Columbia County
Hazard Mitigation Plan Update
2017

Flooding is seen Friday, Sept. 9, 2011, in Bloomsburg, Pa., after remnants from Tropical Storm Lee continued to produce heavy rain overnight. The grounds of the Bloomsburg Fair are located in the middle of this photo with water up to the roofs of buildings. (AP Photo/Mel Evans) http://www.accuweather.com/en/weather-news/pennsylvania-cities-in-ruins-a-1/55099

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1 Introduction

1.1 Background

Across the United States, natural and man-made disasters have led to increasing levels of deaths, injuries, property damage, and interruption of business and government services. The time, money, and effort needed to recover from these disasters exhausts resources, diverting attention from important public programs and private agendas. Since 1955 there have been 50 Presidential Disaster Declarations and nine Presidential Emergency Declarations in Pennsylvania, twelve of which have included Columbia County, respectively. The emergency management community, citizens, elected officials and other stakeholders in Columbia County, Pennsylvania recognize the impact of disasters on their community and support proactive efforts needed to reduce the impact of natural and human-made hazards.

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

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

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

1.2 Purpose

The purpose of this All-Hazard Mitigation Plan Update (HMPU) is:
To protect life, safety, and property by reducing the potential for future damages and economic losses that result from natural hazards';
To qualify for additional grant funding, in both the pre-disaster and the post-disaster environment;
To qualify for additional credit under the Community Ratings System (CRS);
To speed recovery and redevelopment following future disaster events;
To demonstrate a firm local commitment to hazard mitigation principles; and
To comply with both state and federal legislative requirements for local hazard mitigation plans.

1.3 Scope

The Columbia County 2017 Hazard Mitigation Plan update has been prepared to meet requirements set forth by the Federal Emergency Management Agency (FEMA) and Pennsylvania Emergency Management Agency (PEMA) in order for the County to be eligible for funding and technical assistance from state and federal hazard mitigation programs. It will be updated and maintained to address both natural and human-made hazards determined to be of significant risk to the County and/or its local municipalities. Updates will take place at a minimum every five years, but they will also take place following significant disaster events.

1.4 Authority and References

Authority for this plan originates from the following federal sources:
Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended;
Code of Federal Regulations (CFR), Title 44, Parts 201 and 206;
Disaster Mitigation Act of 2000, Public Law 106-390, as amended; and
National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 *et seq.*

Authority for this plan originates from the following Commonwealth of Pennsylvania sources:
Pennsylvania Emergency Management Services Code. Title 35, Pa C.S. Section 101;
Pennsylvania Municipalities Planning Code of 1968, Act 247 as reenacted and amended by Act 170 of 1988; and Pennsylvania Stormwater Management Act of October 4, 1978. P.L. 864, No. 167.

The following FEMA guides and reference documents were used to prepare this document:
FEMA 386-6: *Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning*. May 2005.
FEMA 386-8: *Multijurisdictional Mitigation Planning*. August 2006.
FEMA*: Local Mitigation Planning Handbook*. March 2013.
FEMA: *Local Mitigation Plan Review Guide*. October 1, 2011.
FEMA: *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*. January 2013.
FEMA: *Integrating Hazard Mitigation into Local Planning: Case Studies and Tools for Community Officials*. March 1, 2013.
FEMA: *Plan Integration: Linking Local Planning Efforts*. July 2015.

The following PEMA guides and reference documents were used prepare this document:
PEMA: *Standard Operating Guide*. October 18, 2013.
PEMA: *Pennsylvania State Hazard Mitigation Plan*. October 31, 2013.

2 Community Profile

2.1 Geography and Environment

Columbia County covers a land area of 486 square miles and is located in the northeastern section of Pennsylvania. It is bordered by the counties of Luzerne, Lycoming, Montour, Northumberland, Schuylkill, and Sullivan. The County is nestled amongst and divided by the Appalachian Mountains, creating natural separation between some municipalities. Beaver and Roaring Creek townships are divided by Catawissa Mountain, and Little Mountain separates Locust and Conyngham townships (Battle, 1887).

The bustling Town of Bloomsburg lies in the flattest area of the County north of the Susquehanna River. Most of the land is more mountainous and hilly, often necessitating that developers slope contours and grade the land before construction. Outdoor recreational spaces in the region include Bloomsburg Town Park, Weiser State Forest, Brace's Stables, and Rickett's Glen State Park.

The Susquehanna River traverses the County from east to west, and about 20 miles of the river lie within Columbia County. Some of smaller but still-important waterways in the County include Roaring, Catawissa, Hemlock, Huntingdon, Mill, Pine, and Green Creeks (Freeze, 1883). These waterways are shown in Figure 2.1-1.

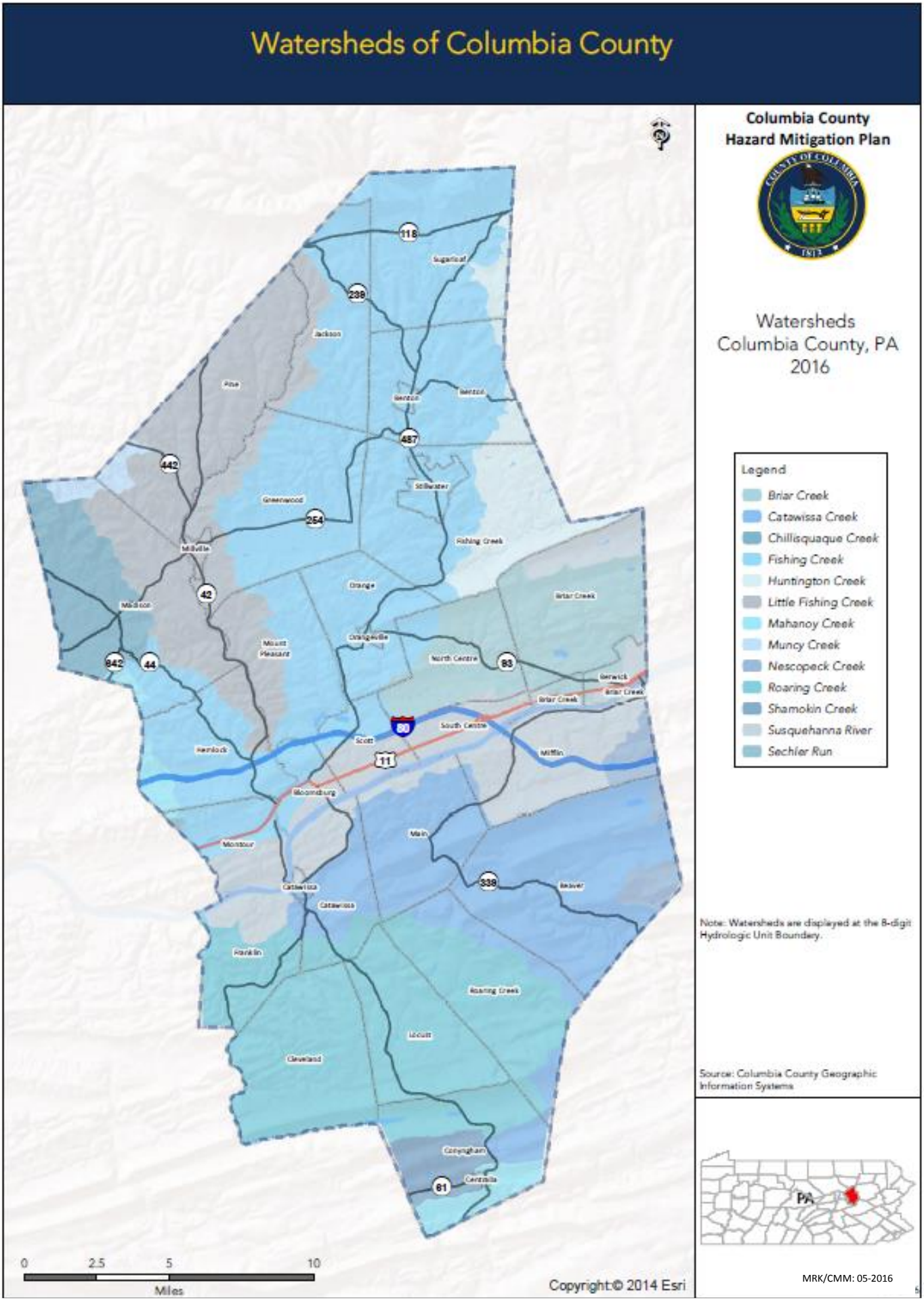

Figure 2.1-1: Watersheds of Columbia County (Columbia County GIS, 2016)

2.2. Community Facts

Columbia County was named after the Italian explorer Columbo, or more commonly known in Latin as Columbus. In March of 1813, Columbia County separated from Northumberland County (Columbia County, 2011). Originally, the County was divided into twelve townships, but eventually grew to a total of 33 municipalities, including 8 boroughs, 24 townships, and the Town of Bloomsburg. These jurisdictions are mapped in Figure 2.2-2. Bloomsburg has been described as a quasi-borough, and is the only incorporated town in the state of Pennsylvania. The area was first known as Bloom Township in 1798, but after many sections of the township were partitioned off to other municipalities, the area was organized into a town in 1870 (Freeze, 1883).

The County is home to many of Pennsylvania's historic covered bridges, with nineteen in the county borders and four that connect Columbia with adjacent counties. Most of the structures were built in the mid to late 1800's, thus drawing tourists and bridge enthusiasts to the area. The Town of Bloomsburg is home to Bloomsburg University, which is comprised of over 9,500 students and staff that bring culture, life, and commerce to the area. Though the town suffered from competition with malls and shopping centers in the recent past, its downtown area has been revamped to draw people and commerce back to the town center. Bloomsburg is also the County seat.

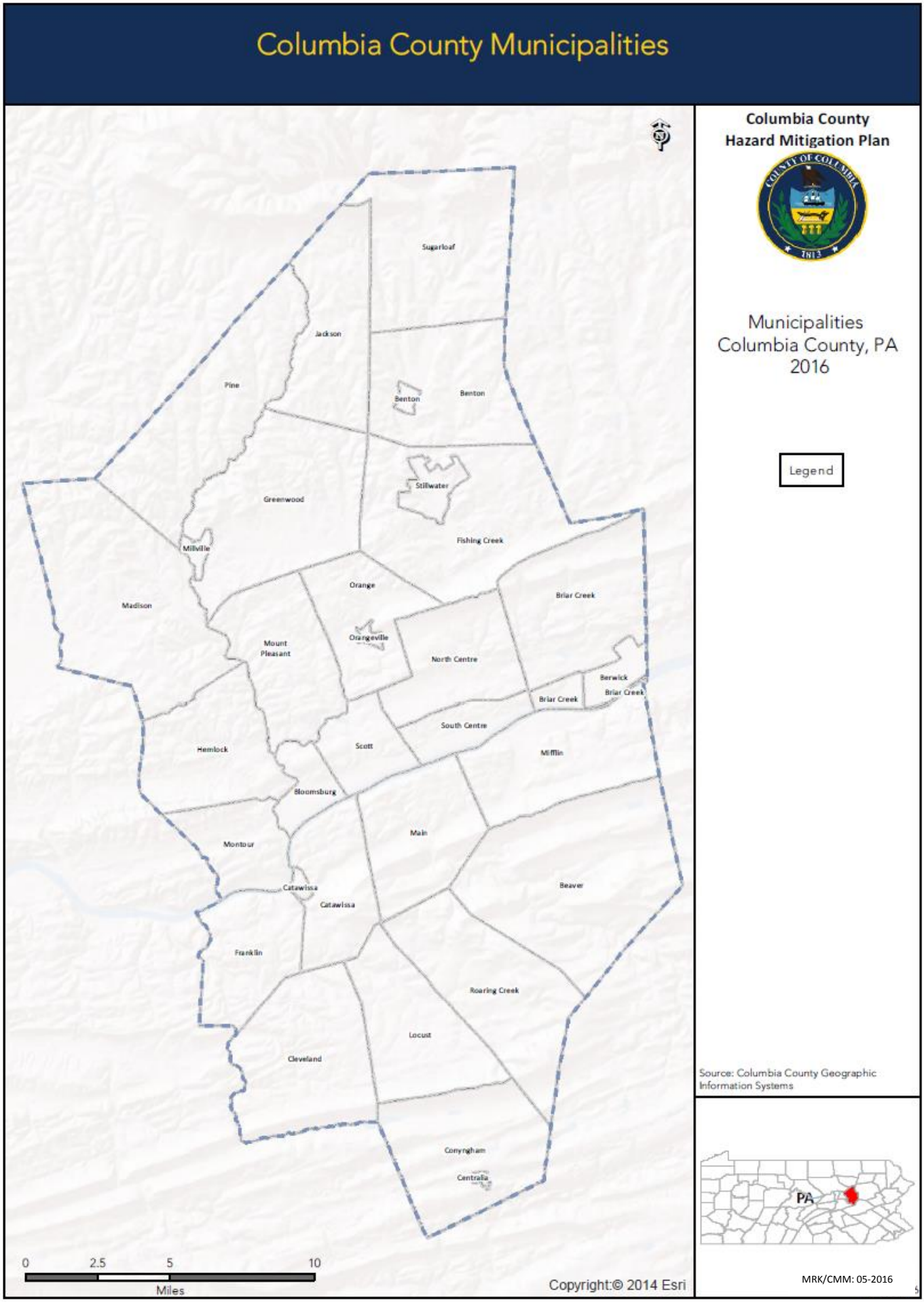

Figure 2.2-1: Basemap of Columbia County (Columbia County GIS Department, 2015)

2.3. Population and Demographics

According to the 2000 Census, the population of Columbia County was 64,191. Columbia County's population grew to 67,295 people according to the 2010 Census. Table 2.3-1 shows the distribution of County population per municipality obtained from the U.S. Census Bureau. Population growth has been strongest in the last ten years in Bloomsburg and in Hemlock Township just north of Bloomsburg, but five municipalities in total saw double-digit growth. Fourteen of the municipalities declined in population. According to the County Planning Commission, the explosive population growth in Bloomsburg is due in large part to the presence of Bloomsburg University; in the decennial Census, individuals are counted in the jurisdiction in which they reside for the majority of the year, meaning that increases in the student population are reflected in the overall population growth in that jurisdiction.

Table 2.3-1: List of municipalities in Columbia County with associated populations.

MUNICIPALITY	2000 Population	2010 Population	Percent Change (%)
Beaver Township	885	917	3.6%
Benton Borough	995	824	-17.2%
Benton Township	1,216	1,245	2.4%
Berwick Borough	10,774	10,477	-2.8%
Bloomsburg, Town of	12,375	14,855	20.0%
Briar Creek Borough	651	660	1.4%
Briar Creek Township	3,061	3,016	-1.5%
Catawissa Borough	1,589	1,552	-2.3%
Catawissa Township	944	932	-1.3%
Centralia Borough	21	10	-52.4%
Cleveland Township	1,004	1,110	10.6%
Conyngham Township	792	758	-4.3%
Fishing Creek Township	1,393	1,416	1.7%
Franklin Township	597	595	-0.3%
Greenwood Township	1,932	1,952	1.0%
Hemlock Township	1,874	2,249	20.0%
Jackson Township	598	626	4.7%
Locust Township	1,410	1,404	-0.4%
Madison Township	1,590	1,605	0.9%
Main Township	1,289	1,236	-4.1%
Mifflin Township	2,251	2,322	3.2%
Millville Borough	991	948	-4.3%
Montour Township	1,437	1,344	-6.5%
Mount Pleasant Township	1,459	1,609	10.3%
North Centre Township	2,009	2,105	4.8%
Orange Township	1,148	1,257	9.5%
Orangeville Borough	500	508	1.6%

Pine Township	1,092	1,046	-4.2%
Roaring Creek Township	495	545	10.1%
Scott Township	4,768	5,113	7.2%
South Centre Township	1,972	1,937	-1.8%
Stillwater Borough	194	209	7.7%
Sugarloaf Township	885	913	3.2%
TOTALS	**64,191**	**67,295**	**4.8%**

Historically, population growth was fairly steady in the 1800's; however, growth has tapered off in recent years, evidenced in some municipalities losing residents in the past ten years. Centralia Borough has dwindled to only ten residents due to a continuously burning underground mine fire that began in 1962. The U.S. government presented residents with buyout offers and all but a few accepted and moved to neighboring townships and boroughs (Krajick, 2005). The median income of households in Columbia County is $46,367. This is almost $7,000 less than the national median household income (U.S. Census ACS, 2010-2014). Nearly 16 percent of the County population lives in poverty. The median age of the County population is 39.8 years with approximately eighty-one percent of the population over 18 years of age and sixteen percent 65 years or older. There are an estimated 29,498 housing units, about ninety percent of which are occupied with ten percent being vacant (U.S. Census ACS, 2010-2014). The median value of an owner-occupied home in the County is $137,000. Ninety-five percent of the County population is White, two percent are Black or African-American, and a total of one percent is American Indian, Alaska Native, or Asian.

2.4. Land Use and Development

Columbia County has primarily forested and undeveloped land. About 92 percent of the land is undeveloped (Columbia County Comprehensive Recreation, Parks, Greenways, and Open Space Plan, 2007), consisting of both forests and agricultural farm land. That leaves only 8 percent of the County as developed land, which is concentrated along the Susquehanna River as Figure 2.4-1 illustrates. The flatland areas of the County are sought after by both farmers and developers who could benefit by cultivating the property. There are small patches of barren land in both Centralia Borough and Conyngham Township due to the mine fire. Both Greenwood and Fishing Creek Townships have small areas designated as waste disposal. During the 1990's, the housing market expanded quickly in Columbia County, and soon the housing units were increasing more than the population. Though the population grew by 949, housing units increased by 2,135 (U.S. Census Bureau, 2000) which indicates that sprawl was occurring.

Fortunately, most municipalities in the County are embracing the use of zoning ordinances to monitor and control the growth of their communities. According to the Columbia County Planning Commission, there have been no changes to the zoning ordinances in places with higher population growth that might indicate increased densification or increased sprawl in those communities. However, as more residents move in from Luzerne County, controlled housing growth will be important for Columbia in order to protect their land.

According to the 2005 Pennsylvania Department of Community and Economic Development (DCED) Land Use Profile, County has specific concerns around open space and farmland

preservation. As a result, the County has placed priority on conserving their open space and resources. Participation in Pennsylvania's Agricultural Conservation Easement Program has helped to save 14 farms and 1,585 acres of land. Another 9,000 acres in Northumberland and Columbia Counties' Brush Valley area have been preserved with the help of the Department of Conservation of Natural Resources (DCED, 2005).

