwise determined by the county to be a discontinued project). Actions from the 2015 HMP that reflect continuously maintaining capabilities have also been removed. 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 6-2. Past Mitigation Action Status

Description	Status	Review Comments
FC-1. County - Develop and conduct refresher courses and trainings for citizens involved with former County Community Emergency Response Team (CERT) and Citizen Corps. Sample supplemental activities could include website, e-blast, and flyers to advertise opportunities.	Continuous/Discontinued	• This training is constantly updated and considered a capability.
FC-2. County - Begin the process to review and revise existing subdivision and land development regulations to minimize flood risk, subsidence/sinkhole risk, and other hazard risks as appropriate. This effort may be multi-municipal/regional, as interest and priorities allow. County can consider public outreach activities (newsletters, e-blasts, and public presentations) to demonstrate inclusiveness, transparency, and multi-municipal/regional collaboration.	Completed	• The county participated in a 6-county regional comprehensive plan through the Southern Alleghenies Planning and Development Commission. • Local regulations are being updated to reflect the comprehensive plan.
FC-3. County and All Municipalities - Develop and implement an enhanced all-hazards, public outreach/education/mitigation information program on natural hazard risks and a non-technical explanation of what residents can do in the way of mitigation and preparedness, including flood insurance.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-4. County and All Municipalities - Encourage cross-training of existing personnel or utilize county personnel resources, as timing and funding permit, to enhance local administrative and technical ability. Areas for further professional development may include planning expertise, floodplain administration, hazard/risk management, grant writing and funding, and cost/benefit analysis.	Continuous/Discontinued	• This is continuously implemented and considered a capability. • The county marked this as “continuous.” • Bethel Township marked this as “in progress.”
FC-5. County - Evaluate the need for a voluntary animal waste/manure/fertilizer self-reporting program for farmers, CAFO facilities, and other relevant organizations to utilize so that the county can more accurately estimate the amount of hazardous biological waste transported through the county and so that additional mitigation/safety measures may be implemented, if necessary.	Continuous	• The PSU Cooperative Extension should be involved. • This action will remain an action for implementation.
FC-6. County - Create and maintain a web-based inventory of the county's special needs population to strengthen emergency response and evacuation operations.	In Progress/Not Yet Complete	• This action will remain an action for implementation.

Description	Status	Review Comments
FC-7. County - Ensure all applicable private industrial, commercial, and public utility service providers have a current Environmental Emergency Response Plan per the Federal Clean Water Act the Pennsylvania Clean Streams Law (35 P.S. §§691.1-691.1001), the Pennsylvania Solid Waste Management Act, the Pennsylvania Storage Tank Act, the Oil Pollution Act, and regulations promulgated thereunder.	No Progress	• This action will remain an action for implementation.
FC-8. County - Strengthen the county's domestic animal health surveillance by familiarizing the Fulton County agricultural community with the list of reportable diseases and conditions related to animal health per the World Organisation for Animal Health (OIE) and the Pennsylvania Domestic Animal Act (Act 100 of 1996).	In Progress/Not Yet Complete	• The Pennsylvania State University (PSU) Cooperative Extension should be involved. • This action will remain an action for implementation.
FC-9. County - Work with the county's agricultural community to develop and implement the County Animal Response Team (CART) to strengthen the county's comprehensive emergency management program.	In Progress/Not Yet Complete	• The PSU Cooperative Extension should be involved. • This action will remain an action for implementation.
FC-10. County - Collaborate with the Pennsylvania Department of Environment Protection (PA DEP) Bureau of Radiation Protection to ensure the State's Radon Awareness Campaign and public service announcements are disseminated throughout Fulton County. This could include collateral and website development/links, County public service announcements, and social media development.	Continuous/Discontinued	• Press releases about radon are issued. • Collaboration occurs on a continuous basis. This action will be considered a capability.
FC-11. Dublin Township - Obtain an engineering study to redesign the intersection at Taylor Road and Waterfall Road in Dublin Township. Currently, emergency vehicles have difficulty making the turn at this intersection.	In Progress/Not Yet Complete	• The township received preliminary drawings and will be speaking with the landowner about obtaining the necessary land.
FC-12. Dublin Township - Research corrective actions needed to improve the condition of Tannery Road Bridge in Dublin Township, and implement appropriate weight limit controls and other follow-up actions.	In Progress/Not Yet Complete	• This project is on the Transportation Improvement Program (TIP) for construction in 2020.
FC-13. Dublin Township - Research corrective action to prevent flooding of Park Road in Dublin Township, and implement, if feasible.	Discontinued	• This project can be removed, as discussed at the December 2016 annual review meeting.
FC-14. Belfast Township - In Belfast Township, cut the bank back at 278 Black Bear Road to improve sight distance and to allow more space on the road.	Completed	• Belfast Township marked this complete.

Description	Status	Review Comments
FC-15. Union Township - In Union Township, continue to pursue political channels and collaboration with state agencies (e.g., Pennsylvania Department of Transportation [PennDOT]) to study and maintain the slide area on T-366 (Old 126).	In Progress/Not Yet Complete	• Old Route 126 was closed for safety in 2019. The township applied for grant funding in 2019 and 2020 for an engineering study to be completed to identify solutions to the problem.
FC-16. Ayr Township - In Ayr Township, identify and implement response to manage stormwater runoff along Route 16, from True Value to Citgo Station.	In Progress/Not Yet Complete	• This project is on the TIP with the PA Route 16 paving project. • The project will be completed in 2021.
FC-17. County and All Municipalities - Conduct workshops and training for municipal officials on the benefits of land use regulations to protect new and existing structures and infrastructure.	Continuous/Discontinued	• Workshops are conducted as needed. This is considered a capability.
FC-18. County - Conduct, sponsor, or facilitate grant-writing trainings for municipal officials and other relevant personnel.	Continuous/Discontinued	• Training sessions are conducted as needed. This is considered a capability.
FC-19. Todd Township - Replace three tiles on Johnstons Drive, in Todd Township, with one squash tile.	Discontinued	• The township supervisors do not feel that a squash tile will remedy the situation.
FC-20. Licking Creek Township - Construct a bridge on Creek Road (T-388) in Licking Creek Township over the creek fording.	No Progress	• The township reported no progress.
FC-21. Bethel Township - Increase visibility at the intersection of Great Cove Road (US-522) and Alpine Road in Bethel Township.	No Progress	• Bethel Township noted that no progress had been made.
FC-22. Bethel Township - Increase visibility at the intersection of Great Cove Road (US-522) and Bethel Church Road in Bethel Township.	In Progress/Not Yet Complete	• Bethel Township marked this project as “in progress.”
FC-23. Bethel Township - Increase visibility at the intersection of SR-643 and Spring Road in Bethel Township.	No Progress	• Bethel Township noted that no progress had been made.
FC-24. Bethel Township - Increase visibility at the intersection of Stoney Break Road and Black Oak Road in Bethel Township.	No Progress	• Bethel Township noted that no progress had been made.
FC-25. Bethel Township - Increase visibility at the intersection of Buck Valley Road and Mays Chapel Road in Bethel Township.	No Progress	• Bethel Township noted that no progress had been made.

Description	Status	Review Comments
FC-26. County and All Municipalities - Comply with floodplain ordinance regulations by continuing to obtain information on existing and proposed new structures in the areas with the highest relative vulnerability to determine the best property protection methods. The following information should be obtained: • Lowest floor elevation • Number of stories • Presence of a basement • Market or replacement value	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-27. All Municipalities - Comply with floodplain ordinance regulations by continuing to obtain information for all existing and proposed new structures in the 1-percent chance floodplain to determine the best property protection methods to promote with individual property owners.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-28. All Municipalities - Comply with floodplain ordinance and building code regulations by requiring anchor straps and improved roofing shingles on new and existing manufactured homes and residences of the county.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-29. County - Establish a Firewise Program in the county, especially around the Meadow Grounds Lake, Cowans Gap State Park, and Breezewood Park. Part of this initiative could include visual development of impacted areas, public service announcements, and educational outreach to farmers, hunters, campers, hikers, school children, and homeowners in the wildland-urban interface.	In Progress/Not Yet Complete	• Fulton County EMA will work with the Department of Forestry to determine what is required.
FC-30. County - Identify and apply for funding to enhance the county's radio system.	Completed	• This has been completed.
FC-31. County and All Municipalities - Identify and apply for funding to upgrade emergency responders' radio equipment.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-32. Belfast Township - Install dry hydrant locations along PA-655 to assist the Needmore Fire Company.	Completed	• Belfast Township marked this "complete."
FC-33. County - Protect natural wetlands that may absorb floodwaters. The benefits of this action would be described in other collateral developed for related initiatives.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-34. County - Implement programs deemed necessary by the Conservation District.	Continuous/Discontinued	• This is continuously implemented and considered a capability.

Description	Status	Review Comments
FC-35. County - Coordinate with the conservation and extension offices to provide education and training to emergency responders, managers, and municipal officials. Topic focuses could include modules from the Emergency Operations Plan, Crisis Communications, volunteer management, and recovery/resilience strategies.	Continuous/Discontinued	• Education and training are provided as needed. This is considered a capability.
FC-36. County and All Municipalities - Encourage major employers and other facilities to participate in the secondary StormReady programs. Such encouragement could occur through digital and print collateral, personal outreach, and speaking events at local service organizations (e.g., Rotary or Chamber events).	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-37. County and All Municipalities - Seek relevant input from all departments during the pre-impact, impact, and post-impact phases of an emergency.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-38. County and All Municipalities - Identify and fill gaps in information needed to conduct vulnerability analysis in hazard areas.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-39. County and All Municipalities - Evaluate existing road capacity with concern to increased truck and other traffic on local roads, and implement road improvements, as applicable.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-40. Thompson Township - In Thompson Township, upgrade and realign the intersection of Dent Road (T-343) and Timber Ridge Road (S.R. 2005) to allow for the passage of emergency vehicles.	In Progress/Not Yet Complete	• Thompson Township has applied for multi-modal funds to implement this project.
FC-41. Taylor Township - In Taylor Township, conduct road improvements on Davis Lane (T-423).	Completed	• The project was completed in 2019.
FC-42. Taylor Township - In Taylor Township, conduct intersection improvements and cut the bank back at Frick Road and Waterfall Road.	In Progress/Not Yet Complete	• The county reported that this project is in progress.
FC-43. Union Township - In Union Township, conduct intersection improvements at Harmonia Road (S.R. 3002) and Lehman Road (T-308).	No Progress	• The township reported no progress.
FC-44. Union Township - In Union Township, conduct intersection improvements at Harmonia Road (S.R. 3002) and Stahle Road (T-314).	No Progress	• The township reported no progress.
FC-45. Dublin Township - In Dublin Township, conduct intersection improvements at Waterfall Road (S.R. 475) and Battle Ridge Road (T-426).	No Progress	• Township supervisors are monitoring the situation.

Description	Status	Review Comments
FC-46. Ayr Township - In Ayr Township, identify correction actions on Great Cove Road (S.R. 522) by Whipporwill Lane to alleviate transportation accidents and dangerous bus stop conditions to road curve.	Discontinued	• Ayr Township marked this project "to be discontinued."
FC-47. Taylor Township - In Taylor Township, identify and coordinate with PennDOT to implement infrastructure improvements to the two state bridges along 655 between Waterfall Road and Hustontown.	No Progress	• Taylor Township reported no progress.
FC-48. Thompson Township - In Thompson Township, replace the corrugated metal culvert carrying West Orchard Road (T-305) over Ditch Run.	In Progress/ Not Yet Complete	• The township reported that this action is in progress.
FC-49. Union Township - In Union Township, maintain and upgrade Bridge No. 3 on Zachs Ridge Road (T-330), as needed.	In Progress/Not Yet Complete	• The underpinning and scour protection have been completed. • The project remains on the TIP.
FC-50. All Municipalities - Consider promoting or adopting higher regulatory and zoning standards to manage flood hazard risk, specifically through the following sample actions: • Support planning board of adjustment variances in cases where appeals are directly tied to compliance with the intent of floodplain regulations (e.g., overall building height, set-backs for inclined walkways). • Develop and adopt a cumulative substantial damage/improvements ordinance.	No Progress	• No progress was reported by any municipality.
FC-51. County and All Municipalities - Continue to promote future growth and development in the county in areas outside of determined hazard zones, where possible.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-52. County - Request digital copies of Emergency Action Plans (EAP) and inundation maps when high-hazard dam EAPs are next updated.	Continuous/Discontinued	• This is continuously implemented and considered a capability.
FC-53. Mill Road Bridge	In Progress/Not Yet Complete	• Licking Creek Township received multi-modal funding for this project in 2018. It will begin in summer 2020.

6.1.3 Additional Past Mitigation Accomplishments

Fulton 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 2015 HMP. The Mill Road Bridge action (FC-53) was added in December 2016, and the township received multi-modal funding in 2018 to implement the project.

6.2 MITIGATION GOALS AND OBJECTIVES

This section describes the mitigation goals and objectives set forth in the 2020 HMP update.

6.2.1 2020 Mitigation Goals

The Steering Committee reviewed the 2015 HMP goals to determine their continuing applicability to county mitigation needs and decided to update them. The updated goals and objectives were distributed at the Mitigation Strategy Workshop. The Steering Committee reviewed and approved the updated goals for the 2020 HMP. The 2020 HMP county goals are in line with Commonwealth 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 2020 HMP county goals are listed below:

1. **Goal 1:** Protect the people, property, and environment in hazard areas.
2. **Goal 2:** Prevent hazards from impacting the community.
3. **Goal 3:** Enhance awareness, understanding, and preparedness among local, county, state, and federal emergency management personnel to protect public health and safety.
4. **Goal 4:** Ensure that stakeholder groups have necessary information to mitigate against hazard impacts.

6.2.2 2020 Mitigation Objectives

The goals listed above were used to develop relevant objectives. The objectives address the results of the vulnerability assessment in more specific terms and reflect the possible effects that can be mitigated for the identified hazards, as well as existing limitations in available data and information. The objectives that were originally identified during the 2015 HMP update process were reviewed by the Steering Committee and updated to reflect changes in county priorities and capabilities since the previous HMP was approved in 2015. The revised and updated objectives were presented at the January 2020 Mitigation Strategy Workshop. Objectives related to each of the goals are listed below (Table 6-1 summarizes the evaluation of all goals and objectives from the 2015 HMP).

Goal 1: Protect the people, property, and environment in hazard areas.

Objective 1.A	Examine property protection measures and their applicability to the community.
Objective 1.B	Protect critical facilities in hazard areas.
Objective 1.C	Acquire, relocate, elevate, and/or retrofit existing structures, including repetitive loss properties, located in hazard areas.
Objective 1.D	Encourage homeowners, renters, and businesses to insure their properties against all hazards, including flood coverage under the National Flood Insurance Program (NFIP).
Objective 1.E	Protect the county’s natural resources.

Goal 2: Prevent hazards from impacting the community.

Objective 2.A Work with the municipalities to create and/or update land use regulations (e.g., zoning, subdivision, and land development).

Objective 2.B Address areas of roadways that are vulnerable to hazard impacts.

Goal 3: Enhance awareness, understanding, and preparedness among local, county, state, and federal emergency management personnel to protect public health and safety.

Objective 3.A: Ensure adequate communications capabilities among emergency response organizations.

Objective 3.B: Continue to train municipal Emergency Management Coordinators, relevant personnel, and interested members of the community on hazard protection, preparedness, and response.

Objective 3.C: Ensure adequate water supply to fight urban and wildland fires.

Goal 4: Ensure that stakeholder groups have necessary information to mitigate against hazard impacts.

Objective 4.A: Develop public education and outreach programs on hazards and hazard mitigation.

Objective 4.B: Educate property owners in hazard-risk areas regarding their risks and the precautions they can take.

Objective 4.C: Encourage residents to implement hazard mitigation and preparedness measures on their properties.

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, "Local Mitigation Planning Handbook" (FEMA 2013). 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 manmade structures to reduce the impact of hazards.
3. **Natural Systems Protection:** These actions minimize damage and losses and also preserve or restore the functions of natural systems.
4. **Education and Awareness Programs:** These actions involve informing and educating 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 Community Rating System, StormReady (National Oceanic and Atmospheric Administration [NOAA]), and Firewise (National Fire Protection Association [NFPA]) Communities (FEMA 2013).

The participants in the Mitigation Strategy Workshop and the Steering Committee identified actions that relate to the techniques listed above. Table 6-3 identifies which mitigation techniques are applicable for the hazards included in the 2020 HMP. In some cases, the mitigation techniques identified for a particular hazard reflect ongoing mitigation capabilities, not specific projects included in the updated HMP. Natural Systems Protection actions were considered, but not determined to be appropriate to address the problems identified throughout the county.

Table 6-3. Mitigation Technique Matrix

Hazard	Local Plans and Regulations	Structure and Infrastructure Projects	Education and Awareness Programs
Dam Failure	✓	✓	✓
Drought	✓	✓	✓
Earthquake	✓	✓	✓
Environmental Hazards	✓	✓	✓
Flood, Flash Flood, and Ice Jam	✓	✓	✓
Hailstorm	✓	✓	✓
Landslides	✓	✓	✓
Radon Exposure	✓	✓	✓
Subsidence and Sinkholes	✓	✓	✓
Tornadoes and Windstorms	✓	✓	✓
Transportation Accidents	✓	✓	✓
Wildfire	✓	✓	✓
Winter Storm	✓	✓	✓

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 2015 update that are still relevant or in progress. This section describes 2020 mitigation initiatives, mitigation strategy prioritization and implementation, and prioritization of mitigation actions.

6.4.1 2020 Mitigation Initiatives

Table 6-4 summarizes the updated mitigation strategies identified by the county and all 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

The updated mitigation actions were documented using the Mitigation Action Worksheet distributed at the Mitigation Strategy Workshop. Appendix G includes a blank version of the Mitigation Action Worksheet and Appendix H provides copies of the completed worksheets. Specific mitigation actions were identified to prevent future losses; however, current funding is not identified for all of these actions at present. Section 5 of this HMP indicates potential funding sources to support future implementation. The county and 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.

The Steering Committee prioritized proposed mitigation actions during the Mitigation Action Worksheet documentation process. In general, mitigation actions ranked as highest priorities should be addressed first within each jurisdiction, depending on funding. However, medium or low-priority mitigation actions will be considered for implementation as funding becomes available. Therefore, the ranking levels should be considered as a preliminary rankings that will evolve based on prevailing priorities and discretion of local governments, the public, PEMA, and FEMA, as the plan update is implemented.

Table 6-4. Hazard Mitigation Strategy

Note: Some of the identified mitigation initiatives in Table 6-4 are dependent upon available funding (grants and local match availability) and may be modified or omitted at any time based on the occurrence of new hazard events and changes in county or municipal priorities. Actions that have been carried over from the 2015 version of the HMP may have been reworded and given a new initiative designation to conform to current needs and procedures. The countywide actions apply to the county as an entity as well as participating municipalities. For most countywide actions, the action applies to all participating municipalities. Appendix H provides action worksheets that specify the municipalities to which other countywide actions apply.