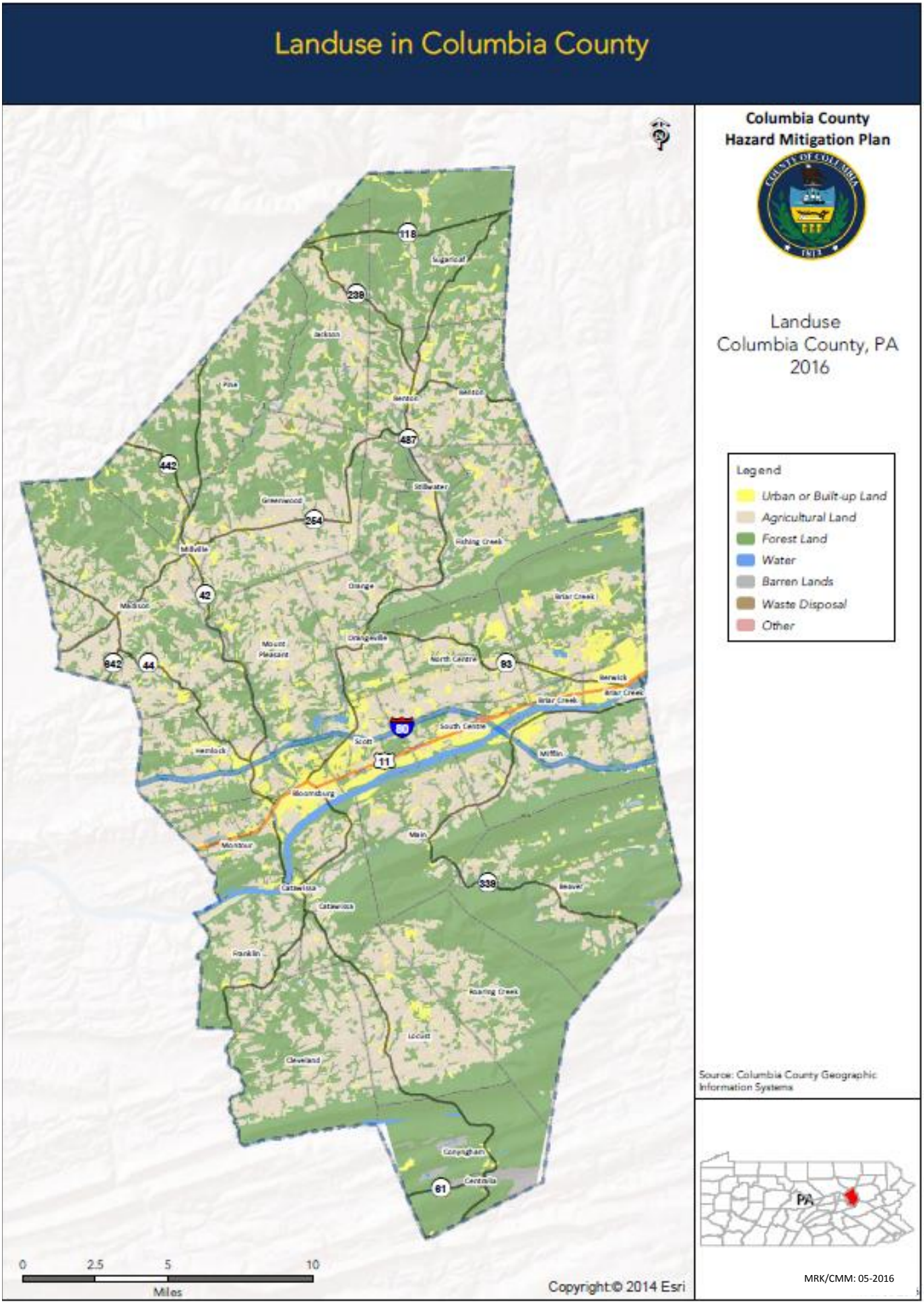

Figure 2.4-1: Map of land use in Columbia County (Columbia County GIS Department, 2016).

2.5. Data Sources and Limitations

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

While NCDC data is comprised of natural hazards information, additional information focused more on human-made hazards was obtained through Knowledge Center (KC). KC is the principal crisis management software that Columbia County uses to provide up-to-date information as an event unfolds through the response and recovery phases. When applicable, KC incident data spanning approximately the last 5 years (beginning on 10/29/2012) was used in the 2017 plan update. Although PEIRS data proved valuable, primarily in the human-made hazards section where few records of past occurrences exist, data limitations exist in that the reporting system is not mandatory. As a result, while KC reports provide important information on the frequency of past events, because it is a voluntary reporting system, the number and frequency of events may be under- reported. KC information was used primarily in the following hazard profile sections: environmental hazards and utility interruptions.

Like all new technology, obtaining buy-in for the use of Knowledge Center was slow to start. However, recently we have seen an increase in the number of users and the data that is being entered. We expect Knowledge Center to be very useful for research in the future.

Every attempt was made to provide consistency in reported data and in data sources. Data from the US Census Bureau 2010 Decennial Census was used throughout this plan. Population data from 2000 and 2010 was used in order to show changes in the population at the municipal level. The calculated population at risk to flooding in Section 4.3.3.5 is derived from the 2010 Census Block geography. In addition, the age of housing units reported in Section 4.3.10, comes from the 2010-2014 American Community Survey because the Decennial Census no longer collects this information. As new Census data becomes available, it will be incorporated into the HMP.

Additional information used to complete the risk assessment for this plan was taken from various government agency and non-government agency sources. Those sources are cited where appropriate throughout the plan with full references listed in **Appendix A – Bibliography**. It should be noted that numerous GIS datasets were obtained from the Pennsylvania Spatial Data Access (PASDA) website (http://www.pasda.psu.edu/). PASDA is the official public access geospatial information clearinghouse for the Commonwealth of Pennsylvania. PASDA was developed by the Pennsylvania State University as a service to the citizens, governments, and businesses of the Commonwealth. PASDA is a cooperative project of the Governor's Office of Administration, Office for Information Technology, Geospatial Technologies Office and the Penn State Institutes of Energy and the Environment of the Pennsylvania State

University.

The Columbia County GIS director provided GIS structures dataset that has been used as an inventory of structures throughout the County in this plan. This dataset included a generalized structure type which has been incorporated into this plan where appropriate. Structure types included agricultural, commercial, exempt, residential, tower, trailer, utility, and vacant. The "Trailers" category incorporates agricultural trailers, residential trailers, commercials, and leased trailers (with no land). In order to estimate the number of trailers in the SFHA, addressable structures with the land uses "agricultural trailer", "residential trailer", "commercial trailer", and "general trailer" structure type were selected; then the structures were intersected with the SFHA.

The flood hazard area data used in this plan is the Effective Countywide Digital Flood Insurance Rate Map (DFIRM), released August 19, 2008. This data provides flood frequency and elevation information used in the flood hazard risk assessment. Other GIS datasets including *large and small streams, ponds, municipalities, roads, land use,* and *critical infrastructure* were provided by the Columbia County GIS Department. Population data from the 2000 Census and 2010 estimated populations were obtained from the U.S. Census Bureau in 2010.

Due to the time and cost involved, the HMPT chose not to utilize HAZUS for the hazard analysis portion of the update. Instead, the Columbia County GIS Department used databases available to them to complete analysis on the various hazards throughout the plan as appropriate. The 100-year chance of flood was analyzed as follows:

> The Department of Geographic Information Systems of the County of Columbia conducted an analysis of the structures impacted by the 1% annual chance flood hazard (100-year flood hazard). Utilizing the following geographic layers – 1% annual chance flood hazard areas (FEMA), parcels (Columbia), and building centroids (Columbia) – the Department identified those at risk structures impacted by the flood hazard. Using those at risk structures, were able to determine the associated structures' valuation data maintained by the county Assessment Office.
>
> Using the following formula, (building market value * 0.5 * 3.69), the structures valuation was converted from 1992 market value to 2016 market value. To simulate the estimated loss for such an event, 25% was applied to each structures valuation.
>
> The estimated loss for a 1% annual chance flood hazard was summarized by municipality and classified by structure land use. (Columbia County GIS, 2016)

This HMP evaluates the vulnerability of the County's critical facilities. For the purposes of this plan, critical facilities are those entities that are essential to the health and welfare of the community, including facilities that would be needed to serve as shelters in an emergency. The list of critical facilities was developed based on the critical infrastructure information from the 2012 HMP; the old plan's information has been updated to reflect changes in the County's critical infrastructure in the last five years. The critical facilities include law enforcement, emergency response, medical services, campgrounds, churches, day care centers, municipal buildings, and schools. There are a total of 367 critical facilities in the County. Table 2.5-1 summarizes the critical facilities in Columbia County by type and by municipality. For a complete listing of critical facilities, please see **Appendix E**.

Table 2.5-1: Columbia County Critical Facilities by type in each municipality (PEMA, 2010; Columbia County GIS, 2016).

Municipality	911 Center	Airport / Airstrip	Ambulance Centers	Camp-grounds	Religious Institutions	Day Care Centers	Fire Stations	Hospitals / Clinics	Lodging	Municipal Building	Nursing Home	Police Station	Educational Facility	Water Treatment Plant	*Total*
Beaver Township					2		1			1			1		*5*
Benton Borough		1	1		2	1	1			1		1	2		*10*
Benton Township				3	3					1			1	1	*9*
Berwick Borough			1		24	5	5	2	1	1	4	1	7	1	*51*
Town of Bloomsburg	1	1	2		15	7	1	2	1	1		2	5	1	*40*
Briar Creek Borough						2			1	1	2				*6*
Briar Creek Township					8	1	1		1	1		1			*13*
Catawissa Borough					3	3	1			1		1			*9*
Catawissa Township					3					1				1	*5*
Centralia Borough							1			1					*2*
Cleveland Township				3	2	1				1					*7*
Conyngham Township					3		3			1		1			*8*
Fishing Creek Township				3	6	2				1					*12*
Franklin Township				1	2					1			4		*8*

Greenwood Township		1		1	7				1	1	1	1	1		*14*
Hemlock Township					3	1	1		3	1		1	1		*11*
Jackson Township				1	3					1					*5*
Locust Township		1		3	4		1		1	1		1			*12*
Madison Township				1	3					1		1			*6*
Main Township					3		1			1		1			*6*
Mifflin Township				1	4	2	1		2	1	1			1	*13*
Millville Borough			1		2	2	1			1	1	1	3	1	*13*
Montour Township		1		2	2	3	1			1		1	1		*12*
Mt Pleasant Township				1	3					1					*5*
North Centre Township				1	6	1				1					*9*
Orange Township				5	1					1					*7*
Orangeville Borough					2		1			1	1	1		1	*7*
Pine Township		1			1				1	1					*4*
Roaring Creek Township										1					*1*
Scott Township					13	2	2	2	2	1	1	1	1	1	*26*

South Centre Township					2	5	1	1	1	1		1	5	1	*18*
Stillwater Borough					2					1					*3*
Sugarloaf Township					2		1		6	1					*10*
Total	*1*	*6*	*5*	*26*	*136*	*38*	*25*	*7*	*21*	*33*	*11*	*17*	*32*	*9*	*367*

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3. Planning Process

3.1. Update Process and Participation Summary

The HMPT exists to develop and coordinate the hazard mitigation planning process. In 2012 the HMPT was headed by the Columbia County Planning Commission. The Committee itself was composed of representatives from the Columbia County Planning Commission, Columbia County Emergency Management Agency (CCEAM), Columbia County Conservations District, Columbia County Commissioners, and municipal representatives, representatives from private industry and non-profit organizations, and Bloomsburg University. Public input in the draft plan was solicited in 2012 by providing opportunity to make comments on the draft plan, posted online to www.columbiaHMP.com.

In the 2017 HMP update process, the CCEMA took the responsibility of being the lead agency for the HMP. To begin the HMP update process, the CCEMA mailed meeting invitations to all municipal officials and EMC's (when applicable) in each municipality as well as the County Commissioners, adjacent county EMA's, and other stakeholders from federal, state and local agencies, non-profits, private industry, health care, and advocacy organizations. During the first meeting, a Contact Information Sheet was collected from each attendee; the HMPT mailing list was created from this contact information. Section 3.2 provides a discussion of the HMPT as well as a table of members and the organization or jurisdiction they represented.

Municipal officials and the other stakeholders continued to receive notification regarding all HMP meetings using their preferred mode of contact: regular mail, telephone, email, or some combination. Written notices were mailed to communities who had not provided an email address to ensure the municipality was informed of the meeting, and written letters and a meeting flyer were distributed to each municipality for the Final Public Meeting. A brief description of each meeting that was held can be found in Section 3.3. In addition, meeting minutes, invitations, and any reminders are available in Appendix C – Meeting and Other Participation Documentation.

In order to obtain information from municipalities and stakeholders, forms and surveys were distributed and collected throughout the planning process. Some of the forms were completed during the planning meetings while others were sent via email and were posted to the HMP website, ema.columbiapa.org, and completed and returned in between meetings. All municipalities were required to have a representative attend at least one meeting and provide pertinent information for the HMP update. Table 3.1-1 lists each municipality along with their specific participation and contributions to the planning process. In total, 32 of 33 municipalities participated in the planning process, thus achieving 97% participation. This represents an overall increase in participation of 6% as 30 of 33 jurisdictions participated in the 2012 HMP update. Sign-in sheets for each meeting with the names and organizations of participants are available in Appendix C along with all completed forms and surveys.

Table 3.1-1: Summary of participation from local municipalities and Bloomsburg University during the 2017 Hazard Mitigation Update Process

Municipality	Meetings				Worksheets/Surveys/Forms						Mitigation Strategy Participation
	Kickoff Nov. 10, 2015	Risk Assessment Meeting April 2016	Mitigation Strategy Workshop June 2016	Public Review of Draft Aug. 2016	Capability Assessment Survey	Evaluation of Identified Hazards and Risks	National Flood Insurance Program (NFIP) Survey	Mitigation Action Plan Review Worksheet	Risk Factor Evaluation	Existing Mitigation Strategy Goals and Objectives	Mitigation Actions
Beaver Township	x		x		x	x	x	x	x	x	x
Benton Borough			x		x	x	x	x			x
Benton Township	x		x		x	x	x	x			x
Berwick Borough	x		x	x	x	x	x	X			x
Bloomsburg, Town of	x	x	x	x	x	x	x	X	x		x
Bloomsburg University	x	x	x	x	x	x		X	x		x
Briar Creek Borough			x		x	x	x	x			x
Briar Creek Township	x		x	x	x	x	x	x			x
Catawissa Borough	x		x		x	x	x	X			x
Catawissa Township			x		x	x	x	x			x
Centralia Borough	Not participating in Hazard Mitigation Plan update										

Cleveland Township	x		x	x	x	x	x	X			x
Conyngham Township	x		x		x	x	X	x			x
Fishing Creek Township	x		x	x	x			x			x
Franklin Township	x		x	x	x	x	x	x			x
Greenwood Township	x		x		x	x	x	x			x
Hemlock Township	x	x	x		x	x	x	X	x	x	x
Jackson Township	x		x	x	x	x	x	x			x
Locust Township	x		x	x	x	x	x	x			x
Madison Township	x		x	x	x	x	x	x			x
Main Township	x		x		x	x	x	x		x	x
Mifflin Township	x		x		x	x	x	x	x	x	x
Millville Borough	x			x	x	x	x	x			x
Montour Township	x	x	x	x	x	x	x	X			x
Mount Pleasant Township	x		x	x	**Wishes to participate but didn't have anything to contribute on the forms. Spoke with Bob Black on 12/16/15**						x
North Centre Township	x		x	x	x	x	x	x			x

Orange Township			x		x	x	x	x			x
Orangeville Borough	x		x	x	**Wishes to participate but didn't have anything to contribute on the forms. Spoke with Neil Shultz on 12/16/15**						x
Pine Township	x		x		x	x		x			x
Roaring Creek Township	x		x	x	x	x	x	x			x
Scott Township	x	x	x		x	x	x	x			x
South Centre Township	x		x		x	x	x	x			x
Stillwater Borough	x		x		x	x	x				
Sugarloaf Township					x	x	x	x			x

With guidance from FEMA and PEMA, Columbia County Emergency Management Agency completed the 2017 HMP update process. The 2017 Columbia County HMPU process was completed in September 2016 but not approved [Date]. The 2017 plan follows an outline developed by PEMA in 2013 which provides a standardized format for all local HMPs in the Commonwealth of Pennsylvania. As a result, the format of the 2017 Columbia County HMP is similar to the 2012 HMP, and all information that was still current was carried over into the new plan. These changes made to the 2017 plan are summarized in Table 3.1-2. Additional update summaries are provided in for each section of the plan in Sections 4.1, 5.1, 6.1, and 7.1.

Table 3.1-2: Summary of changes to the format of the 2012 and 2017 version of the Columbia County HMP

2012 HMP Section	2017 HMP Section
1. Introduction	**1. Introduction**
1.1 Background	**1.1 Background**
1.2 Purpose	**1.2 Purpose**
1.3 Scope	**1.3 Scope**
1.4 Authority and References	**1.4 Authority and References**
2. Community Profile	**2. Community Profile**
2.1 Geography and Environment	**2.1 Geography and Environment**
2.2 Community Facts	**2.2 Community Facts**
2.3 Population and Demographics	**2.3 Population and Demographics**
2.4 Land Use and Development	**2.4 Land Use and Development**
2.5 Data Sources and Limitations	**2.5 Data Sources and Limitations**
3. Planning Process	**3. Planning Process**
3.1. Update Process and Participation Summary	**3.1. Update Process and Participation Summary**
3.2. The Planning Team	**3.2. The Planning Team**
3.3. Meetings and Documentation	**3.3. Meetings and Documentation**
3.4. Public & Stakeholder Participation	**3.4. Public & Stakeholder Participation**
3.5. Multi-Jurisdictional Planning	**3.5. Multi-Jurisdictional Planning**
4. Risk Assessment	**3.6 Existing Planning Mechanisms**
4.1. Update Process Summary	**4. Risk Assessment**
4.2. Hazard Identification	**4.1. Update Process Summary**
4.3. Hazard Profiles	**4.2. Hazard Identification**
4.4. Hazard Vulnerability Summary	**4.3. Hazard Profiles**
5. Capability Assessment	**4.4. Hazard Vulnerability Summary**
5.1. Update Process Summary	**5. Capability Assessment**
5.2. Capability Assessment Findings	**5.1. Update Process Summary**
6. Mitigation Strategy	**5.2. Capability Assessment Findings**
6.1. Update Process Summary	**6. Mitigation Strategy**
6.2. Mitigation Goals and Objectives	**6.1. Update Process Summary**
6.3. Identification and Analysis of Mitigation Techniques	**6.2. Mitigation Goals and Objectives**
6.4. Mitigation Action Plan	**6.3. Identification and Analysis of Mitigation Techniques**
7. Plan Maintenance	**6.4. Mitigation Action Plan**
7.1. Update Process Summary	**7. Plan Maintenance**
7.2. Monitoring, Evaluating and Updating the Plan	**7.1. Update Process Summary**
7.3. Continued Public Involvement	**7.2. Monitoring, Evaluating and Updating the Plan**
8. Plan Adoption	**7.3. Continued Public Involvement**
	8. Plan Adoption

3.2. The Planning Team

The 2017 Columbia County HMP update was led by a HMSG, which included:

1. Jessica Shoup, Operations and Training Officer of the Columbia County Emergency Management Agency
2. Jennifer Long, Emergency Management Coordinator of the Columbia County Emergency Management Agency
3. Eric Stahley, Resiliency Officer, Columbia County
4. Tim Murphy, Director, Columbia County Geographical Information Services

In order to represent the diverse stakeholders in the County, the HMSG developed a diversified list of potential HMPT members. Invitations were extended not only to municipal and county officials but also to adjacent jurisdictions, non-profit organizations, major employers, and federal, state, and county agencies with an interest or focus on hazard mitigation and emergency management. The HMSG worked throughout the process to plan and hold meetings, collect information, and conduct public outreach.