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
Countywide (Multiple Municipalities)												
FultonC-1	Acquire vacant, abandoned, or unsafe structures, especially those in hazard areas, and turn into open space.	Existing	Flood, Flash Flood, and Ice Jams; Landslide; Subsidence and Sinkholes; Dam Failure; Environmental Hazards	2	EMA	Municipal EMCs	High	High	FEMA HMGP, PDM, FMA; PA DCED FMP	Long	Med.	SIP
FultonC-2	Educate the designated NFIP Floodplain Administrator and pursue relevant continuing education training such as FEMA Benefit-Cost Analysis.	N/A	Flood, Flash Flood, and Ice Jams	2	Planning and Mapping	Municipal FPAs	Med.	Low	Operating Budget	Short	Low	LPR
FultonC-3	Work with hazmat facilities to inform them of the hazards they face and ensure emergency plans are current.	N/A	All Hazards	2	LEPC	County EMA and Municipal EMCs	High	Med.	Act 165 Funds	Short	High	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
FultonC-4	Work with police departments in each municipality to ensure their emergency plans are updated, and inform them of the hazard areas in which they are located.	N/A	All Hazards	2	EMA		High	Med.	Operating Budget	Short	Low	LPR
FultonC-5	Work with daycare owners/operators in each municipality to ensure their emergency plans are updated, and inform them of the hazard areas in which they are located.	N/A	All hazards	2	Municipal EMCs		High	Med.	Operating Budget	Short	Low	LPR
FultonC-6	Work with schools and school districts to inform them of the hazards they face and ensure emergency plans are current.	N/A	All hazards	2	EMA	Municipal EMCs	High	Med.	Operating Budget	Short	High	LPR
FultonC-7	Develop and distribute educational information on hazards and emergency preparedness.	N/A	All hazards	2	Municipal		Med.	Low	Operating Budget	Short	Med.	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
FultonC-8	Partner with community groups and local organizations, including civic, business, town watch, faith-based, senior, advocacy and tenant associations, to promote emergency preparedness and mitigation efforts.	New	All hazards	2	County EMA	Municipal EMCs	Med.	Low	Operating Budget	Short	Med.	EAP
FultonC-9	Procure and maintain redundant power sources (portable generators).	New	Tornado, Windstorm, and Winter Storms	2	EMA	Municipal EMCs	High	Med.	FEMA HMGP, PDM; RACP	Short	Med.	SIP
FultonC-10	Purchase or relocate structures located in hazard-prone areas to protect structures from future damage, with repetitive loss properties as a priority.	Existing	All hazards	2	Municipal CEO	Municipal FPAs	High	High	FEMA HMGP, PDM, FMA; RACP	Long	High	SIP
FultonC-11	Encourage homeowners to install appropriate devices to alleviate radon concentrations within homes.	N/A	Radon Exposure	3	EMA	Municipal CEOs; EMCs	Med.	Low	Operating Budget	Short	Low	EAP
FultonC-12	Work with facility operators to protect critical facilities in the wildland-urban interface from wildfires.	Existing	Wildfires	3	Municipal EMCs		High	Med.	Operating Budget	Short	High	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
FultonC-13	Work with facility operators to protect critical facilities in areas prone to sinkholes.	Exisitng	Sinkholes	3	Municipal EMCs		High	Med.	Operating Budget	Short	High	SIP
FultonC-14	Establish a Firewise Program, especially around the Meadow Grounds Lake, Cowans Gap State Park, and Breezewood Park. Part of this initiative could include visual development of impacted areas, public service announcements, and educational outreach to farmers, hunters, campers, hikers, school children, and homeowners in the Wildland-Urban Interface.	New	Wildfire	2	County EMA	PA DCNR	Med.	Low	Operating Budget	Short	Med.	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
FultonC-15	Evaluate the need for a voluntary animal waste/manure/fertilizer self-reporting program for farmers, CAFO facilities, and other relevant organizations to utilize so that the county can more accurately estimate the amount of hazardous biological waste transported through the county and so that additional mitigation/safety measures may be implemented, if necessary.	N/A	All hazards	2	Planning and Mapping	PSU Cooperative Exension	Med.	Low	Operating Budget	Short	Med.	EAP
FultonC-16	Create and maintain a web-based inventory of the county's population with access and functional needs to strengthen emergency response and evacuation operations.	N/A	All hazards	3	EMA		Med.	Low	Operating Budget	Short	Med.	LPR

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
FultonC-17	Ensure all applicable private industrial, commercial, and public utility service providers have a current Environmental Emergency Response Plan per the Federal Clean Water Act the Pennsylvania Clean Streams Law (35 P.S. §§691.1-691.1001), the Pennsylvania Solid Waste Management Act, the Pennsylvania Storage Tank Act, the Oil Pollution Act, and regulations promulgated thereunder.	N/A	All hazards	2	LEPC	EMA; Fire Depts.	Low	Low	Act 165 Funds; Operating Budget	Short	Low	LPR
FultonC-18	Strengthen the county's domestic animal health surveillance by familiarizing the Fulton County agricultural community with the list of reportable diseases and conditions related to animal health per the OIE and the Pennsylvania Domestic Animal Act (Act 100 of 1996).	Exisitng	Environmental Hazards	2	Planning and Mapping	PSU Cooperative Extension	Med.	Low	Operating Budget; USDA Grants	Short	Low	EAP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
FultonC-19	Work with the county's agricultural community to develop and implement the CART to strengthen the county's comprehensive emergency management program	N/A	All hazards	2	Planning and Mapping	PSU Cooperative Exension	Med.	Low	Operating Budget	Short	Low	LPR
FultonC-20	Consider promoting or adopting higher regulatory and zoning standards to manage flood hazard risk	N/A	Flood, Flash Flood, and Ice Jams	2	Municipal FPAs	Municipal CEOs	Med.	Low	Operating Budget	Short	Low	LPR
FultonC-21	Work with dam owners and the population located downstream about dam failure.	Existing	Flood, Flash Flood, and Ice Jams	2	Municipal DPWs	Dam Facility Owners	Med.	Low	Operating Budget	Short	Low	EAP
FultonC-22	Educate the public on the hazards they face.	Existing	All hazards	3	Municipal EMCs		Low	Low	Operating Budget	Short	Low	EAP
Ayr Township												
AyrT-1	Identify and implement response to manage stormwater runoff along Route 16, from True Value to Citgo Station.	Exisitng	Flood, Flash Flood, and Ice Jams	2	Municipal CEO	FPA; Municipal EMC	High	Med.	Operating Budget	Short	Med.	SIP
Belfast Township												
BelfastT-1	Assess and determine best action to reduce vulnerability to hazmat incidents at the Horse Shoe turn on Route 522.	Existing	Transportaion Accidents	2	Planning and Mapping	PennDOT; LEPC	Med.	Low	Act 165 Funds	Short	Med.	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
BelfastT-2	Install a backup generator at the Water Supply Facility.	New	Tornado, Windstorm, and Winter Storms	2	DPW		Med.	Low	FEMA HMGP, PDM	Short	Med.	SIP
BelfastT-3	Protect Needmore Water Supply to the 0.2-percent annual chance flood level.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW	FPA; Municipal EMCs	High	High	FEMA HMGP, PDM, FMA; PA DCED FMP	Short	High	SIP
Bethel Township												
BethelT-1	Increase visibility at the intersection of Buck Valley Road and Mays Chapel Road.	Exisitng	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP
BethelT-2	Increase visibility at the intersection of SR-643 and Spring Road.	Existing	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP
BethelT-3	Increase visibility at the intersection of Great Cove Road (US-522) and Alpine Road.	Exisitng	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP
BethelT-4	Increase visibility at the intersection of Great Cove Road (US-522) and Bethel Church Road.	Existing	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP
BethelT-5	Increase visibility at the intersection of Stoney Break Road and Black Oak Road.	Exisitng	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP
BethelT-6	Work with AT&T to protect the Wireless Cell Tower to the 0.2-percent annual chance flood level.	Exisitng	Flood, Flash Flood, and Ice Jams	2	Municipal FPA		High	High	FEMA HMGP, PDM, FMA; PA DCED; Operating Budget	Short	Med.	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
BethelT-7	Protect Bethel Township Sewer Authority to the 0.2-percent annual chance flood level.	Existing	Flood, Flash Flood, and Ice Jams	2	Sewer Authority	Municipal FPA, DPW	High	Med.	FEMA HMGP, PDM, FMA; PA DCED; Operating Budget	Short	High	SIP
BethelT-8	Work with Global Tower Partners to protect the tower in Bethel Township from landslides.	Existing	Landslides	2	DPW	Municipal EMC	High	High	FEMA HMGP, PDM	Short	High	SIP
Dublin Township												
DublinT-1	Research corrective actions needed to improve the condition of Tannery Road Bridge in Dublin Township, and implement appropriate weight limit controls and other follow-up actions.	Existing	Transportation Accidents	2	DPW	Municipal EMC; Planning and Mapping	Med.	Med.	Operating Budget	Short	Med.	SIP
DublinT-2	Conduct intersection improvements at Waterfall Road (S.R. 475) and Battle Ridge Road (T-426).	Exisitng	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP
DublinT-3	Install generator and circuit for Township Building.	New	Tornado, Windstorm, and Winter Storms	2	DPW	EMA	Med.	Med.	FEMA HMGP, PDM; Operating Budget	Short	High	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
DublinT-4	Obtain an engineering study to redesign the intersection at Taylor Road and Waterfall Road in Dublin Township.	Existing	Transportation Accidents	2	DPW	PennDOT	Med.	Med.	TIP; PennDOT	Short	Med	SIP
Licking Creek Township												
LickingCreekT-1	Construct a bridge on Creek Road (T-388) in Licking Creek Township over the creek fording.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW	Municipal FPA	High	High	TIP; Operating Budget	Long	Low	SIP
LickingCreekT-2	Protect Valley Rural Electric – Route 30 Substation to the 0.2-percent annual chance flood level.	Existing	Flood, Flash Flood, and Ice Jams	2	Municipal FPA	Municipal EMC	High	High	FEMA HMGP, PDM; Operating Budget	Long	High	SIP
LickingCreekT-3	Protect Valley Rural Electric located at 11563 Pleasant Ridge Road to the 0.2-percent annual chance flood level.	Existing	Flood, Flash Flood, and Ice Jams	2	Municipal FPA	Municipal EMC	High	High	FEMA HMGP, PDM, FMA; PA DCED FMP	Short	High	SIP
LickingCreekT-4	Reconstruct Mill Road Bridge.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW	PennDOT	High	High	PA DCED; PennDOT; Operating Budget	Long	Low	SIP
Taylor Township												
TaylorT-1	Conduct intersection improvements and cut the bank back at Frick Road and Waterfall Road.	Existing	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
TaylorT-2	Identify and coordinate with PennDOT to implement infrastructure improvements to the two state bridges along 655 between Waterfall Road and Hustontown.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW	PennDOT	High	High	FEMPA HMGP, PDM; PA DCED; Operating Budget	Long	Low	SIP
TaylorT-3	Protect the Hustontown Post Office facility to the 0.2-percent annual chance flood level.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW	USPS; FPA, Municipal EMC	High	High	FEMA HMGP, PDM, FMA; PA DCED FMP	Short	High	SIP
TaylorT-4	Protect Valley Rural Electric Clear Ridge Substation to the 0.2-percent annual chance flood level.	Existing	Flood, Flash Flood, and Ice Jams	2	Municipal FPA	Municipal EMC	High	High	FEMA HMGP, PDM, FMA; PA DCED FMP	Short	High	SIP
TaylorT-5	Protect theWaterfall Post Office facility to the 0.2-percent annual chance flood level.	Exisitng	Flood, Flash Flood, and Ice Jams	2	DPW	USPS; FPA, Municipal EMC	High	High	FEMA HMGP, PDM, FMA; PA DCED FMP	Short	High	SIP
Thompson Township												
ThompsonT-1	Replace the corrugated metal culvert carrying West Orchard Road (T-305) over Ditch Run.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW		Med.	Med.	FEMA HMGP, PDM, PA DCED FMP; Capital Improvement Budget	Short	Med.	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
ThompsonT-2	Upgrade and realign the intersection of Dent Road (T-343) and Timber Ridge Road (S.R. 2005) to allow for the passage of emergency vehicles.	Existing	All Hazards	2	DPW	PennDOT	Med.	Med.	FEMA HMGP, PDM, PA DCED FMP; Capital Improvement Budget	Short	Med.	SIP
Todd Township												
ToddT-1	Assess and determine best action to mitigate flooding and address deficiencies of Narrows Road Bridge.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW	Municipal FPA	Med.	Med.	Operating Budget	Short	Low	SIP
ToddT-2	Improve drainage in Coldspring development.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW		Med.	Med.	Capital Improvement Budget	Short	High	SIP
ToddT-3	Improve drianage along Lion's Park Drive.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW		Med.	Med.	Capital Improvement Budget	Short	High	SIP
ToddT-4	Improve draiange along Cloverleaf Court.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW		Med.	Med.	Capital Improvement Budget	Short	High	SIP
ToddT-5	Improve drainage in the fairgrounds.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW		Med.	Med.	Capital Improvement Budget	Short	High	SIP
ToddT-6	Improve drainge along Lincoln Way West.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW		Med.	Med.	Capital Improvement Budget	Short	High	SIP

Initiative*	Mitigation Initiative	Applies to New and/or Existing Structures**	Hazard(s) Mitigated	Goals Met	Lead Agency	Support Agencies	Estimated Benefits	Estimated Cost	Sources of Funding	Timeline	Priority	Mitigation Category
Union Township												
UnionT-1	Continue to pursue political channels and collaboration with state agencies (e.g., PennDOT) to study and maintain the slide area on T-366 (Old 126).	Existing	Landslides	2	Municipal CEO	PennDOT; PEMA	Med.	Low	Operating Budget	Short	Med.	EAP
UnionT-2	Maintain and upgrade Bridge No. 3 on Zach's Ridge Road (T-330), as needed.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW		High	High	FEMA HMGP, PDM; PA DCED FMP; Operating Budget; TIP	Long	Low	SIP
UnionT-3	Obtain an engineering study and geological study for repair of Old Route 126.	Existing	Landslides	2	DPW	PennDOT	High	High	PennDOT	Med.	Med	SIP
UnionT-4	Replace culvert over Indian Grave Creek.	Existing	Flood, Flash Flood, and Ice Jams	2	DPW	Municipal FPA	Med.	High	FEMA HMGP, PDM; Capital Improvements Budget; Operating Budget	Short	Low	SIP
UnionT-5	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Lehman Road (T-308).	Existing	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP
UnionT-6	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Stahle Road (T-314).	Existing	Transportation Accidents	2	DPW	PennDOT	High	High	TIP; PennDOT	Long	Med.	SIP

Notes:

** The letters associated with the initiative number indicate the lead agency (i.e., Fulton 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.*

CAFO = Consolidated Animal Feeding Operation
CART = County Animal Response Team
CEO = Code Enforcement Officer
Depts. = Departments
DPW = Department of Public Works
EMA = Emergency Management Agency
EMC = Emergency Management Coordinator
EMS = Emergency Medical Services
FEMA = Federal Emergency Management Agency
FMA = Flood Mitigation Assistance [grant]
FMP = Flood Mitigation Program
FPA = Floodplain Administrator
Hazmat = Hazardous Materials
HMGP = Hazard Mitigation Grant Program
LEPC = Local Emergency Planning Committee
Med. = Medium
NFIP = National Flood Insurance Program
OIE = World Organisation for Animal Health
PA DCED = Pennsylvania Department of Community and Economic Development
PA DCNR = Pennsylvania Department of Conservation and Natural Resources
PDM = Pre-Disaster Mitigation Program
PEMA = Pennsylvania Emergency Management Agency
PennDOT = Pennsylvania Department of Transportation
PSU = Penn State University
RACP = Redevelopment Assistance Capital Program
TIP = Transportation Improvement Program
USDA = United States Department of Agriculture
USPS = United States Postal Service

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

Timeline:
Short Term = 1 to 2 years
Medium Term = 2 to 5 years
Long Term = 5 years or greater

Mitigation Category:

- *Education and Awareness Programs (EAP) - 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) - Actions include government authorities, policies, or codes that influence the way land and buildings are being developed and built.*
- *Natural Systems Protection (NSP) - Actions that minimize damage and losses, and also preserve or restore the functions of natural systems.*
- *Structure and Infrastructure Project (SIP) - Actions that 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 manmade structures to reduce the impact of hazards.*

6.4.2 Mitigation Strategy Prioritization and Implementation

Section 201.6(c) (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, to not only 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 take into consideration 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.

PEMA has developed a mitigation actions evaluation and prioritization process to provide a consistent, uniform approach for counties and jurisdictions to use to consider, in a systematic way, the best mitigation strategies for their communities (PEMA 2013). Jurisdictions first evaluate feasibility of mitigation actions by using the following ten evaluation criteria:

- **Life Safety:** The Steering Committee assesses to what extent a mitigation action will protect individuals from being injured or killed by a hazard.
- **Property Protection:** The Steering Committee assesses to what extent the action will protect property, including homes, businesses, and critical infrastructure.
- **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 Steering Committee determines whether the alternative action is a whole or partial solution, or not a solution at all.
- **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.
- **Legal:** Without the appropriate legal authority, the action cannot lawfully be undertaken. When considering this criterion, the Steering Committee determines whether a jurisdiction has the legal authority at the state, tribal, or local level to implement the action, or whether 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.
- **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 the potential negative consequences to environmental assets such as threatened and endangered species, wetlands, and other protected natural resources.
- **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. Likewise, the Steering Committee should determine whether implementing a mitigation action will have a beneficial or negative effect on a particular segment of the population.

- **Administrative:** Under this part of the evaluation criteria, the Steering Committee 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.
- **Local Champion:** Having an individual who will lead the implementation of a project, particularly a complex project, is essential for implementing it.
- **Other Community Objectives:** The Steering Committee evaluates to what extent implementing the mitigation action supports other community objectives, such as increasing parks and recreation, quality of life, and economic development.

Table 6-5 shows the feasibility evaluation for each identified mitigation action. For each criterion, the feasibility or effectiveness of the action according to the above criteria was indicated with a "+" (highly effective or feasible), "N" (neutral or not applicable), or a "-" (ineffective or not feasible). All actions were deemed feasible.