The stakeholders listed in Table 3.2-1 served on the 2017 HMPT, demonstrating their commitment to actively participate in the planning process by attending meetings, completing assessments, surveys, and worksheets, and/or submitting comments. The HMPT consisted of county and local officials including municipal supervisors and council members, emergency management coordinators, and major employers and institutions. In particular, Bloomsburg University's Public Safety staff has been an active participant in the development of this HMP. It is important to note that since many communities in Columbia County operate under a zone system of emergency management coordinators, one individual may have participated on behalf of multiple jurisdictions. The 2017 HMPT represents a broader group of stakeholders than participated in 2012. During the development of the 2012 plan, the Mitigation Committee was made up of County staff from the Public Safety, Tax Assessment, GIS offices with little involvement from non-profits, other government agencies, institutions, and businesses.

Table 3.2-1: Participants in the 2017 Columbia County HMP Update

Municipality/Organization	Participant(s)
Beaver Township	**Michael Neiswender, Tracy Miller**
Benton Borough	**Dan Jankowski**
Benton Township	**Walter Gordon, Debra Gordon**
Berwick Borough/Briar Creek Borough	**James Meighan, Greg Harkins, Cassandra Mowery**
Bloomsburg University	**Jennifer Haney, Belinda DeLeon, Tom Phillips, Jennifer Whisner**
Bloomsburg, Town of	**Sylvia Costa, Sandy Davis, Charles Fritz**
Briar Creek Township	**Carl Hess, Barry Rothery, John Zaginaylo, Harold Kern**
Catawissa Borough	**Don Traugh, Michael Lindenmuth**
Catawissa Township	**Dean Delsite, James Mollick**
Cleveland Township	**Allen Breach**

Columbia County Commissioners	**Chris Young, David Kovach**
Columbia County Department of Public Safety	**Jennifer Long, Jessica Shoup, Janina Everett, Kirsti Kritzer, Fredrick Hunsinger**
Columbia County GIS	**Tim Murphy, Mitch Kishbach, Amy Marshall**
Columbia County Housing Authority	**Rich Kisner**
Columbia County Planning	**Rachel Swartwood, Robert Aungst**
Columbia County Resiliency Office	**Eric Stahley**
Columbia Montour Area Agency on Aging	**Kathi Lynn**
Columbia Montour Chamber of Commerce	**Fred Gafney**
Columbia Montour Vocational Technical School	**Dave Bacher**
Conyngham Township	**Megan Janolek, Linda Tarlecki**
FEMA	**Matt McCullough**
Fishing Creek Township	**Earnest Bogart, James Kline, Jay Challingsworth**
Franklin Township	**Allen Breach**
Geisinger Nurse Family Partnership	**Loreen Comstock**
Greenwood Township	**Jim Moser, Alice Ringer**
Hemlock Township	**Melissa Matthews**
Jackson Township	**Clayton Emery**
Locust Township	**James Karnes, Allen Breach**
Madison Township	**Jim Moser, Alice Ringer**
Main Township	**Tom Shuman**
Mifflin Township	**Rick Brown, Joyce Brown**
Millville Borough	**Rob Bower**
Montour Township	**Joe Mullen**
Mount Pleasant Township	**Robert Black, John Gordner, Tammy Robbins, Tom Clymer**
North Centre Township	**Steven Hess, Sr.**
Orangeville Borough	**Neil Shultz**
Orange Township	**Erika Burkhart**
PEMA	**Chris Grimm, Tom Hughes, Ernie Szabo**
PennDOT	**Jon Harder**
Pine Township	**Jim Brown**
Roaring Creek Township	**Allen Breach**
Scott Township	**Paul Eyerly, Eric Stahley, Brittany Stastick**
SEDA-COG	**Bill Seigel, Terri Provost**
South Centre Township	**Dale Sneidman**
Stillwater Borough	**John Kline**

3.3. Meetings and Documentation

The following meetings were held during the planning process. All invitations, agendas, sign-in sheets, and minutes for these meetings are included in **Appendix C: Meeting and Other Participation Documentation.**

October 6, 2015: Internal County Kickoff Meeting held at the Columbia County Emergency Operation Center to discuss scope, schedule, project goals, invitees, available resources, and planning standards.

November 10, 2015: Community Kickoff Meeting held at the Espy Fire Department to introduce the project and to local stakeholders, inform community representatives of the HMP update process and schedule, and make a formal request for response to the *Capability Assessment Survey,* the *Evaluation of Identified Hazard and Risk Worksheet,* the *National Flood Insurance Program (NFIP) Worksheet,* and the *Mitigation Action Plan Review Worksheet*.

April 5, 2016: Risk Assessment Review Workshop held at the Columbia County Commissioners' Conference Room to review preliminary risk assessment results, discuss mitigation goals and objectives, and review actions that were included in the last plan.

June 9, 2106: Mitigation Action Workshop held in the conference room at 700 Sawmill Road to assist municipalities in reviewing prior mitigation actions and selecting new mitigation actions. Individual meetings were held with jurisdictions that were not able to attend this meeting to ensure that all had the opportunity to include mitigation actions in the project.

September 20, 2016: Final Public Meeting held to update the public about the HMP update process and findings. The meeting was advertised in the Press Enterprise newspaper. Verbal comments were noted in the meeting minutes and attendees had the opportunity to provide written comments on the HMP. Attendees were also informed of the opportunity to review the entire plan on the HMP update website, https://ema.columbiapa.org (HMP Tab) and provide written comments by mail, email, or using an online submission form.

3.4. Public & Stakeholder Participation

Each stakeholder was given multiple opportunities to participate in the HMP update process through invitations to meetings, reviews of risk assessment results and mitigation actions, and an opportunity to comment on the draft HMP update. The seven tools listed below were distributed with meeting invitations, at meetings, and on the HMP update website to solicit information, data, and comments from both local municipalities and other key stakeholders. Responses to these worksheets and surveys are included in **Appendix C: Meeting and Other Participation Documentation**.

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

2. Capability Assessment Survey: Collects information on local planning, regulatory, administrative, technical, fiscal, political and resiliency capabilities that can be included in the countywide mitigation strategy.

3. National Flood Insurance Program (NFIP) Survey: Collects information on each municipality's level of participation in the NFIP.

4. Mitigation Action Plan Review Worksheet: All municipalities in Columbia County were included in the 2012 HMP actions either individually or with group actions. They were asked to evaluate the status of projects submitted in the previous planning process, indicating if there had been progress, if a project had been discontinued or completed, and whether each project should be carried over into the 2017 Plan.

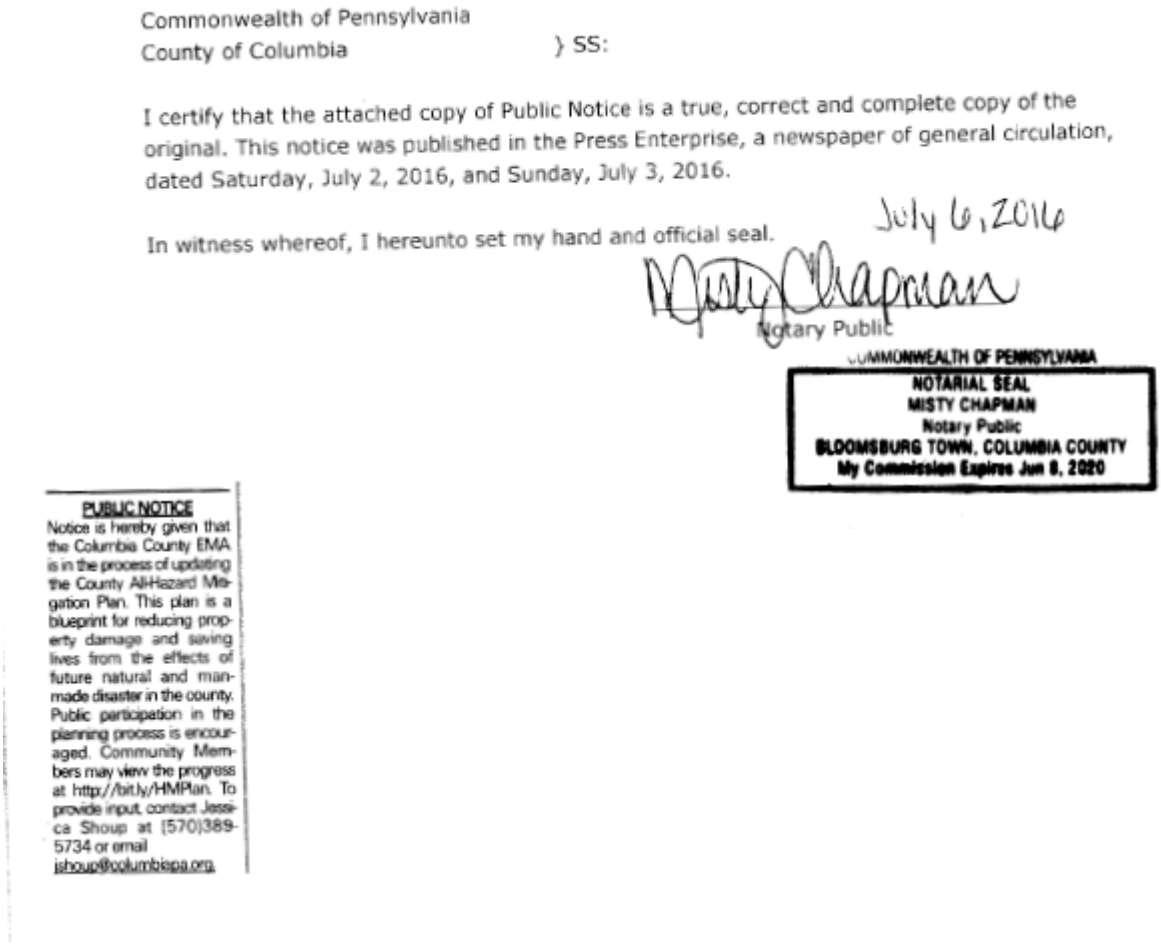
5. Countywide and Jurisdictional Risk Factor Evaluation Form: Collected comments on the draft Countywide Risk Factor Rankings and gave municipal officials a chance to evaluate their jurisdiction's unique risk for each hazard as compared to the County.

6. Mitigation Strategy Goal and Objective Comment Worksheet: Collected comments and suggestions from municipalities on the HMPU goals and objectives that had been vetted by the HMSG.

7. Mitigation Action Form: Allows communities to propose mitigation actions for the HMP and include information about each action such as a lead agency/department, implementation schedule, priority, estimated costs, and potential funding source(s).

Community participation and comments were encouraged throughout the planning process, most notably through the HMP update website, ema.columbiapa.com. This site acted as a repository for the entire planning process, including presentations, agendas, minutes, and worksheets from each meeting as well as promulgating meeting dates, times, and important announcements. The public was also encouraged to participate in the process by means of a newspaper notice that was published in the Press Enterprise newspaper to notify the citizens of Columbia County of the planning process and solicit input as well as to inform them of the date and time of the Public Review of Draft Meeting and the Draft Plan Comment Period. A copy of this newspaper notices are shown in Figure 3.4-1. Social media was also used to encourage public participation in the planning process. Notices were placed on the Columbia County EMA Facebook and Twitter page and can be seen in Figure 3.4-2.

Figure 3.4-1: Newspaper notice of Planning Process.



Commonwealth of Pennsylvania
County of Columbia } SS:

I certify that the attached copy of Public Notice is a true, correct and complete copy of the original. This notice was published in the Press Enterprise, a newspaper of general circulation, dated Saturday, July 2, 2016, and Sunday, July 3, 2016.

In witness whereof, I hereunto set my hand and official seal. July 6, 2016

Notary Public

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
MISTY CHAPMAN
Notary Public
BLOOMSBURG TOWN, COLUMBIA COUNTY
My Commission Expires Jun 8, 2020

PUBLIC NOTICE

Notice is hereby given that the Columbia County EMA is in the process of updating the County All-Hazard Mitigation Plan. This plan is a blueprint for reducing property damage and saving lives from the effects of future natural and man-made disaster in the county. Public participation in the planning process is encouraged. Community Members may view the progress at http://bit.ly/HMPlan. To provide input, contact Jessica Shoup at (570)389-5734 or email jshoup@columbiapa.org.

Figure 3.4-2: Newspaper notice of Public Review of Draft meeting and comment period.

STATE OF PENNSYLVANIA
COUNTY OF COLUMBIA } SS

Paula J. Ream being duly sworn according to law deposes and says that Press Enterprise is a newspaper of general circulation with its principal office and place of business at 3185 Lackawanna Avenue, Bloomsburg, County of Columbia and State of Pennsylvania, and was established on the 1st day of March, 1902, and has been published daily, continuously in said Town, County and State since that day and on the attached notice September 11, 18, 2016 that the affiant is one of the officers or publisher or designated agent of the owner or publisher of said newspaper in which legal advertisement was published; that neither the affiant nor Press Enterprise is interested in the subject matter of said notice and advertisement and that all of the allegations in the foregoing statement as to time, place, and character of publication are true.

PUBLIC NOTICE

Notice is hereby given that the Columbia County EMA is in the process of updating the County All-Hazard Mitigation Plan. This plan is a blueprint for reducing property damage and saving lives from the effects of future natural and man-made disaster in the county. The final public meeting for the plan update will be on Tuesday, September 20, 2016, at 6:00PM at the Summerhill Fire Department, 422 Summerhill Road, Berwick, PA 18603. Interested persons may view the draft plan at ema.columbiapa.org (HMP tab) beginning September 20, 2016. All comments should be submitted in writing no later than October 20, 2016, to Jessica Shoup at jshoup@columbiapa.org or PO Box 380, Bloomsburg, PA 17815.

.....

bscribed to before me this .....19.....day of September.....20.16...

Albert Lee Jensen

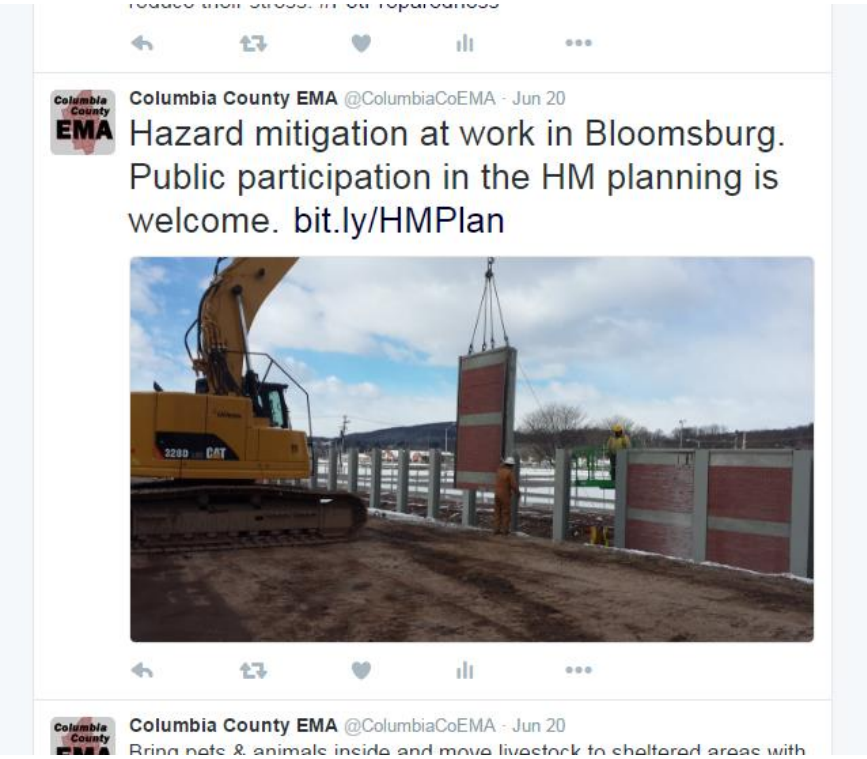
(Notary Public)

COMMONWEALTH OF PENNSYLVANIA
NOTARIAL SEAL
ALBERT LEE JENSEN, Notary Public
Scott Township, Columbia County
My Commission Expires April 21, 2020

And now,....., 20....., I hereby certify that the advertising and publication charges amounting to $.....for publishing the foregoing notice, and the fee for this affidavit have been paid in full.

.....

Figure 3.4-3: Examples of Social Media Notices Encouraging Public Participation



1. Additionally, notification of the HMP update sent to representatives from neighboring communities and other key stakeholders is included in **Appendix C** The HMSG posted the draft Columbia County HMP update on the HMP update website, https://ema.columbiapa.org (HMP tab) beginning on September 20, 2016 and accepted comments through October 20, 2016. The availability of the draft HMP was made public through the meeting and comment period public notice shown in Figure 3.4-1 and disseminating the information to the HMPT via email. Comments were submitted in writing (mail, email, or online form) to Jessica Shoup of Columbia County EMA, or online on the HMP Update website. One comment was received on the draft plan; it has been incorporated as appropriate. Copies of all comments received, including comments collected via the HMP website, are located in **Appendix C**.

3.5. Multi-Jurisdictional Planning

Table 3.1-1 documents jurisdictional presence at the meetings described in Section 3.3 and other involvement from each jurisdiction throughout the planning process. Each municipality was emailed or mailed invitations to all meetings and, if email addresses were available, received email reminders prior to each session. Individual meetings were held to give jurisdictions that previously been unable to physically attend any other meeting an opportunity to participate. Surveys and forms were emailed or mailed to jurisdictions along with letters requesting that local information be provided, and the forms (with instructions) were also posted to the HMP update website. A copy of all invitations, worksheets, forms, and participation documentation can be found in **Appendix C**.