Table 6-5. Evaluation of Mitigation Actions

Initiative	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
FultonC-1	Acquire vacant, abandoned, or unsafe structures, especially those in hazard areas, and turn into open space.	N	+	+	+	N	N	+	+	N	+	6 (+) 4 (N) 0 (-)
FultonC-2	Educate the designated NFIP Floodplain Administrator and pursue relevant continuing education training such as FEMA Benefit-Cost Analysis.	N	N	+	+	+	N	+	+	N	N	5 (+) 5 (N) 0 (-)
FultonC-3	Work with hazmat facilities to inform them of the hazards they face and ensure emergency plans are current.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
FultonC-4	Work with police departments in each municipality to ensure their emergency plans are updated, and inform them of the hazard areas in which they are located.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
FultonC-5	Work with daycare owners/operators in each municipality to ensure their emergency plans are updated, and inform them of the hazard areas in which they are located.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
FultonC-6	Work with schools and school districts to inform them of the hazards they face and ensure emergency plans are current.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
FultonC-7	Develop and distribute educational information on hazards and emergency preparedness.	N	+	+	+	+	N	+	+	N	N	6 (+) 4 (N) 0 (-)
FultonC-8	Partner with community groups and local organizations, including civic, business, town watch, faith-based, senior, advocacy and tenant associations, to promote emergency preparedness and mitigation efforts.	N	+	+	+	+	N	+	+	N	N	6 (+) 4 (N) 0 (-)
FultonC-9	Procure and maintain redundant power sources (portable generators).	+	+	+	+	+	N	+	N	N	+	7 (+) 3 (N) 0 (-)

Initiative	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
FultonC-10	Purchase or relocate structures located in hazard-prone areas to protect structures from future damage, with repetitive loss properties as a priority.	+	+	+	+	+	N	-	N	N	+	6 (+) 3 (N) 1 (-)
FultonC-11	Encourage homeowners to install appropriate devices to alleviate radon concentrations within homes.	+	N	+	+	+	+	N	N	+	N	6 (+) 4 (N) 0 (-)
FultonC-12	Work with facility operators to protect critical facilities in the wildland-urban interface from wildfires.	+	+	+	+	+	N	+	+	+	N	8 (+) 2 (N) 0 (-)
FultonC-13	Work with facility operators to protect critical facilities in areas prone to sinkholes.	+	+	+	+	+	N	+	+	+	N	8 (+) 2 (N) 0 (-)
FultonC-14	Establish a Firewise Program, especially around the Meadow Grounds Lake, Cowans Gap State Park, and Breezewood Park. Part of this initiative could include visual development of impacted areas, public service announcements, and educational outreach to farmers, hunters, campers, hikers, school children, and homeowners in the wildland-urban interface.	N	+	+	+	+	N	+	+	N	N	6 (+) 4 (N) 0 (-)
FultonC-15	Evaluate the need for a voluntary animal waste/manure/fertilizer self-reporting program for farmers, CAFO facilities, and other relevant organizations to utilize so that (1) the county can more accurately estimate the amount of hazardous biological waste transported through the county and (2) additional mitigation/safety measures may be implemented, if necessary.	N	N	+	+	+	+	+	+	N	N	6 (+) 4 (N) 0 (-)
FultonC-16	Create and maintain a web-based inventory of the county's population with access and functional needs to strengthen emergency response and evacuation operations.	+	N	+	+	+	N	+	+	N	N	6 (+) 4 (N) 0 (-)
FultonC-17	Ensure all applicable private industrial, commercial, and public utility service providers have a current Environmental Emergency Response Plan per the Federal Clean Water Act the Pennsylvania Clean Streams Law (35 P.S. §§691.1-691.1001), the Pennsylvania Solid Waste Management Act, the Pennsylvania Storage Tank Act, the Oil Pollution Act, and regulations promulgated thereunder.	N	N	+	+	+	+	+	+	N	N	6 (+) 4 (N) 0 (-)
FultonC-18	Strengthen the county's domestic animal health surveillance by familiarizing the Fulton County agricultural community with the list of reportable diseases and conditions related to animal health per the OIE and the Pennsylvania Domestic Animal Act (Act 100 of 1996).	N	N	+	+	+	N	+	+	N	N	5 (+) 5 (N) 0 (-)
FultonC-19	Work with the county's agricultural community to develop and implement the CART to strengthen the county's comprehensive emergency management program.	N	N	+	+	+	N	+	+	N	N	5 (+) 5 (N) 0 (-)
FultonC-20	Consider promoting or adopting higher regulatory and zoning standards to manage flood hazard risk.	N	+	+	+	+	N	+	N	N	N	4 (+) 5 (N) 0 (-)

Initiative	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
FultonC-21	Work with dam owners and the population located downstream about dam failure.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
FultonC-22	Educate the public on the hazards they face.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
AyrT-1	Identify and implement response to manage stormwater runoff along Route 16, from True Value to Citgo Station.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BelfastT-1	Assess and determine best action to reduce vulnerability to hazmat incidents at the Horse Shoe turn on Route 522.	+	+	+	+	+	N	+	N	N	N	6 (+) 4 (N) 0 (-)
BelfastT-2	Install a backup generator at the Water Supply Facility.	+	+	+	+	+	N	+	N	N	N	6 (+) 4 (N) 0 (-)
BelfastT-3	Protect Needmore Water Supply to the 0.2-percent annual chance flood level.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-1	Increase visibility at the intersection of Buck Valley Road and Mays Chapel Road.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-2	Increase visibility at the intersection of SR-643 and Spring Road.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-3	Increase visibility at the intersection of Great Cove Road (US-522) and Alpine Road.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-4	Increase visibility at the intersection of Great Cove Road (US-522) and Bethel Church Road.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-5	Increase visibility at the intersection of Stoney Break Road and Black Oak Road.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-6	Protect AT&T Wireless Cell Tower to the 0.2-percent annual chance flood level.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-7	Protect Bethel Township Sewer Authority to the 0.2-percent annual chance flood level.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
BethelT-8	Work with Global Tower Partners to protect the tower in Bethel Township from landslides.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
DublinT-1	Research corrective actions needed to improve the condition of Tannery Road Bridge in Dublin Township, and implement appropriate weight limit controls and other follow-up actions.	N	+	+	+	+	N	+	N	N	N	5 (+) 5 (N) 0 (-)
DublinT-2	Conduct intersection improvements at Waterfall Road (S.R. 475) and Battle Ridge Road (T-426).	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
DublinT-3	Install generator and circuit for Township Building.	+	+	+	+	+	N	+	N	+	N	7 (+) 3 (N) 0 (-)

Initiative	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
DublinT-4	Obtain an engineering study to redesign the intersection at Taylor Road and Waterfall Road in Dublin Township.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
Licking CreekT-1	Construct a bridge on Creek Road (T-388) in Licking Creek Township over the creek fording.	N	+	+	+	+	N	+	N	N	N	5 (+) 5 (N) 0 (-)
Licking CreekT-2	Protect Valley Rural Electric – Route 30 Substation to the 0.2-percent annual chance flood level.	N	+	+	+	+	N	+	+	N	+	7 (+) 3 (N) 0 (-)
Licking CreekT-3	Protect Valley Rural Electric located at 11563 Pleasant Ridge Road to the 0.2-percent annual chance flood level.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
Licking CreekT-4	Reconstruct Mill Road Bridge.	N	+	+	+	+	N	+	N	N	N	5 (+) 5 (N) 0 (-)
TaylorT-1	Conduct intersection improvements and cut the bank back at Frick Road and Waterfall Road.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
TaylorT-2	Identify and coordinate with PennDOT to implement infrastructure improvements to the two state bridges along 655 between Waterfall Road and Hustontown.	N	+	+	+	+	N	+	N	N	N	5 (+) 5 (N) 0 (-)
TaylorT-3	Protect the Hustontown Post Office facility to the 0.2-percent annual chance flood level.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
TaylorT-4	Protect Valley Rural Electric Clear Ridge Substation to the 0.2-percent annual chance flood level.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
TaylorT-5	Protect the Waterfall Post Office facility to the 0.2-percent annual chance flood level.	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
ThompsonT-1	Replace the corrugated metal culvert carrying West Orchard Road (T-305) over Ditch Run.	N	+	+	+	+	N	+	+	N	N	6 (+) 4 (N) 0 (-)
ThompsonT-2	Upgrade and realign the intersection of Dent Road (T-343) and Timber Ridge Road (S.R. 2005) to allow for the passage of emergency vehicles.	N	+	+	+	+	N	+	+	N	N	6 (+) 4 (N) 0 (-)
ToddT-1	Assess and determine best action to mitigate flooding and address deficiencies of Narrows Road Bridge.	N	+	+	+	+	N	+	+	+	N	7 (+) 3 (N) 0 (-)
ToddT-2	Improve drainage in Coldspring development.	N	+	+	+	+	N	+	+	+	N	7 (+) 3 (N) 0 (-)
ToddT-3	Improve drainage along Lion's Park Drive.	N	+	+	+	+	N	+	+	+	N	7 (+) 3 (N) 0 (-)
ToddT-4	Improve drainage along Cloverleaf Court.	N	+	+	+	+	N	+	+	+	N	7 (+) 3 (N) 0 (-)
ToddT-5	Improve drainage in the Fairgrounds.	N	+	+	+	+	N	+	+	+	N	7 (+) 3 (N) 0 (-)

Initiative	Mitigation Action	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Total Score
ToddT-6	Improve drainage along Lincoln Way West.	N	+	+	+	+	N	+	+	+	N	7 (+) 3 (N) 0 (-)
UnionT-1	Continue to pursue political channels and collaboration with state agencies (e.g., PennDOT) to study and maintain the slide area on T-366 (Old 126).	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
UnionT-2	Maintain and upgrade Bridge No. 3 on Zach's Ridge Road (T-330), as needed.	N	+	+	+	+	N	+	N	N	N	5 (+) 5 (N) 0 (-)
UnionT-3	Obtain an engineering study and geological study for repair of Old Route 126.	+	+	+	+	+	N	+	+	+	N	8 (+) 2 (N) 0 (-)
UnionT-4	Replace culvert over Indian Grave Creek.	N	+	+	+	+	N	+	+	N	N	6 (+) 4 (N) 0 (-)
UnionT-5	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Lehman Road (T-308).	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (N) 0 (-)
UnionT-6	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Stahle Road (T-314).	+	+	+	+	+	N	+	+	N	N	7 (+) 3 (-) 0 (-)

6.4.3 Prioritization of Mitigation Actions

Actions that are deemed feasible (i.e., receive a positive evaluation score) were then compared and prioritized using another set of criteria (PEMA 2013), described below:

- Effectiveness (20% of score) – The extent to which an action reduces the vulnerability of people and property.
- Efficiency (30% of score) – The extent to which time, effort, and cost is well used as a means of reducing vulnerability. This criterion assesses the benefits of an action versus the cost of the action's implementation.
- Multi-Hazard Mitigation (20% of score) – The action reduces vulnerability for more than one hazard.
- Addresses High-Risk Hazard (15% of score) – The action reduces vulnerability for people and property from a hazard(s) that is identified as high risk.
- Addresses Critical Communications/Critical Infrastructure (15% of score) – The action pertains to the maintenance of critical functions and structures such as transportation, supply-chain management, and data circuits.

Scores in each criterion range from 0 to 3. The action's priority is determined by using a formula based on the criteria values and weights. Priority values range from 0 to 3 as well. An action's priority is then determined using the following scale (PEMA 2013):

- Low priority = 0 – 1.8
- Medium priority = 1.9 – 2.4
- High priority = 2.5 – 3

Table 6-6 shows the prioritization scores for the identified, feasible mitigation actions. Municipal officials reviewed and updated the prioritization values based on local needs.

Table 6-6. Prioritization Scoring of Mitigation Actions

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Priority
FultonC-1	Acquire vacant, abandoned, or unsafe structures, especially those in hazard areas, and turn into open space.	2	3	1	3	0	2.0
FultonC-2	Educate the designated NFIP Floodplain Administrator and pursue relevant continuing education training such as FEMA Benefit-Cost Analysis.	1	1	1	2	2	1.3
FultonC-3	Work with hazmat facilities to inform them of the hazards they face and ensure emergency plans are current.	2	2	1	2	0	1.5
FultonC-4	Work with police departments in each municipality to ensure their emergency plans are updated, and inform them of the hazard areas in which they are located.	2	2	1	2	0	1.5
FultonC-5	Work with daycare owners/operators in each municipality to ensure their emergency plans are updated, and inform them of the hazard areas in which they are located.	2	2	1	2	0	1.5
FultonC-6	Work with schools and school districts to inform them of the hazards they face and ensure emergency plans are current.	2	2	1	2	0	1.5
FultonC-7	Develop and distribute educational information on hazards and emergency preparedness.	1	1	1	1	1	1.0
FultonC-8	Partner with community groups and local organizations, including civic, business, town watch, faith-based, senior, advocacy and tenant associations, to promote emergency preparedness and mitigation efforts.	1	1	1	1	1	1.0
FultonC-9	Procure and maintain redundant power sources (portable generators).	2	2	1	3	3	2.1
FultonC-10	Purchase or relocate structures located in hazard-prone areas to protect structures from future damage, with repetitive loss properties as a priority.	2	2	1	3	3	2.1
FultonC-11	Encourage homeowners to install appropriate devices to alleviate radon concentrations within homes.	0	2	3	1	2	1.8
FultonC-12	Work with facility operators to protect critical facilities in the wildland-urban interface from wildfires.	2	2	1	2	3	2.0
FultonC-13	Work with facility operators to protect critical facilities in areas prone to sinkholes.	2	2	1	2	3	2.0
FultonC-14	Establish a Firewise Program, especially around the Meadow Grounds Lake, Cowans Gap State Park, and Breezewood Park. Part of this initiative could include visual development of impacted areas, public service announcements, and educational outreach to farmers, hunters, campers, hikers, school children, and homeowners in the wildland-urban interface.	1	1	1	1	1	1.0
FultonC-15	Evaluate the need for a voluntary animal waste/manure/fertilizer self-reporting program for farmers, CAFO facilities, and other relevant organizations to utilize so that (1) the county can more accurately estimate the amount of hazardous biological waste transported through the county and (2) additional mitigation and safety measures may be implemented, if necessary.	2	2	1	1	0	1.4
FultonC-16	Create and maintain a web-based inventory of the county's population with access and functional needs to strengthen emergency response and evacuation operations.	2	2	1	1	0	1.4

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Priority
FultonC-17	Ensure all applicable private industrial, commercial, and public utility service providers have a current Environmental Emergency Response Plan per the Federal Clean Water Act the Pennsylvania Clean Streams Law (35 P.S. §§691.1-691.1001), the Pennsylvania Solid Waste Management Act, the Pennsylvania Storage Tank Act, the Oil Pollution Act, and regulations promulgated thereunder.	2	2	1	1	0	1.4
FultonC-18	Strengthen the county's domestic animal health surveillance by familiarizing the Fulton County agricultural community with the list of reportable diseases and conditions related to animal health per the OIE and the Pennsylvania Domestic Animal Act (Act 100 of 1996).	2	2	1	1	0	1.4
FultonC-19	Work with the county's agricultural community to develop and implement the CART to strengthen the county's comprehensive emergency management program.	2	2	1	1	0	1.4
FultonC-20	Consider promoting or adopting higher regulatory and zoning standards to manage flood hazard risk.	2	2	1	3	1	1.8
FultonC-21	Work with dam owners and the population located downstream about dam failure.	1	1	1	1	1	1.0
FultonC-22	Educate the public on the hazards they face.	1	1	1	1	1	1.0
AyrT-1	Identify and implement response to manage stormwater runoff along Route 16, from True Value to Citgo Station.	3	3	1	3	3	2.6
BelfastT-1	Assess and determine best action to reduce vulnerability to hazmat incidents at the Horse Shoe turn on Route 522.	2	2	1	3	3	2.1
BelfastT-2	Install a backup generator at the Water Supply Facility.	2	2	1	3	3	2.1
BelfastT-3	Protect Needmore Water Supply to the 0.2-percent annual chance flood level.	3	3	1	3	3	2.6
BethelT-1	Increase visibility at the intersection of Buck Valley Road and Mays Chapel Road.	2	2	1	2	1	1.7
BethelT-2	Increase visibility at the intersection of SR-643 and Spring Road.	2	2	1	2	1	1.7
BethelT-3	Increase visibility at the intersection of Great Cove Road (US-522) and Alpine Road.	2	2	1	2	1	1.7
BethelT-4	Increase visibility at the intersection of Great Cove Road (US-522) and Bethel Church Road.	2	2	1	2	1	1.7
BethelT-5	Increase visibility at the intersection of Stoney Break Road and Black Oak Road.	2	2	1	2	1	1.7
BethelT-6	Protect AT&T Wireless Cell Tower to the 0.2-percent annual chance flood level.	3	3	1	3	3	2.6
BethelT-7	Protect Bethel Township Sewer Authority to the 0.2-percent annual chance flood level.	3	3	1	3	3	2.6
BethelT-8	Work with Global Tower Partners to protect the tower in Bethel Township from landslides.	3	3	1	3	3	2.6
DublinT-1	Research corrective actions needed to improve the condition of Tannery Road Bridge in Dublin Township, and implement appropriate weight limit controls and other follow-up actions.	2	2	1	3	1	1.8
DublinT-2	Conduct intersection improvements at Waterfall Road (S.R. 475) and Battle Ridge Road (T-426).	2	2	1	2	1	1.7
DublinT-3	Install generator and circuit for Township Building.	2	2	1	3	3	2.1
DublinT-4	Obtain an engineering study to redesign the intersection at Taylor Road and Waterfall Road in Dublin Township.	2	2	1	2	1	1.7
LickingCreekT -1	Construct a bridge on Creek Road (T-388) in Licking Creek Township over the creek fording.	2	2	1	3	1	1.8

Initiative	Mitigation Action	Effectiveness	Efficiency	Multi-Hazard Mitigation	Addresses High-Risk Hazard	Addresses Critical Communications/ Critical Infrastructure	Priority
LickingCreekT-2	Protect Valley Rural Electric – Route 30 Substation to the 0.2-percent annual chance flood level.	3	3	1	3	3	2.6
LickingCreekT-3	Protect Valley Rural Electric located at 11563 Pleasant Ridge Road to the 0.2-percent annual chance flood level.	3	3	1	3	3	2.6
LickingCreekT-4	Reconstruct Mill Road Bridge.	2	2	1	3	1	1.8
TaylorT-1	Conduct intersection improvements and cut the bank back at Frick Road and Waterfall Road.	2	2	1	2	1	1.7
TaylorT-2	Identify and coordinate with PennDOT to implement infrastructure improvements to the two state bridges along 655 between Waterfall Road and Hustontown.	2	2	1	3	1	1.8
TaylorT-3	Protect the Hustontown Post Office facility to the 0.2-percent annual chance flood level.	3	3	1	3	3	2.6
TaylorT-4	Protect Valley Rural Electric Clear Ridge Substation to the 0.2- chance annual flood level.	3	3	1	3	3	2.6
TaylorT-5	Protect the Waterfall Post Office facility to the 0.2-percent annual chance flood level.	3	3	1	3	3	2.6
ThompsonT-1	Replace the corrugated metal culvert carrying West Orchard Road (T-305) over Ditch Run.	2	2	1	3	1	1.8
ThompsonT-2	Upgrade and realign the intersection of Dent Road (T-343) and Timber Ridge Road (S.R. 2005) to allow for the passage of emergency vehicles.	2	2	1	3	1	1.8
ToddT-1	Assess and determine best action to mitigate flooding and address deficiencies of Narrows Road Bridge.	2	2	1	3	1	1.8
ToddT-2	Improve drainage in Coldspring development.	2	2	1	3	1	1.8
ToodT-3	Improve drainage along Lion’s Park Drive.	2	2	1	3	1	1.8
ToddT-4	Improve drainage along Cloverleaf Court.	2	2	1	3	1	1.8
ToddT-5	Improve drainage in the fairgrounds.	2	2	1	3	1	1.8
ToddT-6	Improve drainage along Lincoln Way West.	2	2	1	3	1	1.8
UnionT-1	Continue to pursue political channels and collaboration with state agencies (e.g., PennDOT) to study and maintain the slide area on T-366 (Old 126).	2	2	1	1	1	1.5
UnionT-2	Maintain and upgrade Bridge No. 3 on Zach's Ridge Road (T-330), as needed.	2	2	1	3	1	1.8
UnionT-3	Obtain an engineering study and geological study for repair of Old Route 126.	2	2	1	2	1	1.7
UnionT-4	Replace culvert over Indian Grave Creek.	2	2	1	3	1	1.8
UnionT-5	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Lehman Road (T-308).	2	2	1	2	1	1.7
UnionT-6	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Stahle Road (T-314).	2	2	1	2	1	1.7

The actions in Table 6-7 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 Steering Committee and represents actions that 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).