In the end, 32 of 33 municipalities in the County participated in the plan, thus achieving 97% participation. This represents an overall increase in participation of 6% as only 30 of 33 jurisdictions participated in the update of the HMP in 2012. The non-participating jurisdiction was Centralia. In the cases of Centralia Borough, the municipality has a small population and has been ravaged by the Centralia Mine Fire; as a result, according to the County staff, they have little capacity to participate in any planning process. Contact was made with Centralia Borough and they declined the desire to participate in the planning process. They were advised of the benefits of participation and still chose not to participate.

Throughout the planning process, paper invitations were mailed, emails were sent, and phone calls made to the municipal building and address on file for the emergency management coordinators for each HMPU meeting.

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4. Risk Assessment

4.1. Update Process Summary

The risk assessment provides a factual basis for activities proposed by the County in their mitigation strategy. Hazards that may affect Columbia County are identified and defined in terms of their location and extent, magnitude of impacts, previous events, and probability of future events. This hazard profile structure is similar to that used in the 2012 HMP. All information from the previous plan has been incorporated and/or updated in the 2017 HMPU unless indicated.

The 2012 Columbia County HMP profiled ten natural hazards in the County: drought, earthquake, flood/flash flood/ice jam, hurricane/tropical storm/nor'easter, pandemic, landslide, radon exposure, tornado/windstorm, wildfire, and winter storm. Five human made hazards were also identified: dam failure, environmental hazards, levee failure, nuclear incidents, and utility interruption. In order to evaluate the hazards currently in the plan and select these new hazards significant to the County, the municipal representatives were asked to assess the change in risk for all hazards identified in the 2012 plan and vote on which hazards not previously identified but included in the Pennsylvania Standard State List of Hazards had the potential to impact Columbia County using the Evaluation of Identified Hazard and Risk Form. After an analysis of the responses (found in **Appendix C**), consultation with the Pennsylvania Standard State All-Hazard Mitigation Plan, the County's HVA, and the HMSG's assessment of hazard risk, it was decided by the HMSG that no new hazards would be included in the 2017 update.

Following hazard identification and profiling, a vulnerability assessment was conducted for each hazard to identify the impact of both natural and human-made hazard events on people, buildings, infrastructure, and the community, as appropriate. Each hazard is discussed in terms of its potential impact on individual communities, including the structures that may be at risk. This assessment allows the County and its municipalities to focus on and prioritize local mitigation efforts on areas that are most likely to be damaged or require early response to a hazard event. A vulnerability analysis was performed which identifies structures, critical facilities, and/or populations that may be impacted during hazard events and describes what events can do to physical, social, and economic assets. Depending upon data availability, assessment results consist of an inventory of vulnerable structures or populations. Finally, when available, potential losses were determined using historic data, data from the Columbia County GIS department, and structure assessed values.

In order to provide greater connections between the community and institutional hazard mitigation planning, Bloomsburg University was an active participant in this planning process, including the Risk Assessment. Bloomsburg University created a Hazard Mitigation Plan for the University in 2016. This plan profiled six hazards: floods/flash flooding/ice jam, pandemic/infectious disease, tornadoes/windstorms, civil disturbance, environmental hazards - hazardous materials releases, nuclear incidents, radon exposure, terrorism, and utility interruption. Any information from these hazard profiles indicating the unique vulnerability of the University and its population have been incorporated into this HMP in Section 4.3.X.5. For hazards profiled in the 2017 Columbia County HMP but not profiled in the University's plan, the University's assets are at equal risk to all assets in the Town of Bloomsburg, where all institutional assets are located.

4.2. Hazard Identification

Presidential Disaster and Emergency Declarations are issued when it has been determined that state and local governments need assistance in responding to a disaster event. Table 4.2-1 identifies ten Presidential Disaster Declarations and three Presidential Emergency Declarations issued between 1955 through 2016 that have affected Columbia County. Future disaster declarations will be available for view on the FEMA website at: http://www.fema.gov/news/disasters. This was the most current data that was available when the plan was updated for 2017. At that point there had been no further disasters declared for Columbia County.

Table 4.2-1: Presidential Disaster and Emergency Declarations affecting Columbia County.

Declaration Number	Date	Event
4030	September 2011	Remnants of Tropical Storm Lee
1649	June 2006	Flooding
3235*	September 2005	Hurricane Katrina Evacuee Assistance
1587	April 2005	Severe Storms and Flooding
1557	September 2004	Tropical Depression Ivan
3180*	March 2003	Snowstorm
1093	January 1996	Flooding
1085	January 1996	Blizzard
1015	March 1994	Winter Storm, Severe Storm
3105*	March 1993	Severe Winter Storm
523	October 1976	Severe Storms, Flooding
485	September 1975	Severe Storms, Heavy Rains, Flooding
400	July 1973	Severe Storms, Flooding
340	June 1972	Hurricane Agnes
Note: * Denotes a Presidential Emergency Declaration		

In addition to these Federally-declared events, nineteen events warranted Gubernatorial Proclamations of Emergency. These events are listed in Table 4.2-2.

Table 4.2-2: Gubernatorial Disaster Declarations or Proclamations affecting Columbia County.

Date	Event
January 2011	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
June 2006	Proclamation of Emergency – Flooding
September 2005	Proclamation of Emergency – Hurricane Katrina
September 2003	Hurricane Isabel/Henri
February 2003	Severe Winter Storm
September 1999	Hurricane Floyd
July 1999	Drought
September 1995	Drought
July 1991	Drought
February 1978	Blizzard
January 1978	Heavy Snow
September 1975 F	Flood (Eloise)
February 1974	Truckers Strike
February 1972	Heavy Snow
January 1966	Heavy Snow
August 1955	Flood (Diane)

Columbia County has also been offered Small Business Administration Disaster Assistance for three disaster events. This disaster assistance qualifies communities for access to affordable, timely, and accessible financial assistance. Table 4.2-3 provides details for these events.

Table 4.2-3: Small Business Administration Disaster Declarations affecting Columbia County.

Date	Event
September 2011	Tropical Storm Lee
October 2009	Fire
December 2006	Severe Storms and Tornadoes
November 2006	Severe Storms and Flooding

Since 1955, declarations have been issued for a variety of hazard events, including hurricanes, tornadoes, severe winter storms, and flooding. A unique Presidential Emergency Declaration was issued in September 2005; through Emergency Declaration 3235, President George W. Bush declared that a state of emergency existed in the Commonwealth of Pennsylvania and ordered federal aid to supplement Commonwealth and local response efforts to help people evacuated from their homes due to Hurricane Katrina. All counties within Pennsylvania, including Columbia County, were indirectly affected by Hurricane Katrina as a result of evacuee assistance.

4.2.2. Summary of Hazards

The HMPT was provided the Pennsylvania Standard List of Hazards to be considered for evaluation in the 2017 HMP. Following a review of the hazards considered in the 2012 HMP and the Standard List of Hazards, the HMPT decided that the 2017 plan should identify, profile, and analyze fifteen hazards. The hazards include all hazards profiled in the 2012 plan. Table 4.2-4 contains a complete list of the fifteen hazards that have the potential to impact Columbia County as identified through previous risk assessments and input from those that participated in the 2017 HMP update. Hazard profiles are included in Section 4.3 for each of these hazards.

Table 4.2-4: Hazards identified and profiled in the 2017 Columbia County HMPU

Hazard	Hazard Description
Natural Hazards	
Drought	Drought is a natural climatic condition which occurs in virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought. This hazard is of particular concern in Pennsylvania due to the presence of farms as well as water-dependent industries and recreation areas across the Commonwealth. A prolonged drought could severely impact these sectors of the local economy, as well as residents who depend on wells for drinking water and other personal uses. (National Drought Mitigation Center, 2006).
Earthquake	An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10-20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking which is dependent upon amplitude and duration of the earthquake. (FEMA, 1997).
Flood, Flash Flood, Ice Jam	Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in Pennsylvania. Flooding events are generally the result of excessive precipitation. General flooding is typically experienced when precipitation occurs over a given river basin for an extended period of time. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious surfaces. The severity of a flood event is dependent upon a combination of stream and river basin topography and physiography, hydrology, precipitation and weather patterns, present soil moisture conditions, the degree of vegetative clearing as well as the presence of impervious surfaces in and around flood-prone areas. (NOAA, 2009). Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams. All forms of flooding can damage infrastructure (USACE, 2007).
Hurricane, Tropical Storm, Nor'easter	Hurricanes, tropical storms, and nor'easters are classified as cyclones and are any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise (in the Northern Hemisphere) and whose diameter averages 10-30 miles across. While most of Pennsylvania is not directly affected by the devastating impacts cyclonic systems can have on coastal regions, many areas in the state are subject to the primary damaging forces associated with these storms including high-level sustained winds, heavy precipitation, and tornadoes. Areas in southeastern Pennsylvania could be susceptible to storm surge and tidal flooding. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico during the official Atlantic hurricane season (June through November). (FEMA, 1997).

Landslide	A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation reacting to the force of gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, and changes in groundwater levels. Mudflows, mudslides, rockfalls, rockslides, and rock topples are all forms of a landslide. 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 & Wilshusen, 2001).
Pandemic and Infectious Disease	A pandemic occurs when infection from of a new strain of a certain disease, to which most humans have no immunity, substantially exceeds the number of expected cases over a given period of time. Such a disease may or may not be transferable between humans and animals. (Martin & Martin-Granel, 2006).
Radon Exposure	Radon is a cancer-causing natural radioactive gas that you can't see, smell, or taste. It is a large component of the natural radiation that humans are exposed to and can pose a serious threat to public health when it accumulates in poorly ventilated residential and occupation settings. According to the USEPA, radon is estimated to cause about 21,000 lung cancer deaths per year, second only to smoking as the leading cause of lung cancer (EPA 402-R-03-003: EPA Assessment…, 2003). An estimated 40% of the homes in Pennsylvania are believed to have elevated radon levels (Pennsylvania Department of Environmental Protection, 2009).
Tornado, Wind Storm	A wind storm can occur during severe thunderstorms, winter storms, coastal storms, or tornadoes. Straight-line winds such as a downburst have the potential to cause wind gusts that exceed 100 miles per hour. Based on 40 years of tornado history and over 100 years of hurricane history, FEMA identifies western and central Pennsylvania as being more susceptible to higher winds than eastern Pennsylvania. (FEMA, 1997). A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes or tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of high wind velocities and windblown debris. According to the National Weather Service, tornado wind speeds can range between 30 to more than 300 miles per hour. They are more likely to occur during the spring and early summer months of March through June and are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small, short-lived tornadoes can inflict tremendous damage. Destruction ranges from minor to catastrophic depending on the intensity, size, and duration of the storm. Structures made of light materials such as mobile homes are most susceptible to damage. Waterspouts are weak tornadoes that form over warm water and are relatively uncommon in Pennsylvania. Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (NOAA, 2002). Based on NOAA Storm Prediction Center Statistics, the number of recorded F3, F4, & F5 tornadoes between 1950-1998 ranges from <1 to 15 per 3,700 square mile area across Pennsylvania (FEMA, 2009). A water spout is a tornado over a body of water (American Meteorological Society, 2009).
Wildfire	A wildfire is a raging, uncontrolled fire that spreads rapidly 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. Wildfires can occur at any time of the year, but mostly occur during long, dry hot spells. Any small fire in a wooded area, 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 fields, grass, brush, and forests. 98% of wildfires in Pennsylvania are a direct result of people, often caused by debris burns (PA DCNR, 1999).

Winter Storm	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. A winter storm can range from a moderate snowfall or ice event over a period of a few hours to blizzard conditions with wind-driven snow that lasts for several days. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility and disrupt transportation. The Commonwealth of Pennsylvania has a long history of severe winter weather. (NOAA, 2009).
Human-Made Hazards	
Dam Failure	A dam is a barrier across flowing water that obstructs, directs, or slows down water flow. Dams provide benefits such as flood protection, power generation, drinking water, irrigation, and recreation. Failure of these structures results in an uncontrolled release of impounded water. Failures are relatively rare, but immense damage and loss of life is possible in downstream communities when such events occur. Aging infrastructure, hydrologic, hydraulic and geologic characteristics, population growth, and design and maintenance practices should be considered when assessing dam failure hazards. The failure of the South Fork Dam, located in Johnstown, PA, was the deadliest dam failure ever experienced in the United States. It took place in 1889 and resulted in the Johnstown Flood which claimed 2,209 lives (FEMA, 1997). Today there are approximately 3,200 dams and reservoirs throughout Pennsylvania (Pennsylvania Department of Environmental Protection, 2009).
Environmental Hazards	Environmental hazards are hazards that pose threats to the natural environment, the built environment, and public safety through the diffusion of harmful substances, materials, or products. For the purposes of the SSAHMP, environmental hazards include the following: Hazardous material releases at fixed facilities or in transit; including toxic chemicals, infectious substances, bio hazardous waste, and any materials that are explosive, corrosive, flammable, or radioactive (PL 1990-165, § 207(e)). Coal mining incidents; including the release of harmful chemical and waste materials into water bodies or the atmosphere, explosions, fires, and other hazards and threats to life safety stemming from mining (Environmental Protection Agency, Natural Disaster PSAs, 2009). Oil and gas well incidents; including the release of harmful chemical and waste materials into water bodies or the atmosphere, explosions, fires, and other hazards and threats to life safety stemming from oil and gas extraction(Environmental Protection Agency, Natural Disaster PSAs, 2009).
Levee Failure	A levee is a human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding (Interagency Levee Policy Review Committee, 2006). Levee failures or breaches occur when a levee fails to contain the floodwaters for which it is designed to control or floodwaters exceed the height of the constructed levee. 51 of Pennsylvania's 67 counties have been identified as having at least one levee (FEMA Region III, 2009).
Nuclear Incidents	Nuclear accidents generally refer to events involving the release of significant levels of radioactivity or exposure of workers or the general public to radiation (FEMA, 1997). Nuclear accidents/incidents can be placed into three categories: 1) Criticality accidents which involve loss of control of nuclear assemblies or power reactors, 2) Loss-of-coolant accidents which result whenever a reactor coolant system experiences a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating make-up system, and 3) Loss-of-containment accidents which involve the release of radioactivity. The primary concern following such an incident or accident is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g. death, burns, severe impairment), chronic health effects (e.g. cancer), and psychological effects. (FEMA, 1997).

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

4.3. Hazard Profiles

4.3.1. Drought

4.3.1.1. Location and Extent

Droughts are defined as the consequence of a natural reduction in the amount of precipitation expected over an extended period of time, usually a season or more in length. Droughts are regional climatic events, so they typically impact all communities in a relatively uniform fashion with only minor localized variations in rainfall events. Droughts often occur across county boundaries, affecting large areas of Pennsylvania at the same time. The spatial extent for areas of impact can range from localized areas in Pennsylvania to the entire Mid-Atlantic region. Areas with extensive agriculture uses are particularly vulnerable to drought; 35% of the total land acreage of Columbia County (over 110,000 acres) is devoted to agricultural uses that are spread throughout nearly every municipality.

4.3.1.2. Range of Magnitude

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

1. Precipitation deficits (measured as the departure from normal, 30-year average precipitation)
2. Stream flows (based on exceedances)

3. Groundwater levels monitored in each county (exceedances of 75, 90, and 95 are used to indicate watch, warning, and emergency)
4. Soil moisture – provided in the form of the Palmer Drought Severity Index – a soil moisture algorithm calibrated for relatively homogeneous regions which measures dryness based on recent precipitation and temperature (see Table 4.3.1-1).
5. Reservoir storage levels in several large public water supply reservoirs (especially three New York City reservoirs in upper Delaware River Basin)

Table 4.3.1-1: Palmer Drought Severity Index (PSDI) classifications (NDMC, 2015).

Severity Category	PSDI Value
Extremely wet	4.0 or more
Very wet	3.0 to 3.99
Moderately wet	2.0 to 2.99
Slightly wet	1.0 to 1.99
Incipient wet spell	0.5 to 0.99
Near normal	0.49 to -0.49
Incipient dry spell	-0.5 to -0.99
Mild drought	-1.0 to -1.99
Moderate drought	-2.0 to -2.99
Severe drought	-3.0 to -3.99
Extreme drought	-4.0 or less

Phases of drought preparedness in Pennsylvania in order of increasing severity are:

- Drought Watch: A period to alert government agencies, public water suppliers, water users and the public regarding the 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 if conditions worsen. A request for voluntary water conservation is made. The objective of voluntary water conservation measures during a drought watch is to reduce water uses by 5 percent in the affected areas. Due to varying conditions, individual water suppliers or municipalities may be asking for more stringent conservation actions.

- Drought Warning: This phase involves 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 uses by 10-15 percent in the affected areas. Due to varying conditions, individual water suppliers or municipalities may be asking for 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 priority water uses and to avoid unnecessary economic dislocations. 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 fifteen 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.

The effects of a drought can be far-reaching in both the economic and environmental realms. Economic impacts include the reduced productivity of aquatic resources, mandatory water use restrictions, well failures, cutbacks in industrial production, agricultural losses, and limited recreational opportunities. Environmental impacts of drought include:

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

Based on the County's disaster history and other drought occurrence data, the worst drought event in Columbia County occurred in the summer of 1999. Extended dry weather spurred Governor Ridge to declare a drought emergency in 55 counties, including Columbia. During this event, precipitation deficits for that summer averaged 5-7 inches; the Susquehanna River hit record low flows, streams were empty, and wells dried up. Crop damages indicated losses of

over $500 million statewide, and crop losses totaled 70-100%. There were additional losses from the decline of milk production due to the drought (NCDC, 2011).

4.3.1.3. Past Occurrence

The Department of Environmental Protection (PA DEP) maintains the most comprehensive data on drought occurrences across the Commonwealth. Declared drought status from 1980 to 2015 is shown in Table 4.3.1-2. Descriptions of drought status categories (i.e. *watch, warning, and emergency*) are included in Section 4.3.1.2. Columbia County's record of droughts prior to 1980 is limited, but the County's disaster history indicates that a severe drought occurred in 1963 resulting in a Gubernatorial Proclamation of Disaster.

Table 4.3.1-2: Past drought events in Columbia County (PA DEP 2015).

Date	Drought Status	Date	Drought Status
Nov 18, 1980 - Apr 20, 1982	Emergency	Mar 15, 1999 - Jun 10, 1999	Watch
Apr 26, 1985 - Jul 29, 1985	Watch	Jun 10, 1999 - Jun 18, 1999	Warning
Jul 29, 1985 – Oct 22, 1985	Watch	Jun 18, 1999 - Jul 20, 1999	Warning
Oct 22, 1985 - Oct 29, 1985	Watch	Jul 20, 1999 - Sep 30,1999	Emergency
Oct 29, 1985 - Dec 19, 1985	Watch	Sep 30, 1999 - Dec 16, 1999	Watch
Jul 7, 1988 - Aug 24, 1988	Watch	Dec 16, 1999 - Feb 25,2000	Watch
Aug 24, 1988 - Dec 12, 1988	Watch	Feb 25, 2000 - May 5, 2000	Watch
Jun 28, 1991 - Jul 24, 1991	Warning	Aug 8, 2001 - Aug 24, 2001	Watch
Jul 24, 1991 - Aug 16, 1991	Emergency	Aug 24, 2001 - Nov 6, 2001	Watch
Aug 16, 1991 - Sep 13, 1991	Emergency	Nov 6, 2001 - Dec 5, 2001	Watch
Sep 13, 1991 - Oct 21, 1991	Emergency	Dec 5, 2001 - Feb 12, 2002	Warning
Oct 21, 1991 - Jan 16, 1992	Warning	Feb 12, 2002 - May 13, 2002	Warning
Jan 17, 1992 - Apr 20, 1992	Warning	May 13, 2002 - Jun 14, 2002	Warning
Apr 20, 1992 - Jun 23, 1992	Warning	Aug 9, 2002 - Sep 5, 2002	Watch
Sep 1, 1995 - Sep 20, 1995	Warning	Sep 5, 2002 - Nov 7, 2002	Warning
Sep 20, 1995 - Nov 8, 1995	Emergency	Apr 11, 2006 - Jun 30, 2006	Watch
Nov 8, 1995 - Dec 18, 1995	Warning	Aug 8, 2007 - Sep 5, 2007	Watch
Jul 17, 1997 - Oct 27, 1997	Watch	Sep 5, 2007 - Oct 5, 2007	Watch
Oct 27, 1997 - Nov 13, 1997	Watch	Oct 5, 2007 - Jan 11, 2008	Watch

Dec 3, 1998 - Dec 8, 1998	Watch	Sep 16, 2010 – Nov 10, 2010	Watch
Dec 8, 1998 - Dec 14, 1998	Watch	Mar 24, 2015 – Jun 17, 2015	Watch
Dec 14, 1998 - Dec 16, 1998	Warning	Jun 17, 2015 – Jul 10, 2015	Watch
Dec 16, 1998 - Jan 15, 1999	Warning		
Jan 15, 1999 - Mar 15, 1999	Warning		

4.3.1.4. Future Occurrence

It is difficult to forecast the exact severity of future drought events. However, County staff indicates that based upon the most recent data provided by the PA DEP it appears drought events have decreased. During times of drought the impact of shortages on municipal water suppliers is expected to remain minor to moderate, however the impact could become more severe for those living in rural areas, especially with increased development in those areas and the economic dependence on water supply for agricultural uses. Based on national data from 1895-1995, Columbia County is in severe or extreme drought approximately 10-14.9% percent of the time (see Figure 4.3.1-1). This is equivalent to a PDSI value of less than or equal to -3. Therefore, the future occurrence of a drought can be considered *possible* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

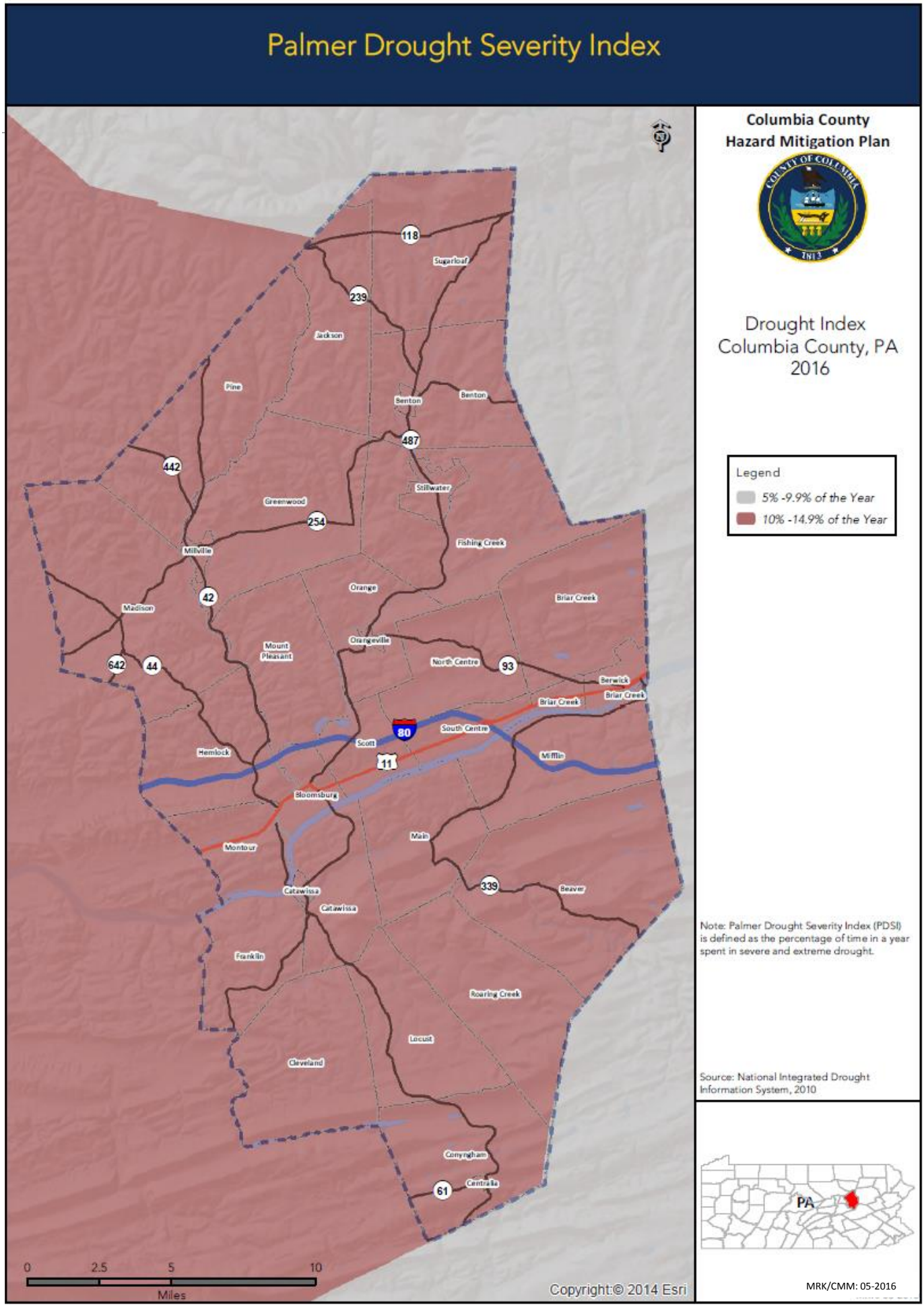


Figure 4.3.1-1: PDSI value for Columbia County (Columbia County GIS, 2016).

4.3.1.5. Vulnerability Assessment

As indicated in Section 4.3.2.2, the sizeable agricultural economy and community in Columbia County is most vulnerable to droughts and other water supply deficiencies. Historical losses are usually crop damage and losses and reduced livestock productivity rather than injuries or deaths of individuals. Columbia County ranks 28th in the total value of agricultural products sold, but it ranks 13th in crops, including nursery and greenhouse products and 1st in the production of cut Christmas trees and short rotation woody crops. The total value of all agricultural products is nearly $74.3 million annually (USDA, 2012). Nearly 66% of this total is the production of crops; the remaining 34% is made up of livestock, poultry, and their products.

Water supplies are also vulnerable to the effects of drought, particularly in locations where citizens rely on wells for their fresh drinking water. Future droughts will quickly affect those systems relying on surface supplies while those on wells should be able to handle short-term droughts without any major problem. However, longer-term droughts which inhibit recharging of groundwater aquifers will extend the problems of well owners for an undetermined length of time. As a result, Columbia County residents that use private domestic wells are more vulnerable to droughts. Table 4.3.1-3 shows the number of domestic wells per municipality.

(Note: Data for domestic wells in municipalities not served by a public water system were calculated by using assumptions of the presence of a domestic well on each addressed structure. The domestic well data for municipalities served by a public water system was obtained from the Pennsylvania Groundwater Information System (PaGWIS). **PaGWIS relies on voluntary submissions of well record data by well drillers; as a result, it is not a complete database of all domestic wells in the County.** The combinations of these two are the most complete dataset of domestic wells available. The Columbia County GIS Director estimates this data to be 80-90% accurate and finds this to be the most effective way for our county to calculate this data)

Table 4.3.1-3: Domestic Well Data for Columbia County. (Columbia County GIS, 2016)

Municipality	Number of Reported Domestic Wells	Municipality	Number of Reported Domestic Wells
Beaver Township	460	Locust Township	723
Benton Borough	27	Madison Township	755
Benton Township	651	Main Township	402
Berwick Borough	43	Mifflin Township	513
Bloomsburg, Town of	60	Millville Borough	17
Briar Creek Borough	155	Montour Township	629
Briar Creek Township	1,576	Mount Pleasant Township	653
Catawissa Borough	22	North Centre Township	734
Catawissa Township	477	Orange Township	586
Centralia Borough	3	Orangeville Borough	4
Cleveland Township	584	Pine Township	559
Conyngham Township	435	Roaring Creek Township	308
Fishing Creek Township	853	Scott Township	142
Franklin Township	314	South Centre Township	112
Greenwood Township	897	Stillwater Borough	122
Hemlock Township	1011	Sugarloaf Township	732
Jackson Township	342	**Grand Total**	14,901

4.3.2. Earthquake

4.3.2.1. Location and Extent

Earthquake events in Pennsylvania do not typically impact areas greater than 100 km from the epicenter of the event and are usually mild events. The Department of Earth Sciences at Millersville University identified relative earthquake hazard zones for Pennsylvania. As seen in Figure 4.3.2-1, the County falls into the “slight” zone.

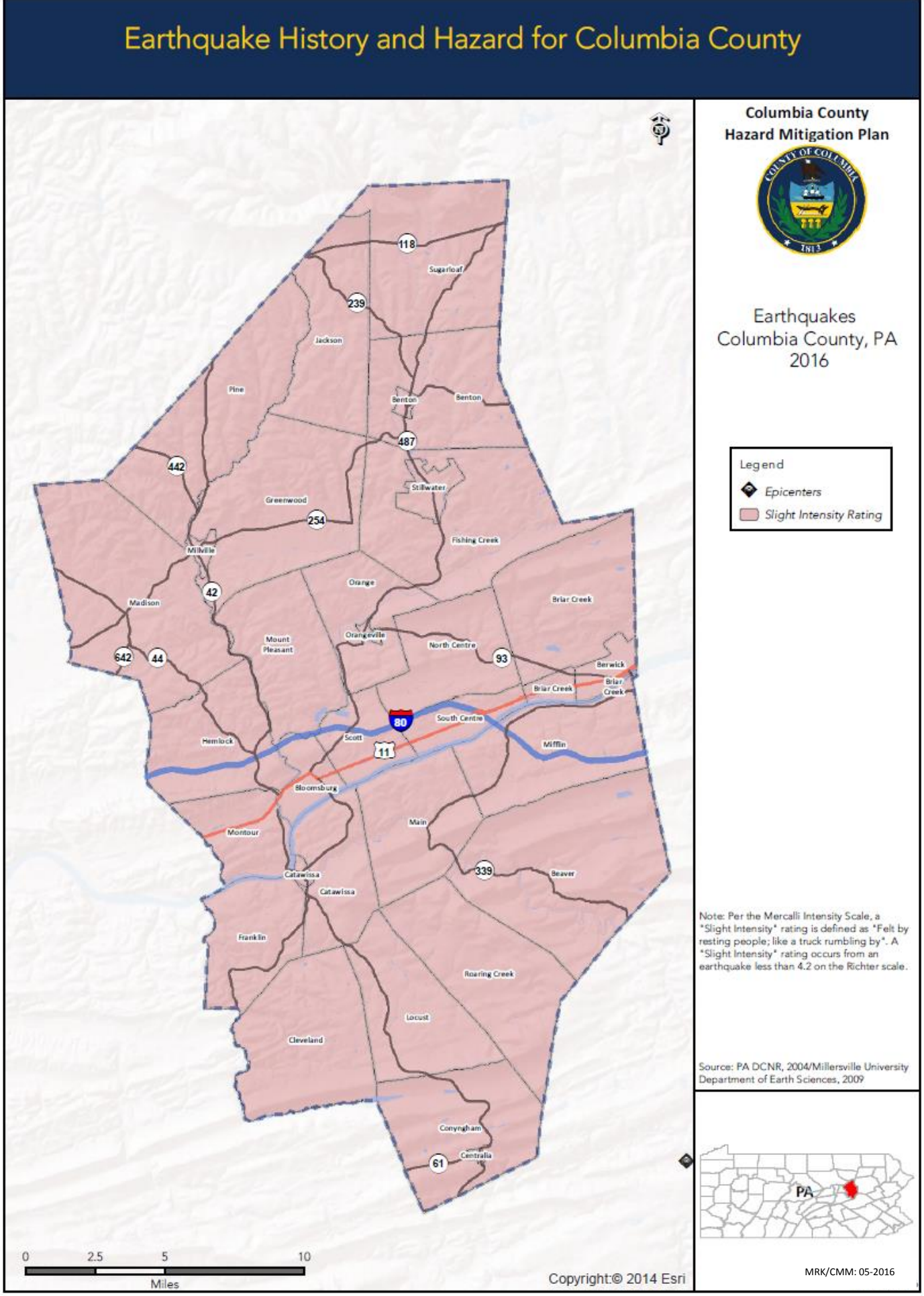


Figure 4.3.2-1: Earthquake hazard zones for Pennsylvania, highlighting Columbia County (Columbia County GIS, 2016)

4.3.2.2. Range of Magnitude

Earthquake magnitude is often measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake. Table 4.3.2-1 summarizes Richter Scale Magnitudes as they relate to the spatial extent of impacted areas. A historical survey of earthquakes occurring near Columbia County indicates that earthquakes have generally had magnitudes of less than 3.5, and Pennsylvania has not experienced any earthquakes with a magnitude greater than 6.0.

Table 4.3.2-1: Richter scale magnitudes and associated earthquake size effects.

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
Less than 3.5	Generally not felt, but recorded.
3.5-5.4	Often felt, but rarely causes damage
Under 6.0	At most, slight damage to well-designed buildings; can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas where people live up to about 100 kilometers across.
7.0-7.9	Major earthquake; can cause serious damage over large areas.
8.0 or greater	Great earthquake; can cause serious damage in areas several hundred kilometers across.

The Richter scale does not give any indication of the impact or damage of an earthquake, although it can be inferred that higher magnitude events cause more damage. Instead, the impact of an earthquake event is measured in terms of earthquake intensity, usually measured using the Modified Mercalli Intensity Scale, shown in Table 4.3.2-2. Because Columbia County is not on an active fault line, little or no damage is expected from these earthquake events. However, since 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 Columbia County. As described in Table 4.3.2-1, this magnitude of event would be felt and non-stationary objects may shake or fall off shelves, but damage would be very mild, particularly in populated areas of the County.

Table 4.3.2-2: 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	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	<4.2
IV	Moderate	Felt by people walking	<4.2
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	<5.4
VII	Very Strong	Mild alarm, walls crack, plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged	<6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open	<6.9
X	Disastrous	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed, general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction, trees fall, ground rises and falls in waves	>8.1

Environmental impacts of earthquakes can be numerous, widespread, and devastating, particularly if indirect impacts like economic impacts are considered. Some examples of these impacts are listed below, but are unlikely to occur in Columbia County:

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

4.3.2.3. Past Occurrence

According to records maintained by the Pennsylvania DCNR, there has never been an earthquake with an epicenter located in Columbia County. However, as shown in Figure 4.3.2- 2, there have been some minor events located in Luzerne, Schuylkill, Sullivan, and Lycoming Counties. On the whole, though, these have largely been minor events with low magnitudes and intensities.

4.3.2.4. Future Occurrence

One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. Peak horizontal ground acceleration (PHGA) measures the strength of ground movements in this manner. PGHA is the percent of *g* (acceleration due to gravity) experienced during the earthquake or the rate in change of motion of the earth's surface during an earthquake as a percent of the

established rate of acceleration due to gravity. On general, an acceleration of 10- to 15- percent of gravity is associated with structural damage to ordinary buildings not designed to withstand earthquakes, although soil conditions at individual sites will impact the amount of damage.

The US Geologic Survey models contours which represent earthquake ground motions that have a 10-percent probability of being experienced over a 50-year period. The PGHA value for Columbia County is between two and three. These values correspond to events with low intensities and an expectation of little or no structural damage. Overall, the future occurrence of earthquakes in Columbia County can be considered *unlikely*, as defined by the Risk Factor methodology probability criteria (see Table 4.4-1).

4.3.2.5. Vulnerability Assessment

Earthquakes of the magnitude seen in Northeast Pennsylvania are small and shallow. Based on the past history of earthquake events near Columbia County, the County's vulnerability to this hazard is expected to be low. In the event of an earthquake, unanchored objects may be upset, but few damages are expected.