A blank Mitigation Action Worksheet template is included in Appendix G. The set of completed action worksheets and a table summarizing the worksheets by jurisdiction are presented in Appendix H.

Table 6-7. Prioritized Mitigation Actions

Mitigation Action		Score
High Priority		
AyrT-1	Identify and implement response to manage stormwater runoff along Route 16, from True Value to Citgo Station.	2.6
BelfastT-3	Protect Needmore Water Supply to the 0.2-percent annual chance flood level.	2.6
BethelT-6	Protect AT&T Wireless Cell Tower to the 0.2-percent annual chance flood level.	2.6
BethelT-7	Protect Bethel Township Sewer Authority to the 0.2-percent annual chance flood level.	2.6
BethelT-8	Work with Global Tower Partners to protect the tower in Bethel Township from landslides.	2.6
LickingCreekT-2	Protect Valley Rural Electric – Route 30 Substation to the 0.2-percent annual chance flood level.	2.6
LickingCreekT-3	Protect Valley Rural Electric located at 11563 Pleasant Ridge Road to the 0.2-percent annual chance flood level.	2.6
TaylorT-3	Protect the Hustontown Post Office facility to the 0.2-percent annual chance flood level.	2.6
TaylorT-4	Protect Valley Rural Electric Clear Ridge Substation to the 0.2-percent annual chance flood level.	2.6
TaylorT-5	Protect the USPS facility to the 0.2-percent annual chance flood level.	2.6
Medium Priority		
BelfastT-1	Assess and determine best action to reduce vulnerability to hazmat incidents at the Horse Shoe turn on Route 522.	2.1
BelfastT-2	Install a backup generator at the Water Supply Facility.	2.1
DublinT-3	Install generator and circuit for Township Building.	2.1
FultonC-9	Procure and maintain redundant power sources (portable generators).	2.1
FultonC-10	Purchase or relocate structures located in hazard-prone areas to protect structures from future damage, with repetitive loss properties as a priority.	2.1
FultonC-1	Acquire vacant, abandoned, or unsafe structures, especially those in hazard areas, and turn into open space.	2.0
FultonC-12	Work with facility operators to protect critical facilities in the wildland-urban interface from wildfires.	2.0
FultonC-13	Work with facility operators to protect critical facilities in areas prone to sinkholes.	2.0
Low Priority		
DublinT-1	Research corrective actions needed to improve the condition of Tannery Road Bridge in Dublin Township, and implement appropriate weight limit controls and other follow-up actions.	1.8
FultonC-11	Encourage homeowners to install appropriate devices to alleviate radon concentrations within homes.	1.8
FultonC-20	Consider promoting or adopting higher regulatory and zoning standards to manage flood hazard risk.	1.8
LickingCreekT-1	Construct a bridge on Creek Road (T-388) in Licking Creek Township over the creek fording.	1.8
LickingCreekT-4	Reconstruct Mill Road Bridge.	1.8
TaylorT-2	Identify and coordinate with PennDOT to implement infrastructure improvements to the two state bridges along 655 between Waterfall Road and Hustontown.	1.8
ThompsonT-1	Replace the corrugated metal culvert carrying West Orchard Road (T-305) over Ditch Run.	1.8

Mitigation Action		Score
ThompsonT-2	Upgrade and realign the intersection of Dent Road (T-343) and Timber Ridge Road (S.R. 2005) to allow for the passage of emergency vehicles.	1.8
ToddT-1	Assess and determine best action to mitigate flooding and address deficiencies of Narrows Road Bridge.	1.8
ToddT-2	Improve drainage in Coldspring development.	1.8
ToddT-3	Improve drainage along Lion's Park Drive.	1.8
ToddT-4	Improve drainage along Cloverleaf Court.	1.8
ToddT-5	Improve drainage in the fairgrounds.	1.8
ToddT-6	Improve drainage along Lincoln Way West.	1.8
UnionT-2	Maintain and upgrade Bridge No. 3 on Zach's Ridge Road (T-330), as needed.	1.8
UnionT-4	Replace culvert over Indian Grave Creek.	1.8
BethelT-1	Increase visibility at the intersection of Buck Valley Road and Mays Chapel Road.	1.7
BethelT-2	Increase visibility at the intersection of SR-643 and Spring Road.	1.7
BethelT-3	Increase visibility at the intersection of Great Cove Road (US-522) and Alpine Road.	1.7
BethelT-4	Increase visibility at the intersection of Great Cove Road (US-522) and Bethel Church Road.	1.7
BethelT-5	Increase visibility at the intersection of Stoney Break Road and Black Oak Road.	1.7
DublinT-2	Conduct intersection improvements at Waterfall Road (S.R. 475) and Battle Ridge Road (T-426).	1.7
DublinT-4	Obtain an engineering study to redesign the intersection at Taylor Road and Waterfall Road in Dublin Township.	1.7
TaylorT-1	Conduct intersection improvements and cut the bank back at Frick Road and Waterfall Road.	1.7
UnionT-3	Obtain an engineering study and geological study for repair of Old Route 126.	1.7
UnionT-5	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Lehman Road (T-308).	1.7
UnionT-6	Conduct intersection improvements at Harmonia Road (S.R. 3002) and Stahle Road (T-314).	1.7
FultonC-3	Work with hazmat facilities to inform them of the hazards they face and ensure emergency plans are current.	1.5
FultonC-4	Work with police departments in each municipality to ensure their emergency plans are updated and inform them of the hazard areas in which they are located.	1.5
FultonC-5	Work with daycare owners/operators in each municipality to ensure their emergency plans are updated and inform them of the hazard areas in which they are located.	1.5
FultonC-6	Work with schools and school districts to inform them of the hazards they face and ensure emergency plans are current.	1.5
UnionT-1	Continue to pursue political channels and collaboration with state agencies (e.g., PennDOT) to study and maintain the slide area on T-366 (Old 126).	1.5
FultonC-15	Evaluate the need for a voluntary animal waste/manure/fertilizer self-reporting program for farmers, CAFO facilities, and other relevant organizations to utilize so that (1) the county can more accurately estimate the amount of hazardous biological waste transported through the county and (2) additional mitigation/safety measures may be implemented, if necessary.	1.4
FultonC-16	Create and maintain a web-based inventory of the county's population with access and functional needs to strengthen emergency response and evacuation operations.	1.4
FultonC-17	Ensure all applicable private industrial, commercial, and public utility service providers have a current Environmental Emergency Response Plan per the Federal Clean Water Act the Pennsylvania Clean Streams Law (35 P.S. §§691.1-691.1001), the Pennsylvania Solid Waste Management Act, the Pennsylvania Storage Tank Act, the Oil Pollution Act, and regulations promulgated thereunder.	1.4
FultonC-18	Strengthen the county's domestic animal health surveillance by familiarizing the Fulton County agricultural community with the list of reportable diseases and conditions related to animal health per the OIE and the Pennsylvania Domestic Animal Act (Act 100 of 1996).	1.4
FultonC-19	Work with the county's agricultural community to develop and implement the CART to strengthen the county's comprehensive emergency management program.	1.4
FultonC-2	Educate the designated NFIP Floodplain Administrator and pursue relevant continuing education training such as FEMA Benefit-Cost Analysis.	1.3

Mitigation Action		Score
FultonC-7	Develop and distribute educational information on hazards and emergency preparedness.	1.0
FultonC-8	Partner with community groups and local organizations, including civic, business, town watch, faith-based, senior, advocacy and tenant associations, to promote emergency preparedness and mitigation efforts.	1.0
FultonC-14	Establish a Firewise Program, especially around the Meadow Grounds Lake, Cowans Gap State Park, and Breezewood Park. Part of this initiative could include visual development of impacted areas, public service announcements, and educational outreach to farmers, hunters, campers, hikers, school children, and homeowners in the wildland-urban interface.	1.0
FultonC-21	Work with dam owners and the population located downstream about dam failure.	1.0
FultonC-22	Educate the public on the hazards they face.	1.0

SECTION 7 PLAN MAINTENANCE PROCEDURES

This section describes how the plan was updated since 2015 (Section 7.1); the system established by Fulton County and used by all participating jurisdictions to monitor, evaluate, and update the Hazard Mitigation Plan (HMP) (Section 7.2); and the strategy to continue public involvement for plan maintenance (Section 7.3).

7.1 UPDATE PROCESS SUMMARY

Monitoring, evaluating, and updating the HMP are critical to maintaining its value and supporting the success of Fulton County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and supports future resiliency.

The Fulton County Steering Committee reviewed the 2015 plan maintenance procedures and carried them forward to the current HMP update, as described in the sections below. The Fulton County Planning and Mapping Director shall continue to serve as the Hazard Mitigation Plan (HMP) Coordinator for the Steering Committee. Going forward, the plan will continue to be available on the Fulton County Planning and Mapping website. The 2020 plan maintenance procedures also describe the ways in which this plan may be integrated into other planning mechanisms in the County.