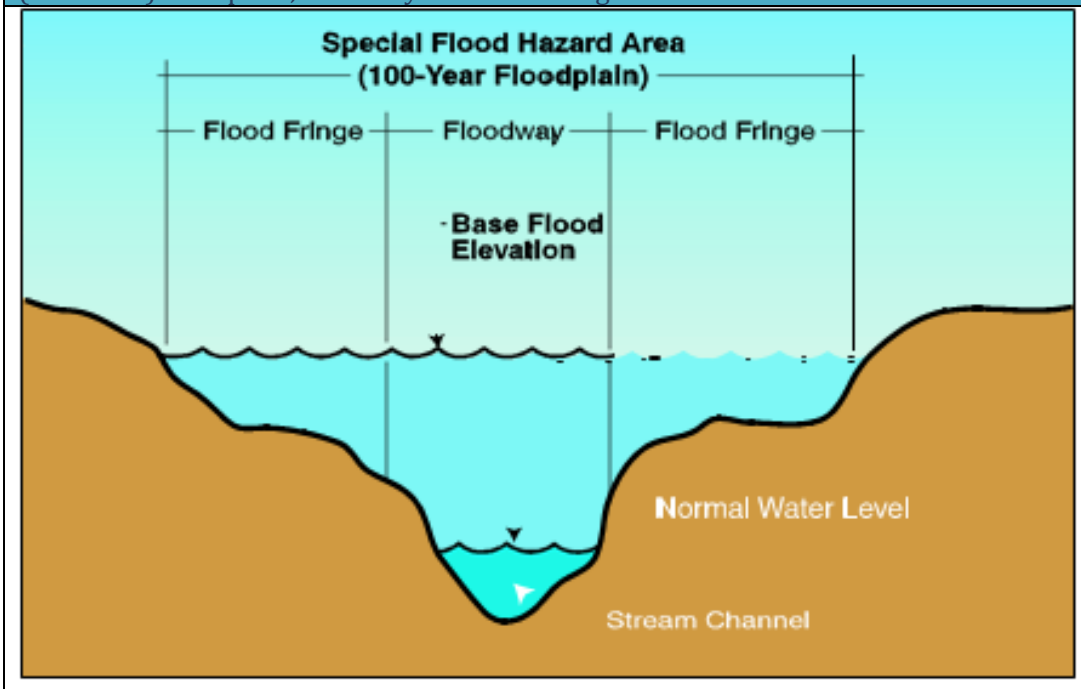
4.3.3. Flood, Flash Flood, Ice Jam

4.3.3.1. Location and Extent

Most communities in Columbia County are located along the stream and creek valleys throughout the County, many of which are flood prone as seen in Figure 4.3.2-2. Excess water from snowmelt or rainfall accumulates and overflows onto stream banks and adjacent floodplains. Floodplains are lowlands adjacent to rivers, streams and creeks that are subject to recurring floods. The size of the floodplain is described by the recurrence interval of a given flood. Flood recurrence intervals are explained in more detail in Section 4.3.2.4. However, in assessing the potential spatial extent of flooding it is important to know that a floodplain associated with a flood that has a 10 percent chance of occurring in a given year is smaller than the floodplain associated with a flood that has a 0.2% annual chance of occurring. Community development of the floodplain has resulted in frequent flooding in these areas.

The National Flood Insurance Program (NFIP), for which Flood Insurance Rate Maps (FIRM) are published, identifies the 1% annual chance flood. This 1% annual chance flood event is used to delineate the SFHA and identify Base Flood Elevations. Figure 4.3.3-1 illustrates these terms. The SFHA serves as the primary regulatory boundary used by FEMA, the Commonwealth of Pennsylvania and Columbia County local governments.

Figure 4.3.3-1: Diagram identifying Special Flood Hazard Area, 1% annual chance (100-Year) floodplain, floodway and flood fringe.



The Effective Countywide DFIRMs were released for Columbia County and all communities on August 19, 2008. All communities within the County are now shown on a single set of countywide FIRMs. Prior to the publication of this digital data, flood hazard information from FEMA was available through paper FIRMs and Q3 data. These final FIRMs for Columbia County can be obtained from the FEMA Map Service Center (http://www.msc.fema.gov). These maps can be used to identify the expected spatial extent and elevation of flooding from a 1% and 0.2% annual chance event. All of the municipalities in the County except Centralia were determined to have SFHA. Centralia has only Zone X but is still a participant in the NFIP. These are still considered to be the most current DFIRM maps as of 2016.

Figure 4.3.3-2 shows the location of watercourses and flood zones in Columbia County identified in the DFIRM database. The location of approximate and detailed (including Base Flood Elevations) Special Flood Hazard Areas (1% annual-chance-zones) are shown. Flooding occurs in the major watersheds and along the major waterways in Columbia County. The largest of these waterways is the Susquehanna River; other waterways with frequent flooding include the Big and Little Fishing Creeks, Green Creek, Huntington Creek, Briar Creek, Roaring Creek, Mugser Run, and Catawissa Creek. The County also indicates that the Big and Little Fishing Creeks, Green Creek, Huntington Creek, Briar Creek, Roaring Creek, Mugser Run, and Catawissa Creek are prone to flash flooding. Backwater flooding in the communities bordering the Susquehanna River is also an issue, especially for the Town of Bloomsburg. In the vicinity of Bloomsburg, the river has very little slope and shallow banks, so the river flows more slowly in the area, hindering Fishing Creek's normal discharge and causing widespread backwater and overbank flooding that can cover up to 33% of the landmass of Bloomsburg (Bloomsburg Planning Commission, 2009).

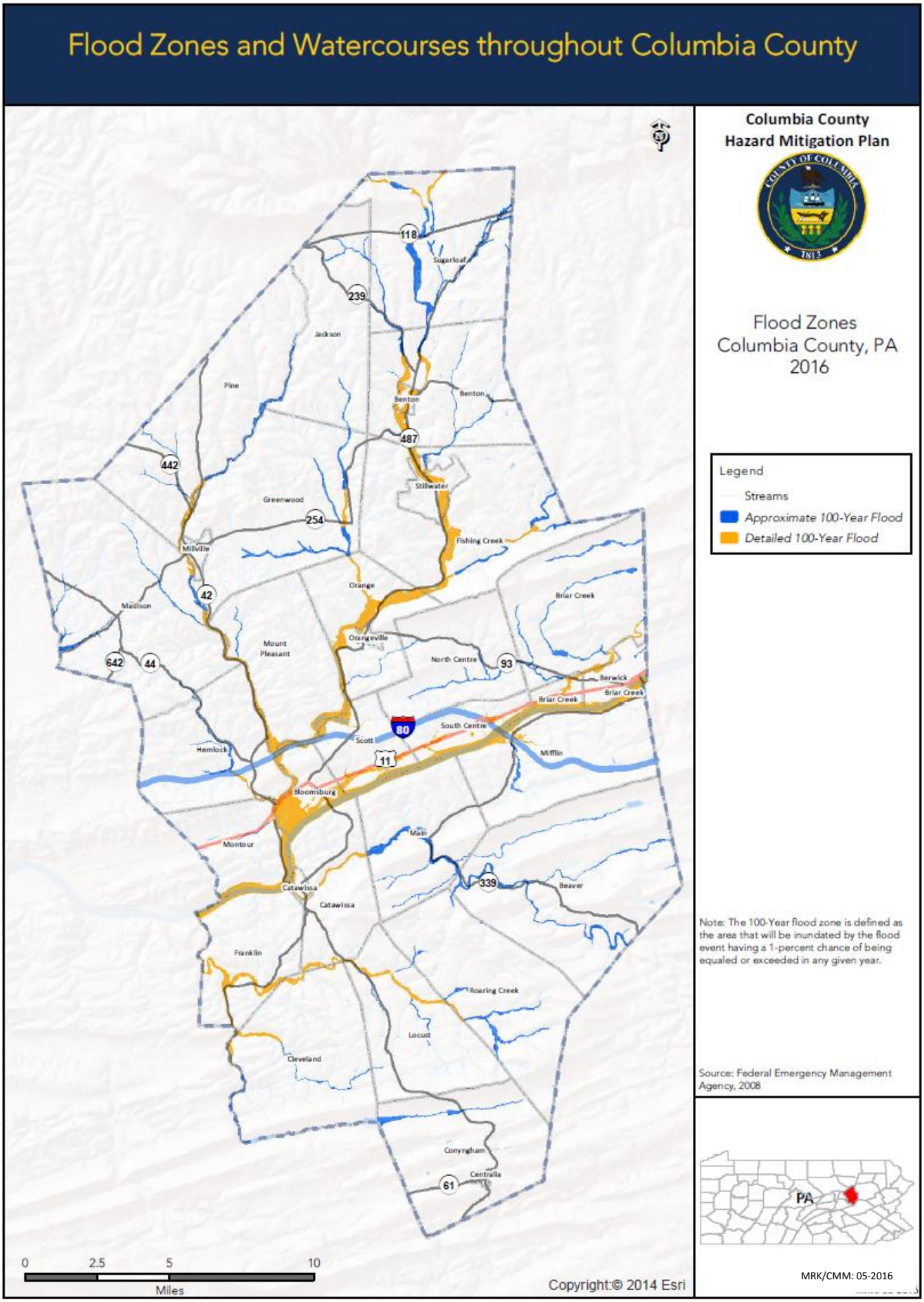


Figure 4.3.3-2: Map showing the location of watercourses and flood zones throughout Columbia County (Columbia County GIS, 2016).

4.3.3.2. Range of Magnitude

Floods are considered hazards when people and property are affected. Most injuries and deaths from flooding happen when people are swept away by flood currents and most property damage results from inundation by sediment-filled water. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, or other impervious developed areas. Flooding can occur in individual municipalities within Columbia County or it can have a countywide affect, involving multiple sites and streams. Several factors determine the severity of floods, including rainfall intensity and duration, topography, ground cover and rate of snowmelt. Water runoff is greater in areas with steep slopes and little to no vegetative ground cover. Also, urbanization typically results in the replacement of vegetative ground cover with asphalt and concrete, increasing the volume of surface runoff and storm water, particularly in areas with poorly planned storm water drainage systems.

In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snowpack throughout contributing watersheds. Summer floods have occurred from intense rainfall on previously saturated soils. Summer thunderstorms deposit large quantities of rainfall over a short period of time that can result in flash flood events, when the velocity of floodwaters has the potential to amplify the impacts of a flood event.

Winter floods also have resulted from runoff of intense rainfall on frozen ground, and, on rare occasions, local flooding has been exacerbated by ice jams in rivers. Ice jam floods occur on rivers that are totally or partially frozen. A rise in stream stage will break up a totally frozen river and create ice flows that can pile up on channel obstructions such as shallow riffles, log jams, or bridge piers. The jammed ice creates a dam across the channel over which the water and ice mixture continues to flow, allowing for more jamming to occur.

The worst case scenario for flooding in Columbia County was Tropical Storm Lee. This storm developed as a tropical disturbance in the Gulf of Mexico and was a particularly large and slow moving storm. By the time it reached Pennsylvania, the storm had lost its tropical characteristics and merged with an upper level trough positioned over the eastern third of the US, resulting in a storm of renewed strength. The storm dumped record rainfall in the Susquehanna River Valley – 10-15 inches total in the County. The flooding was exacerbated by the fact that in many areas, the ground was still saturated from Hurricane Irene's rains the week prior. During Lee, the Susquehanna River crested at a record high of 32.75 feet. Approximately 25% of Bloomsburg was flooded. Pennsylvania Governor Tom Corbett declared a Level 1 emergency in the Commonwealth for this event. It was the first time that level of emergency had been declared since September 11, 2001.

Tropical Storm Lee knocked out power in the County for 7 days (September 8-16). Three shelters were activated during the storm, and over 80 units of temporary housing were deployed after the fact. Of those temporary units, 65 were still occupied in 2012. One of the river gauges in the Susquehanna was lost as well. A snapshot of Columbia County damages from Lee is $14.2 million on November 7, 2011, but officials expected damages to total between $17-22 million. This includes approximately $5 million in damage to just the airport and the water authority in Bloomsburg. There were 2392 applicants for individual assistance at the time the 2012 plan was updated. The storm caused damage to roads and bridges; this infrastructure damage hindered travel in and around the County, further hampering response and recovery activities. The County also experienced significant business interruption and employment-related losses; two major industries located on the riverfront sustained major damage, and the Bloomsburg Fair was cancelled for the first time since it opened in 1855. As of October 2, 2011, the Bloomsburg Red Cross estimated that 1,888 homes had been affected by the flood. Damages ranged, but included:

- 141 homes totally destroyed
- 661 homes with major damage
- 425 homes with minor damage
- 621 homes affected in some way – i.e., damaged, but less than "minor" (Bloomsburg Daily, 2011).

While Tropical Storm Lee can be considered the flood of record for Columbia County, Hurricane Agnes in June 1972 remains an important flood event in the County. This early season hurricane came up from the Gulf of Mexico and brought heavy rain that exceeded the carrying capacity of streams and rivers from southern New York to Virginia from June 22nd to 25th (Gelber, 2002). Hurricane Agnes caused the most damage in central Pennsylvania. The Susquehanna River and its major tributaries flooded across the region. The flooding resulted in evacuations, economic losses, and casualties in many communities and major cities, including Harrisburg, Wilkes-Barre, and York. The flooding from Hurricane Agnes caused $2.8 billion in economic losses and 48 deaths in Pennsylvania.

In Columbia County, Agnes reportedly dropped 11.63 inches of rain in Bloomsburg; the USGS stream gauge in Bloomsburg recorded a peak river stage of over 31 feet with discharge rates of 350,000 cubic feet per second. Damage estimates in Columbia County were over $183.8 million (1972 dollars).

Although floods can cause damage to property and loss of life, floods are naturally occurring events that benefit riparian systems which have not been disrupted by human actions. Such benefits include groundwater recharge and the introduction of nutrient rich sediment improving soil fertility. However, the destruction of riparian buffers, changes to land use and land cover throughout a watershed, and the introduction of chemical or biological contaminants which often accompany human presence cause environmental harm when floods occur. Hazardous material facilities are potential sources of contamination during flood events. Other negative environmental impacts of flooding include: water-borne diseases, heavy siltation, damage or loss of crops, and drowning of both humans and animals.

4.3.3.3. Past Occurrence

Columbia County has a long history of flooding events. Flash flooding is the most common type of flooding that occurs in the County. Five of the eight Presidential Disaster and Emergency Declarations affecting Columbia County have been in response to hazard events related to flooding (see Section 4.2.1: Table of Presidential Disaster Declarations). Table 4.3.3-1 lists flood event information from 1993 to 2016 obtained from the NCDC databases. According to NCDC and Columbia County EMA records the storm listed for September 2013 is the last recorded flooding event in Columbia County as of the 2017 plan update.

Table 4.3.3-1: Flood and flash flood events impacting Columbia County from 1993-2016 (NCDC, 2016; PIERS, 2016). "Countywide" indicates several locations in the County were affected.

DATE	LOCATION & DESCRIPTION
11/28/1993	Multiple Counties. Widespread heavy rains as well as gusty showers with torrential downpours accompanied the storm system and resulted in a combination of long term flooding as well as flash flooding events
9/26/1994	Countywide. An estimated 2 inches of rain fell within 30 minutes around Bloomsburg. This partially submerged the middle and southern end of the Bloomsburg fairground. Numerous vendors were forced to close for the day. Elsewhere in Columbia County, in Greenwood Township flood waters carried a Ford Explorer into a stream.

DATE	LOCATION & DESCRIPTION
6/26/1995	Countywide. Slowly drifting thunderstorms deposited up to three inches (Recorded in Hetlerville) of rain within the county. Several parts of Mifflinville-Hetlerville Road were washed out. In Mifflinville drainage ditches overflowed flooding seven homes.
1/19/1996	Countywide. No description reported.
6/7/1996	Berwick. A trailer park along Briar Creek near Berwick was flooded.
12/1/1996	Countywide. No description reported.
12/13/1996	Countywide. Rain of 1-3 inches fell across a wide section of central Pennsylvania causing flooding of roads and streams.
1/8/1998	Countywide. No description reported.
1/18/1999	Countywide. Roads & basements flooded.
1/24/1999	Countywide. Heavy rains fell across the central mountains of Pennsylvania with most areas receiving in excess of 1 inch from late afternoon on the 23rd until early morning of Sunday the 24th. The snow pack which included a hard layer of ice held up to 2 inches of water in some spots. Small streams overflowed their banks, ice jams caused problems and some basements and roads were flooded.
9/16/1999	Countywide. No description reported.
7/30/2000	Northeast portion of the County. Heavy rains closed several roads across northeast parts of Columbia County. Rainfall in Benton totaled 4.78 inches. Several homes were evacuated due to high water. A bridge was washed out on Route 254.
8/2/2000	North portion of the County. Small streams and roads flooded.
12/17/2000	Countywide. No description reported.
5/26/2004	Bloomsburg. Heavy rain caused flooding along Route 42 in Pine Township in Northwest Columbia county, forcing Department of Transportation officials to close the roadway.
6/17/2004	Berwick. Thunderstorms with heavy rain caused Flash Flooding in Columbia county during the afternoon and early evening of June 17. Flash flooding began in the Stillwater area where a road was washed out and a mudslide occurred. In the Briar Creek area, just west of Berwick, flash flooding was also observed with some evacuations required due to the high water. Flooding in the county mainly occurred between Bloomsburg and Berwick.
9/17/2004	Multiple Counties. The remnants of Hurricane Ivan moved in during Friday, September 17th, and led to a large swath of excessive rainfall across central Pennsylvania as the system weakened to a tropical depression. Rainfall amounts of 3 to 6 inches were common, with some localized amounts exceeding 8 inches within a 12-hour period. As a result of this excessive rainfall, many smaller creeks and streams overflowed their banks by Friday evening, while many larger tributaries of the Susquehanna River experienced moderate to major flooding from Saturday into Sunday.
9/18/2004	Bloomsburg. Heavy rain caused the Susquehanna River at Bloomsburg to exceed its flood stage of 19 feet.
1/14/2005	Bloomsburg. Heavy rain caused flooding along the Main Stem Susquehanna River at Bloomsburg.
3/29/2005	Bloomsburg. Heavy rain caused the Susquehanna River at Bloomsburg to flood. The river exceeded flood stage of 19 feet.
3/29/2005	Multiple Counties. This storm produced very heavy rainfall across the middle and upper Susquehanna Valley from Monday afternoon into early Tuesday morning. Rainfall amounts from 1 to 3 inches, combined with rapid snowmelt to produce widespread flooding across the region. Numerous roadways were reported closed due to flooding.

DATE	LOCATION & DESCRIPTION
4/2/2005	Countywide. Heavy rainfall led to numerous road closures as smaller streams and creeks overflowed their banks during Saturday afternoon and night. The widespread flooding led to numerous evacuations in portions of Columbia County, particularly in the vicinity of Bloomsburg, where approximately 250 to 350 homes were evacuated. In addition, the Sewage Treatment Plant was shut down in Bloomsburg. Columbia County was officially declared as a Federal Disaster Area
4/3/2005	Bloomsburg. Heavy rain caused the Susquehanna River at Bloomsburg flood.
5/30/2006	Catawissa. Heavy rain from a slow moving cluster of thunderstorms caused flash flooding along a narrow portion of west-central Columbia County. A small tributary to Catawissa Creek flooded a car dealership in Catawissa. The waters eroded the stream bank, and swept one car (unoccupied) into the water. Several mudslides were also reported.
6/27/2006	Countywide. Heavy rain associated with a stalled frontal boundary, interacting with the remnants of a weak tropical system, caused flash flooding throughout central and eastern Pennsylvania. While flash flooding ended on the June 28th, flood waters continued in some locations until July 1st. Numerous bridges and roads were washed out. Residents in Fernville were evacuated.
6/28/2006	Bloomsburg. Heavy rain caused Susquehanna River at Bloomsburg to flood.
7/1/2006	Bloomsburg. Heavy rain caused Susquehanna River at Bloomsburg to flood.
11/16/2006	Bloomsburg. Heavy rain caused flash flooding in Columbia County, especially near Bloomsburg. Fishing Creek and other small creeks came out of their banks, flooding several roads. Interstate 80 was also closed in Hemlock Township.
3/5/2008	Grassmere. Heavy rain caused flooding in Columbia County, closing over seven state roads and producing widespread urban, small stream and river flooding.
7/11/2009	Bloomsburg. A cold front moving southeast across the Great Lakes triggered severe thunderstorms across central Pennsylvania during the afternoon and evening hours. Several of these storms moved repeatedly across the same areas of Columbia County, causing flash flooding.
7/31/2009	Benton. Runoff from heavy rainfall produced flash flooding along Fishing Creek in Benton. The creek came out of its banks and flooded portions of a boy scout camp.
1/25/2010	Bendertown. Heavy rain caused widespread areal flooding, mainly along Fishing Creek. Numerous roads were flooded and closed in Benton, Maple Grove, Stillwater, Orangeville and Bloomsburg.
1/25/2010	Benton. Heavy rain during the morning hours caused significant flash flooding along Fishing Creek. Little Fishing Creek actually changed its natural course, and the flash flood waters surged into downtown Benton. A dyke system failed, leading to several residences having moderate to major flooding. Many people were evacuated to Red Cross Shelters. A disaster declaration was announced for the Benton area with initial damages estimates approaching one million dollars.
3/10/2011	Countywide. Heavy rainfall between 2 to 4 inches across central and eastern Pennsylvania combined with snowmelt in the northern mountains to produce significant flooding. The Susquehanna River at Bloomsburg crested at 22.58 feet on March 12th at 8:30 am. This is categorized as a moderate flood. At 22.0 feet a number of homes located between the fairgrounds and the river were affected by high water. Several buildings at the airport were also affected.
4/28/2011	Bloomsburg and Grovania. The Susquehanna River at Bloomsburg crested above moderate flood stage. A number of homes located between the fairgrounds and the river were affected by high water. Several buildings at the airport were also affected. Near Grovania, several road closures, mudslides and small stream flooding were reported.
9/8/2011	Countywide. Tropical Storm Lee. For details, see Section 4.3.3.2.

DATE	LOCATION & DESCRIPTION
9/28/2011	Buckhorn and Rupert. Slow moving heavy rain showers and thunderstorms produced flash flooding and flooding across central Pennsylvania and resulted in numerous road wash-outs across Columbia County.
5/27/2012	Catawissa and Roaring Creek. Heavy thunderstorms over northwest Pennsylvania produced widespread wind damage and localized flash flooding. Heavy thunderstorm rains caused streams and creeks to overflow their banks in Catawissa and Franklin Townships, taking large objects including cars downstream in the flood waters.
9/6/2012	Berwick and Forks. Scattered severe thunderstorms produced marginally severe hail and localized heavy downpours that resulted in isolated flash flooding.
9/2/2013	Sugarloaf Township, Benton, and Stillwater. A stationary thunderstorm produced heavy rain and localized flash flooding. Damage included a road washout, agricultural flooding resulting in significant losses to a pumpkin patch, a mudslide, downed trees, and closed roadways.

In addition to the aforementioned past flood events, the National Flood Insurance Program identifies properties that frequently experience flooding. ***Repetitive loss properties*** are structures insured under the NFIP which have had at least two paid flood losses of more than $1,000 over any ten-year period since 1978. A property is considered a ***severe repetitive loss*** *property* either when there are at least four losses each exceeding $5,000 or when there are two or more losses where the building payments exceed the property value. As of 2014, there were 97 repetitive loss properties in Columbia County (PEMA, 2014). These repetitive loss properties are located in seventeen of the 33 municipalities in Columbia County: Berwick Borough, Town of Bloomsburg, Briar Creek Borough, Catawissa Borough, Catawissa Township, Cleveland Township, Fishing Creek Township, Franklin Township, Greenwood Township, Hemlock Township, Locust Township, Main Township, Mifflin Township, Montour Township, Mount Pleasant Township; Orangeville Borough; Orange Township, Scott Township. By far the most repetitive loss properties are located in Bloomsburg. Table 4.3.3-2 shows the number of repetitive loss properties by municipality. There are thirty-five severe repetitive loss properties in Columbia County – the majority of which are in Bloomsburg.

Table 4.3.3-2: Summary of the number and type of Repetitive Loss properties by municipality (PEMA, 2014).

MUNICIPALITY	Type				SUM OF REPETITIVE LOSS PROPERTIES	SUM OF SEVERE REPETITIVE LOSS PROPERTIES
	NON-RESIDENTIAL	2-4 FAMILY	SINGLE FAMILY	CONDOS		
Beaver Township	0	0	0	0	**0**	**0**
Benton Borough	0	0	0	0	**0**	**0**
Benton Township	0	0	0	0	**0**	**1**
Berwick Borough	0	0	1	0	**1**	**1**
Bloomsburg, Town of	2	4	25	1	**32**	**16**
Briar Creek Borough	0	0	1	0	**1**	**0**
Briar Creek Township	0	0	0	0	**0**	**0**

Catawissa Borough	0	0	3	0	**3**	**3**
Catawissa Township	0	0	1	0	**1**	**0**
Centralia Borough	0	0	0	0	**0**	**0**
Cleveland Township	0	0	2	0	**2**	**0**
Conyngham Township	0	0	0	0	**0**	**0**
Fishing Creek Township	0	0	10	0	**10**	**3**
Franklin Township	1	0	4	0	**5**	**1**
Greenwood Township	0	0	0	0	**0**	**0**
Hemlock Township	0	0	20	0	**20**	**0**
Jackson Township	0	0	0	0	**0**	**0**
Locust Township	0	0	2	0	**2**	**1**
Madison Township	0	0	0	0	**0**	**0**
Main Township	0	0	1	0	**1**	**0**
Mifflin Township	0	0	1	0	**4**	**1**
Millville Borough	0	0	0	0	**0**	**0**
Montour Township	1	0	4	0	**5**	**2**
Mount Pleasant Township	0	0	2	0	**2**	**1**
North Centre Township	0	0	0	0	**0**	**0**
Orange Township	0	0	3		**3**	**1**
Orangeville Borough	0	0	2	0	**2**	**0**
Pine Township	0	0	0	0	**0**	**0**
Roaring Creek Township	0	0	0	0	**0**	**0**
Scott Township	0	0	6	0	6	4
South Centre Township	0	0	0	0	**0**	**0**
Stillwater Borough	0	0	0	0	**0**	**0**
Sugarloaf Township	0	0	0	0	**0**	**0**
TOTAL	**4**	**4**	88	**1**	**97**	**35**

Floods are the most common and costly natural catastrophe in the United States. In terms of economic disruption, property damage, and loss of life, floods are “nature’s number-one disaster.” For that reason, flood insurance is almost never available under industry-standard homeowner’s and renter’s policies. The best way for citizens to protect their property against flood losses is to purchase flood insurance through the NFIP.

Congress established the NFIP in 1968 to help control the growing cost of federal disaster relief. The NFIP is administered by FEMA, part of the U.S. Department of Homeland Security. The NFIP offers federally-backed flood insurance in communities that adopt and enforce effective floodplain management ordinances to reduce future flood losses.

Since 1983, the chief means of providing flood insurance coverage has been a cooperative venture of FEMA and the private insurance industry known as the Write Your Own (WYO) Program. This partnership allows qualified property and casualty insurance companies to “write” (that is, issue) and service the NFIP’s Standard Flood Insurance Policy (SFIP) under their own names.

Today, nearly 90 WYO insurance companies issue and service the SFIP under their own names. More than 4.4 million federal flood insurance policies are in force. These policies represent $650 billion in flood insurance coverage for homeowners, renters, and business owners throughout the United States and its territories. As of 2016, the number of WYO insurance companies has decreased to 79.

In 2012, the U.S. Congress passed the Biggert Waters Flood Insurance Reform Act of 2012. This act was intended to change the way that the NFIP is ran including insurance policy rate increases to reflect true risk and changes in how the Flood Insurance Rate Map (FIRM) updates impact policyholders.

On March 21, 2014, President Obama signed the Homeowner Flood Insurance Affordability Act of 2014 into law. This law repealed and modified certain provisions of the Biggert-Waters Flood Insurance Reform Act and makes additional program changes to other aspects of the program not covered by that Act. Many provisions of the Biggert-Waters Flood Insurance Reform Act remain and are still being implemented.

As a result of the changes, in April 1, 2015, every new or renewed NFIP policy includes an annual surcharge required by the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA). The surcharge amount depends on the use of your insured building and the type of policy insuring the building, regardless of its flood zone or date of construction.

The NFIP provides flood insurance to individuals in communities that are members of the program. Membership in the program is contingent on the community adopting and enforcing floodplain management and development regulations. The NFIP is based on the voluntary participation of communities of all sizes. In the context of this program, a “community” is a political entity – whether an incorporated city, town, township, borough, or village, or an unincorporated area of a county or parish – that has legal authority to adopt and enforce floodplain management ordinances for the area under its jurisdiction.

National Flood Insurance is available only in communities that apply for participation in the NFIP and agree to implement prescribed flood mitigation measures. Newly participating communities are admitted to the NFIP’s Emergency Program. Most of these communities quickly earn “promotion” to the Regular Program.

The Emergency Program is the initial phase of a community's participation in the NFIP. In return for the local government's agreeing to adopt basic floodplain management standards, the NFIP allows local property owners to buy modest amounts of flood insurance coverage.

In return for agreeing to adopt more comprehensive floodplain management measures, an Emergency Program community can be "promoted" to the Regular Program. Local policyholders immediately become eligible to buy greater amounts of flood insurance coverage. All municipalities in Columbia County are in the Regular Program.

The minimum floodplain management requirements include:

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

In addition, Regular Program communities are eligible to participate in the NFIP's Community Rating System (CRS). Under the CRS, policyholders can receive premium discounts of 5 to 45 percent as their cities and towns adopt more comprehensive flood mitigation measures. Currently, the Town of Bloomsburg is the only community in Columbia County participating in CRS. Bloomsburg has been a CRS community since October 2003; its CRS class is 8 with 1,164 points. For more information on CRS, see Section 5.2.2.

Table 4.3.3-3 lists the Columbia County municipalities participating in the NFIP along with the date of the initial FIRM and the current effective map date. Note that all municipalities in the County participate in the program and have Current Effective DFIRMS as of August 19, 2008. This table was confirmed as the most up to date data as of the time the plan was update in 2017.

Table 4.3.3-3: Columbia County Municipal Participation in the National Flood Insurance Program.

COMMUNITY	PARTICIPATION STATUS	CID	INITIAL FIRM IDENTIFIED	CURRENT EFFECTIVE MAP DATE
Beaver Township	Participating	421547	11/15/85	8/19/2008
Benton Borough	Participating	421543	10/18/83	8/19/2008
Benton Township	Participating	421037	08/01/78	8/19/2008
Berwick Borough	Participating	420338	08/03/89	8/19/2008
Bloomsburg, Town of	Participating	420339	05/01/80	8/19/2008
Briar Creek Borough	Participating	420340	08/15/79	8/19/2008
Briar Creek Township	Participating	421548	06/19/89	8/19/2008
Catawissa Borough	Participating	420341	09/14/79	8/19/2008
Catawissa Township	Participating	420342	10/05/79	8/19/2008
Centralia Borough*	Participating	421544	08/19/08	NSFHA

Cleveland Township	Participating	421000	08/01/79	8/19/2008
Conyngham Township	Participating	421549	10/15/85	8/19/2008
Fishing Creek Township	Participating	421550	08/03/89	8/19/2008
Franklin Township	Participating	420343	08/01/79	8/19/2008
Greenwood Township	Participating	421551	03/16/89	8/19/2008
Hemlock Township	Participating	420344	08/01/79	8/19/2008
Jackson Township	Participating	421552	10/15/85	8/19/2008
Locust Township	Participating	421001	08/01/79	8/19/2008
Madison Township	Participating	421553	08/03/89	8/19/2008
Main Township	Participating	421554	10/15/85	8/19/2008
Mifflin Township	Participating	421167	08/15/79	8/19/2008
Millville Borough	Participating	421545	06/19/89	8/19/2008
Montour Township	Participating	421002	08/01/79	8/19/2008
Mount Pleasant Township	Participating	421042	02/18/81	8/19/2008
North Centre Township	Participating	421555	10/15/85	8/19/2008
Orange Township	Participating	421003	08/01/79	8/19/2008
Orangeville Borough	Participating	420345	08/01/79	8/19/2008
Pine Township	Participating	421556	04/03/89	8/19/2008
Roaring Creek Township	Participating	421557	04/30/86	8/19/2008
Scott Township	Participating	421004	09/02/81	8/19/2008
South Centre Township	Participating	421137	11/19/80	8/19/2008
Stillwater Borough	Participating	421546	08/15/89	8/19/2008
Sugarloaf Township	Participating	421558	07/04/89	8/19/2008
**No Special Flood Hazard Area (NSFHA)*				

4.3.3.4. Future Occurrence

In Columbia County, flooding occurs commonly and can occur during any season of the year. Therefore, the future occurrence of floods in Columbia County can be considered highly likely as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1). Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) 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%-annual-chance flood, also known as the *base flood*, as the standard for identifying properties subject to federal flood insurance purchase requirements. A 1%-annual-chance flood is a flood which has a 1% chance of occurring over a given year. The DFIRMs are used to identify areas subject to the 1- and 0.2%-annual-chance flooding. Areas subject to 2% and 10% 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 4.3.3-4 shows a range of flood recurrence intervals and associated probabilities of occurrence. Although the information is from 2001, it is still considered the best available information on this topic.

Table 4.3.3-4: Recurrence intervals and associated probabilities of occurrence (FEMA, 2001).

RECURRENCE INTERVAL	CHANCE OF OCCURRENCE IN ANY GIVEN YEAR (%)
10 year	10
50 year	2
100 year	1
500 year	0.2

4.3.3.5. Vulnerability Assessment

Columbia County is vulnerable to flooding that causes loss of lives, property damage, and road closures. Flood water damages that occur to agricultural, urban, and other properties such as roads, bridges and utilities are projected to increase in Columbia County due to the development of flood prone lands. For purposes of assessing vulnerability, the County focused on community assets that are located in the 1%-annual-chance floodplain. While greater and smaller floods are possible, information about the extent and depths for this floodplain is available for all municipalities countywide, thus providing a consistent basis for analysis. Flood vulnerability maps for each applicable local municipality, showing the 1%-annual-chance flood hazard area and addressable structures, critical facilities and transportation routes within it, are included in **Appendix D**. These maps were created using FEMA Countywide Effective digital data.

Table 4.3.3-5 displays the number of addressable structures, structures classified as “Trailers,” and populations intersecting the SFHA along with the total number of addressable structures, trailers, and population in each municipality. The Trailers category incorporates agricultural trailers, residential trailers, commercials, and leased trailers (with no land). The number of vulnerable addressable structures was calculated by overlaying the addressable structures with the SFHA. Similarly, the estimated population in the SFHA was calculated utilizing data from the United States Census Bureau that found there were an average of 2.39 people per housing unit in Columbia County between 2010 and 2014. In order to estimate the number of trailers in the SFHA, addressable structures with the land uses “agricultural trailer”, “residential trailer”, “commercial trailer”, and “general trailer” structure type were selected; then the structures were intersected with the SFHA.

Overall, only 6.6% of the addressable structures and 6.6% of the population of the County are most at risk to the 1%-annual-chance flood zone. The Town of Bloomsburg has over 400 structures located in the SFHA. However, proportionally, Benton Borough has the highest percentage of structures in the SFHA; 39.7% of all structures in the municipality are located in the SFHA. Other jurisdictions with a comparatively higher proportion of addressable structures in the SFHA include Stillwater Borough and Orange Township each of which has 37.7% and 16.8% of addressable structures in the SFHA respectively. Stillwater Borough and Benton Borough have the highest proportions of populations living in the SFHA with 39.7% and 37.7% of each jurisdiction’s population falling within the SFHA. The only other jurisdictions with over 10% of the population at risk to the 1%-annual-chance flood are the town of Bloomsburg, and Briar Creek, Fishing Creek, Franklin, and Orange Townships. Of all the flood prone jurisdictions, Conyngham Township, Centralia Borough, Jackson Township, and Millville Borough have comparatively lower structure vulnerability; less than 1% of the total addressable structures in those jurisdictions are located in the SFHA. These are also among the jurisdictions with the lowest proportion of population in the SFHA.

The number and geography of vulnerable trailers is quite different from the overall structure vulnerability in the County. Briar Creek Borough has the highest number and proportion of trailers in the SFHA at 31 while South Centre Township has 27 trailers in the SFHA. Centralia, and Orangeville Boroughs and Beaver, Conyngham, and Main Townships have no trailers in the SFHA.

Table 4.3.3-5: Structure and population vulnerability to floods in Columbia County (Columbia County GIS, 2016).