7.2 MONITORING, EVALUATING, AND UPDATING THE PLAN

The Fulton County HMP Steering Committee intends to remain the organization responsible for monitoring, evaluating, and updating this plan. The Planning and Mapping Director shall serve as HMP Coordinator for the Steering Committee. Each participating jurisdiction is expected to retain a municipal hazard mitigation representative to support the monitoring, evaluating, and updating responsibilities of the jurisdiction identified in this section. Members of the Steering Committee are listed in Section 3.

Understanding that individual commitments change over time, each jurisdiction and its representatives are responsible for informing the Fulton County HMP Coordinator of any changes in representation by formal letter. The HMP Coordinator will strive to keep the Steering Committee makeup as a representation of planning partners and stakeholders within the County. The HMP Coordinator shall maintain the current membership of the Steering Committee on the Fulton County Planning and Mapping Department website (http://www.co.fulton.pa.us/planning-commission.php) or in publicly-accessible County records.

The following sections describe the monitoring, evaluating, and updating processes and protocols for the Fulton County HMP.

7.2.1 Monitoring

The Steering Committee will be responsible for monitoring implementation, evaluating the effectiveness of the HMP, and documenting this information in a progress report. Prior to Steering Committee progress meetings (detailed below), Steering Committee 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 Steering Committee. The Fulton County HMP Coordinator will work with municipal representatives to provide additional opportunities for members of the public to learn about the hazards they face, and to provide information to be incorporated into the HMP. FEMA's National Flood Hazard Layer interactive tools can be used to facilitate this process. Further, the representatives shall obtain from their municipal supervisor, mayor, or councilperson any public comments made on the plan and provide them to the Steering Committee for inclusion in the progress report.

The Steering Committee representatives will be expected to document the following, as needed and as appropriate:

- Additional stakeholders (such as planning agencies and business representatives) who should be invited to participate in the planning process
- Additional local assets (such as major employers, points of interest, residential areas, etc.) to consider in the risk assessment and mitigation strategy, providing more detail of what each municipality considers vital to be included in the HMP
- Hazard events and losses occurring in their jurisdiction, including their nature, 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
- How floodplain management, in accordance with the National Flood Insurance Program (NFIP), is carried out in the municipality (through completion of the NFIP Survey worksheet)
- Public and stakeholder input and comments on the plan

Local Steering Committee representatives may use the progress reporting forms (Worksheets #1 and #3 in the Federal Emergency Management Agency [FEMA] 386-4 guidance document[1]) 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 Steering Committee. At least 1 month before the progress plan review meeting, the Fulton County HMP Coordinator will advise Steering Committee members of the meeting date, agenda, and expectations of the members. The Fulton County HMP Coordinator may also distribute additional flood mitigation survey and mitigation project opportunity forms to jurisdictions with new or revised information or to jurisdictions that did not participate in the update process.

The Fulton 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

[1] https://www.fema.gov/media-library-data/20130726-1521-20490-9008/fema_386_4.pdf

- 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 Steering Committee will review the mitigation goals, objectives, activities, and projects using the following performance-based indicators:

- New agencies or 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-spending or over-spending regarding proposed mitigation action budgets
- Achievement of the goals and objectives
- Resource allocation to note whether resources are required to implement mitigation activities
- Timeframe comments on whether proposed schedules are sufficient to address actions
- Budget notes (indicating 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 if certain goals, objectives, or actions prove to be unfeasible

Finally, the Steering Committee 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 in Section 5.2.6). These other programs and policies can include those that address the following:

- Economic development
- Environmental preservation and permitting
- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

The Steering Committee may refer to the evaluation forms (Worksheets #2 and #4 in the FEMA 386-4 guidance document) to assist in the evaluation process.

The Fulton 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 Steering Committee meeting, and other information as appropriate and relevant. These county progress reports will provide data for the 5-year update of this HMP and will assist in identifying implementation challenges. By monitoring the implementation of the plan, the Steering Committee will be able to assess which projects are completed, are no longer feasible, or may require additional funding.

The 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 Steering Committee meeting, the planning partners shall establish a schedule for the 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 determine if 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 over the performance period to facilitate the risk assessment. Revisiting the risk assessment 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 Fulton County Hazard Mitigation Steering Committee will update this plan on a 5-year cycle from the date of plan adoption.

To facilitate the update process, the Fulton County HMP Coordinator (with support from the Steering Committee) will 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 Fulton County HMP Coordinator will 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 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 Steering Committee shall determine the resources needed to complete the update. The Fulton County HMP Coordinator shall be responsible for ensuring that needed resources are secured.

The Fulton County HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring incorporation in the 5-year plan update, as appropriate. Additional meetings may also be held as deemed necessary by the Steering Committee. The purpose of these meetings will be to provide an opportunity for the public to express concerns, opinions, and ideas about the HMP.

7.3 CONTINUED PUBLIC INVOLVEMENT

Fulton 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 Planning & Mapping Department website (http://www.co.fulton.pa.us/planning-county-plans.php), and copies of the plan will be made available for review during normal business hours at the Planning & Mapping Department office. Fulton County will make electronic copies of the plan available for local municipalies to provide public access.

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 Steering Committee members and the Pennsylvania State Hazard Mitigation Officer.

The Fulton County HMP Coordinator will be responsible for receiving, tracking, and filing public comments on the HMP. The public will have an opportunity to comment on the plan at the review meeting and during the 5-year plan update. Fulton County will maintain an active link on the Planning & Mapping Department website to collect public comments.

The Steering Committee 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 Planning & Mapping Department website, and provisions for public comment submitted in writing will also be made. All public comments shall be addressed to:

  Hazard Mitigation Plan Steering Committee
  c/o Fulton County Planning Commission
  219 North 2nd Street, Suite 102
  McConnellsburg, PA 17233
- 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 a Fulton County HMP website (i.e., https://www.co.fulton.pa.us/planning-hmp.php) 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 Planning & Mapping Department website (http://www.co.fulton.pa.us/planning-county-plans.php).
- Public notices will be made, as appropriate, to inform the public of the availability of the plan, particularly during plan update cycles.

The Fulton County HMP Coordinator shall ensure the following:

- Public comment and input on the HMP (and hazard mitigation in general) will be recorded and addressed, as appropriate.
- HMP content on the Planning & Mapping Department website will be maintained and updated, as appropriate.
- All public and stakeholder comments received will be documented and maintained.
- Copies of the latest approved plan will be available for review at the Planning & Mapping Department, along with instructions to facilitate public input and comment on the plan.
- Public notices, including media releases, will be made (as appropriate) to inform the public of the availability of the plan, particularly during plan update cycles.

SECTION 8 PLAN ADOPTION

By adopting the Fulton County Hazard Mitigation Plan (HMP), local governing bodies demonstrate their commitment to fulfill the mitigation goals and objectives outlined in the plan. Adoption of the HMP by Fulton County and each participating jurisdiction legitimizes the HMP and authorizes responsible agencies to execute their responsibilities.

Each participating jurisdiction in Fulton County will continue with formal adoption proceedings upon conditional approval of this HMP from the Federal Emergency Management Agency (FEMA), known as "Approval Pending Adoption (APA)." Each participating jurisdiction understands that conditional approval of the HMP will be provided for those municipalities that meet the planning requirements with the exception of the adoption requirement, as stated above.

Following adoption or formal action on the HMP, each participating jurisdiction must submit a copy of the resolution or other legal instrument showing formal adoption (acceptance) of the HMP to the Fulton County Hazard Mitigation Plan (HMP) Coordinator. Fulton County will forward the executed resolutions to the Pennsylvania Emergency Management Agency (PEMA), which will subsequently forward the resolutions to FEMA. Each participating jurisdiction understands that FEMA will transmit acknowledgement of verification of formal HMP adoption and the official approval of the HMP to the HMP Coordinator. Resolutions reflecting the formal adoption of this HMP by the County and participating jurisdictions are included in Appendix F of this HMP. A sample resolution to be used by the County and its jurisdictions is provided on the following pages.

Fulton County Hazard Mitigation Plan

County Adoption Resolution

Resolution No. ___________________

Fulton County, Pennsylvania

WHEREAS, the municipalities of Fulton 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, Fulton County acknowledges the requirement of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving Hazard Mitigation Assistance funds, and

WHEREAS, the Fulton County Hazard Mitigation Plan has been developed by Fulton County Planning & Mapping Department in cooperation with other County departments, local municipal officials, and the citizens of Fulton County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Fulton County Hazard Mitigation Plan, and

WHEREAS, the Fulton 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 Fulton that:

- The 2020 Fulton 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 2020 Fulton County Hazard Mitigation Plan are hereby directed to execute the recommended activities assigned to them.

ADOPTED, this _________ day of ________________, 2020

ATTEST: **FULTON COUNTY COMMISSIONERS**

____

By ______________________________

By ______________________________

By ______________________________

Fulton County Hazard Mitigation Plan

Municipal Adoption Resolution

Resolution No. ___________________

< *Municipality Name*>, Fulton County, Pennsylvania

WHEREAS, the <*Municipality Name*>, Fulton 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 Hazard Mitigation Assistance funds, and

WHEREAS, the Fulton County Hazard Mitigation Plan has been developed by Fulton County Planning & Mapping Department 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 Fulton County Hazard Mitigation Plan, and

WHEREAS, the Fulton 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 2020 Fulton 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 2020 Fulton County Hazard Mitigation Plan are hereby directed to execute the recommended activities assigned to them.

ADOPTED, this _________ day of ________________, 2020

ATTEST:

____

< *MUNICIPALITY NAME*> REPRESENTATIVES

By _______________________________

By _______________________________

By _______________________________