Municipality	Total Addressable Structures	Total Addressable Structures in SFHA	% of Total Addressable Structures in SFHA	Total Assessed Value of Addressable Structures in SFHA	# of Trailers	# of Trailers in SFHA	Total Population (2.39 ppl per Household)	Estimated Population in SFHA (2.39 ppl per Household)	% Population in SFHA
Beaver Township	461	10	2.2%	$504,381	29	-	1,102	24	2.2%
Benton Borough	426	169	39.7%	$13,651,637	46	8	1,018	404	39.7%
Benton Township	651	63	9.7%	$3,319,742	67	4	1,556	151	9.7%
Berwick Borough	4,719	62	1.3%	$2,701,549	205	9	11,278	148	1.3%
Town of Bloomsburg	4,016	434	10.8%	$40,817,149	35	6	9,598	1,037	10.8%
Briar Creek Borough	326	41	12.6%	$20,818,270	131	31	779	98	12.6%
Briar Creek Township	1,578	122	7.7%	$5,273,381	266	20	3,771	292	7.7%
Catawissa Borough	689	30	4.4%	$1,064,694	28	3	1,647	72	4.4%
Catawissa Township	477	12	2.5%	$640,208	23	2	1,140	29	2.5%
Centralia Borough	3	-	-	–	-	-	7	-	-
Cleveland Township	584	49	8.4%	$5,791,411	36	6	1,396	117	8.4%
Conyngham Township	436	1	0.2%	$1,886,854	18	-	1,042	2	0.2%

Fishing Creek Township	866	97	11.2%	$3,223,733	85	1	2,070	232	11.2%
Franklin Township	313	39	12.5%	$2,831,748	24	4	748	93	12.5%
Greenwood Township	897	85	9.5%	$3,393,549	96	8	2,144	203	9.5%
Hemlock Township	1,014	92	9.1%	$5,054,756	37	1	2,423	220	9.1%
Jackson Township	342	1	0.3%	$10,852	40	1	817	2	0.3%
Locust Township	755	49	6.5%	$1,920,787	107	24	1,804	117	6.5%
Madison Township	758	8	1.1%	$306,388	83	2	1,812	19	1.1%
Main Township	563	19	3.4%	$282,815	77	-	1,346	45	3.4%
Mifflin Township	1,056	31	2.9%	$2,275,671	107	1	2,524	74	2.9%
Millville Borough	442	4	0.9%	$170,594	9	1	1,056	10	0.9%
Montour Township	629	17	2.7%	$1,399,765	84	7	1,503	41	2.7%
Mt. Pleasant Township	652	45	6.9%	$1,952,624	55	22	1,558	108	6.9%
North Centre Township	903	16	1.8%	$5,299,906	229	6	2,158	38	1.8%
Orange Township	631	106	16.8%	$3,993,146	295	19	1,508	253	16.8%
Orangeville Borough	168	13	7.7%	$514,904	2	-	402	31	7.7%
Pine Township	559	14	2.5%	$683,491	68	2	1,336	33	2.5%

Roaring Creek Township	378	22	5.8%	$945,199	38	2	903	53	5.8%
Scott Township	2,601	120	4.6%	$10,236,912	301	3	6,216	287	4.6%
South Centre Township	968	41	4.2%	$3,405,510	261	27	2,314	98	4.2%
Stillwater Borough	122	46	37.7%	$1,854,494	7	3	292	110	37.7%
Sugarloaf Township	732	107	14.6%	$7,749,548	98	7	1,749	256	14.6%

Table 4.3.3-6 shows the various types of structure land uses throughout the flood prone areas of Columbia County. Residential structures are the most common buildings found in the SFHA throughout the County, whereas Industrial structures are scarcer, with a cluster of five structures in the Town of Bloomsburg, and at least one structure in Benton, Briar Creek, Hemlock, Scott, South Centre, and Sugarloaf Townships and Briar Creek, Catawissa, Stillwater Boroughs. Bloomsburg has the highest concentration of residential structures in the SFHA with over 300, but Benton Borough, Briar Creek Township, and Hemlock Township each have over 70 vulnerable homes. Orangeville Borough and Scott Township are the only jurisdictions with towers in SFHA; Berwick Borough, the Town of Bloomsburg, Mifflin and Orange Township are the only jurisdictions with utility structures within the SFHA. The Exempt column consists of tax-exempt entities such as churches, schools and similar institutions. Catawissa Borough has the most exempt structures in the SFHA with 22, the Town of Bloomsburg follows closely with 19, and Briar Creek Borough and Benton Borough are the next highest with 11 and 12. Other jurisdictions with this type of vulnerable structures are Millville, and Orangeville Boroughs, Benton, Briar Creek, Conyngham, Fishing Creek, Franklin, Greenwood, Hemlock, Montour, North Centre, Orange, Scott, and Sugarloaf Townships. Bloomsburg, Beaver, Benton, Briar Creek, Catawissa, Cleveland, Fishing Creek, Franklin, Greenwood, Hemlock, Montour, Mount Pleasant, Orange, Roaring Creek, Scott, and Sugarloaf Townships, and Berwick and Stillwater Boroughs, all have vacant structures that are vulnerable to the 1% annual-chance-flood.

Table 4.3.3-6: Structure land use in Columbia County within the 1% Annual-Chance Flood area (Columbia County GIS, 2016).

MUNICIPALITY	AGRICULTURAL	COMMERCIAL	EXEMPT	INDUSTRIAL	RESIDENTIAL	TOWER	TRAILER	UTILITY	VACANT	TOTAL
Beaver Township	2	0	0	0	8	0	0	0	1	**11**
Benton Borough	3	32	12	0	123	0	7	0	0	**177**
Benton Township	9	3	2	1	44	0	0	0	3	**62**
Berwick Borough	0	3	0	0	55	0	2	2	2	**64**
Bloomsburg, Town of	1	59	19	5	334	0	2	3	2	**425**
Briar Creek Borough	0	32	11	1	7	0	30	0	0	**81**
Briar Creek Township	6	23	1	1	86	0	11	0	4	**132**
Catawissa Borough	0	3	22	1	5	0	0	0	0	**31**
Catawissa Township	2	0	0	0	4	0	2	0	3	**11**
Cleveland Township	9	18	0	0	15	0	0	0	1	**43**
Conyngham Township	0	0	1	0	0	0	0	0	0	**1**
Fishing Creek Township	8	4	4	0	21	0	0	0	6	**43**
Franklin Township	4	2	1	0	8	0	3	0	3	**21**
Greenwood Township	6	12	2	0	64	0	1	0	1	**86**
Hemlock Township	4	3	3	3	71	0	0	0	8	**92**

Locust Township	7	6	0	0	15	0	4	0	0	**32**
Madison Township	2	2	0	0	4	0	1	0	0	**9**
Main Township	2	0	0	0	16	0	0	0	0	**18**
Mifflin Township	1	1	0	0	25	0	0	1	0	**28**
Millville Borough	0	0	3	0	1	0	1	0	0	**5**
Montour Township	0	8	2	0	6	0	6	0	1	**23**
Mt Pleasant Township	6	24	0	0	13	0	1	0	2	**46**
North Centre Township	2	6	1	0	8	0	6	0	0	**23**
Orange Township	28	11	3	0	52	0	16	1	4	**115**
Orangeville Borough	0	1	2	0	1	1	0	0	0	**5**
Pine Township	4	2	0	0	7	0	0	0	0	**13**
Roaring Creek Township	6	0	0	0	13	0	1	0	1	**21**
Scott Township	0	55	4	1	56	1	3	0	1	**121**
South Centre Township	1	30	0	3	7	0	27	0	0	**68**
Stillwater Borough	6	2	0	1	33	0	2	0	2	**46**
Sugarloaf Township	21	2	6	1	33	0	1	0	1	**65**
Total	**141**	**344**	**99**	**18**	**1135**	**2**	**127**	**7**	**46**	**1919**

Table 4.3.3-7 displays the number of critical facilities that are located in the SFHA by jurisdiction. There are 47 critical facilities that are located in the SFHA, representing about 13% of the County's total critical facilities. Berwick Borough has the highest number of flood prone critical facilities with 10; Scott and Sugarloaf Townships follow closely with 6 each. Other jurisdictions with critical facilities located in the SFHA include Benton, Catawissa and Millville Boroughs, Benton, Fishing Creek, Franklin, Greenwood, Locust, Montour, Mount Pleasant, Orange, South Centre, and Stillwater Townships, and Bloomsburg.

Table 4.3.3-7: Critical facilities vulnerable to flood by municipality (Columbia County GIS, 2016)

MUNICIPALITY	TOTAL CRITICAL FACILITIES IN SFHA	TOTAL CRITICAL FACILITIES PER MUNICIPALITY
Beaver Township	0	5
Benton Borough	5	10
Benton Township	3	9
Berwick Borough	10	52
Bloomsburg, Town of	4	39
Briar Creek Borough	0	6
Briar Creek Township	0	13
Catawissa Borough	1	10
Catawissa Township	0	5
Centralia Borough	0	3
Cleveland Township	0	7
Conyngham Township	0	8
Fishing Creek Township	3	12
Franklin Township	1	8
Greenwood Township	2	14
Hemlock Township	0	11
Jackson Township	0	5
Locust Township	2	12
Madison Township	0	6
Main Township	0	6
Mifflin Township	0	13
Millville Borough	5	13
Montour Township	1	12
Mt Pleasant Township	1	5
North Centre Township	0	9
Orange Township	4	7
Orangeville Borough	0	7
Pine Township	0	4
Roaring Creek	0	1
Scott Township	6	27
South Centre Township	1	18
Stillwater Borough	1	3
Sugarloaf Township	6	11
TOTAL	**47**	**371**

The specific flood vulnerability for Bloomsburg University's main campus is generally low as there are no structures, infrastructure, or critical facilities located in the SFHA. The Magee Conference Center, located one mile from the main campus, was the only University asset in a floodplain, and was located in a Zone X (shaded), also known as the 0.2 percent annual chance (or 500 year) flood. This structure was in the floodplain of Fishing Creek; however, it had been modified for wet flood proofing, so its overall vulnerability was lower. Additionally, no new structures are planned for University property located in the SFHA near Fishing Creek. Since the completion of the 2012 HMPU the Magee Conference Center was demolished due the cost involved in renovations resulting directly from the Tropical Storm Lee flood event in 2011.

Additional information on flood vulnerability and losses in Columbia County, including the 1%- annual-chance flood event results derived from data provide by the Columbia County GIS Department, the number of parcels vulnerable to flood hazards and the assessed value of vulnerable parcels, is provided in Section 4.4.3: Potential Loss Estimates.

4.3.4 Hurricane, Tropical Storm, Nor'easter

4.3.4.1 Location and Extent

Tropical storms impacting Columbia County develop in tropical or sub-tropical waters found in the Atlantic Ocean, Gulf of Mexico, or Caribbean Sea. Cyclones with maximum sustained winds of less than 39 miles per hour (mph) are called tropical depressions. A tropical storm is a cyclone with maximum sustained winds between 39-74 mph. These storms sometimes develop into hurricanes with wind speeds in excess of 74 mph.

While Columbia County is located about 120 miles from the Atlantic Coast, tropical storms can track inland causing heavy rainfall and strong winds. These storms are regional events that can impact very large areas hundreds to thousands of miles across over the life of the storm. Therefore, all communities within Columbia County are equally subject to the impacts of hurricanes, tropical storms, and Nor'easters that track through or near the County. Areas in Columbia County which are subject to flooding, wind, and winter storm damage are particularly vulnerable.

Figure 4.3.4-1 shows wind speed zones developed by the American Society of Civil Engineers based on information including 40 years of tornado history and over 100 years of hurricane history. It identifies wind speeds that could occur across the United States to be used as the basis for design and evaluation of the structural integrity of shelters and critical facilities.

Columbia County falls within Zone III, meaning design wind speeds for shelters and critical facilities should be able to withstand a 3-second gust of up to 200 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event. Columbia County also falls on the edge of the identified Hurricane Susceptibility Region, meaning that while hurricane-force winds may be possible, it is uncommon that the County would suffer from the impacts of severe hurricane winds.

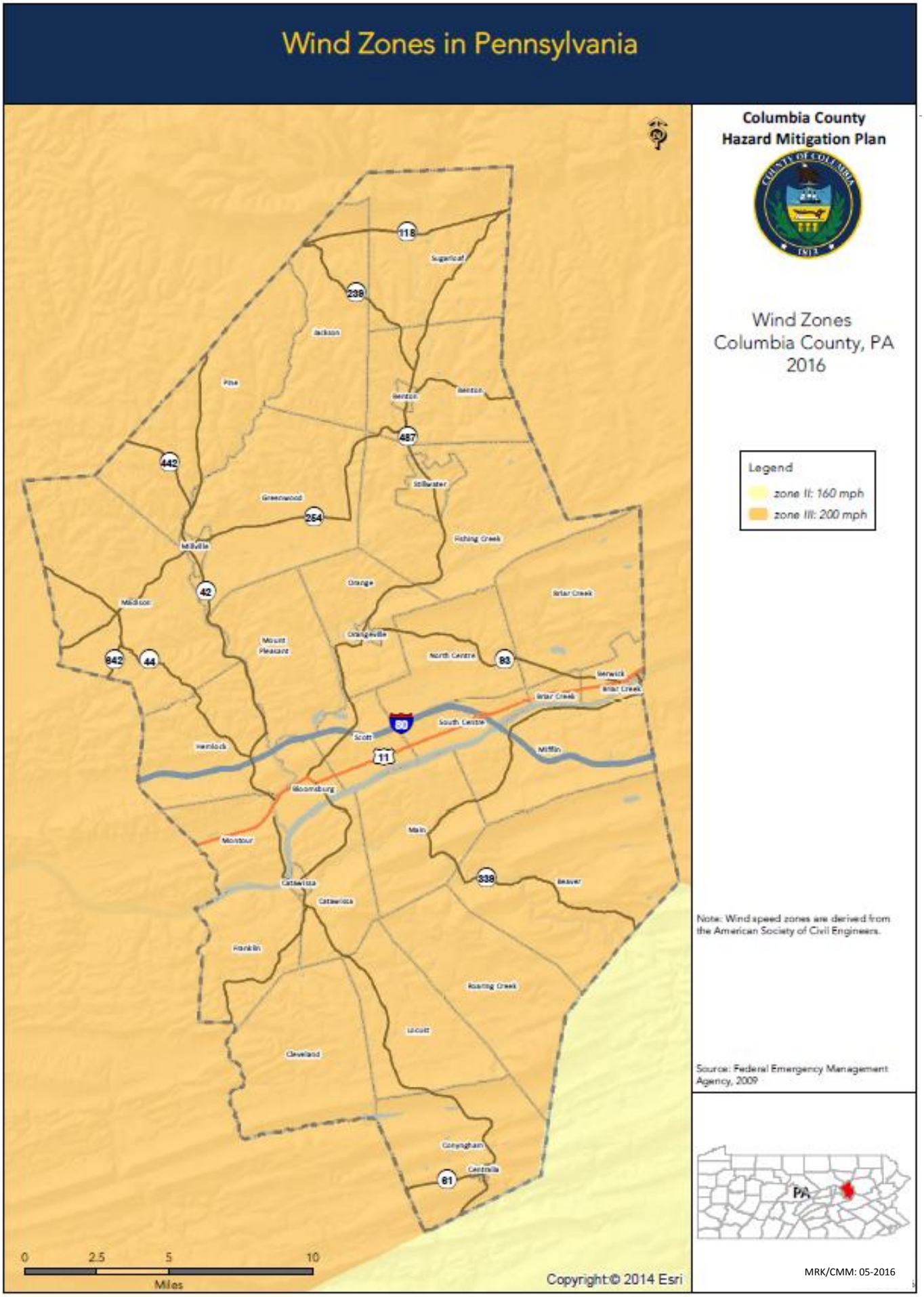


Figure 4.3.4-1: Wind zones in Pennsylvania and Columbia County (Columbia County GIS, 2016).

4.3.4.2 Range of Magnitude

Tropical cyclones with maximum sustained winds of less than 39 miles per hour (mph) are called *tropical depressions*. A *tropical storm* is a cyclone with maximum sustained winds between 39-74 mph. These storms sometimes develop into *hurricanes* with wind speeds in excess of 74 mph. *Extra-tropical* is a term used to describe a hurricane or tropical storm whose cyclone has lost its "tropical" characteristics and has cold air at its core, rather than warm air. While an extra-tropical storm denotes a change in weather pattern and how a coastal storm is gathering energy, it may still have winds that are tropical storm or hurricane force. The impacts associated with hurricanes and tropical storms are primarily wind damage and flooding. It is not uncommon for tornadoes to develop during these events. Historical tropical storm and hurricane events have brought intense rainfall, sometimes leading to damaging floods, northeast winds, which, combined with waterlogged soils, caused trees and utility poles to fall.

The impact tropical storm or hurricane events have on an area is typically measured in terms of wind speed. Expected damage from hurricane force winds is measured using the Saffir-Simpson Scale. The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential (characteristic of tropical storms and hurricanes, but not a threat to inland locations like Columbia County), which are combined to estimate potential damage. Table 4.3.4-1 lists the Saffir-Simpson Scale categories with associated wind speeds and expected damages. Categories 3, 4, and 5 are classified as "major" hurricanes. While major hurricanes comprise only 20 of all tropical cyclones making landfall, they account for over 70 percent of the damage in the United States. The likelihood of these damages occurring in Columbia County is assessed in Section 4.3.4.4, *Future Occurrence*.

Table 4.3.4-1: Saffir-Simpson Scale categories with associated wind speeds and damages (NHC,

STORM CATEGORY	WIND SPEED (mph)	DESCRIPTION OF DAMAGES
1	74-95	MINIMAL: Damage is limited primarily to shrubbery and trees, unanchored mobile homes, and signs. No significant structural damage.
2	96-110	MODERATE: Some trees are toppled, some roof coverings are damaged, and major damage occurs to mobile homes. Some roofing material, door, and window damage.
3	111- 129	EXTENSIVE: Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Large trees are toppled. Terrain may be flooded well inland.
4	130- 156	EXTREME: Extensive damage to roofs, windows, and doors; roof systems on small buildings completely fail. More extensive curtain wall failures. Terrain may be flooded well inland.
5	>157	CATASTROPHIC: Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Massive evacuation of residential areas may be required.

It is important to recognize the potential for flooding events during hurricanes and tropical storms; the risk assessment and associated impact for these events is included Section 4.2.3. Wind impacts in Columbia County generally include downed trees and utility poles, which can spark widespread utility interruptions. Wind impacts are particularly an issue for mobile homes and other manufactured housing; these structures are often not well-anchored and are highly susceptible to wind damage in a hurricane, tropical storm, or Nor'easter.

The worst case hurricane, tropical storm, or Nor'easter event in Columbia County was Tropical Storm Lee, which was also the worst-case flood event for Columbia County. Details on this event can be found in Section 4.3.3.2.

4.3.4.3 Past Occurrence

The National Oceanic and Atmospheric Administration's Coastal Services Center maintains records of all coastal storms occurring in the United States since the 1850s. Table 4.3.4-2 lists all coastal storms having centers of circulation to pass through or within 20 nautical miles of Columbia County's borders. As of the 2017 update this is the most recent data on coastal storms that tracked through or near Columbia County.

Table 4.3.4-2: Previous coastal storms tracking through or near Columbia County.

YEAR	EVENT	STRENGTH IN/NEAR COLUMBIA COUNTY
1994	Beryl	Tropical Depression
1979	David	Tropical Storm
1949	Not Named	Tropical Storm
1933	Not Named	Tropical Storm
1923	Not named	Tropical Storm

It is important to note that a number of hurricane, tropical storm, and nor'easter events have impacted the County without tracking through or near it; these storm events include Hurricanes Agnes (1972), Eloise (1975), Floyd (1999), Isabel/Henri (2003), Tropical Depression Ivan (2004), and Tropical Storm Lee (2011). Each of these storm events resulted in a Presidential Disaster Declaration.

4.3.4.4 Future Occurrence

Although hurricanes and tropical storms can cause flood events consistent with 1 percent- and 2 percent- level frequency, their probability of occurrence is measured relative to wind speed. The National Oceanic and Atmospheric Administration Hurricane Research Division published the map included as Figure 4.3.4-2 showing the chance that a tropical storm or hurricane will affect a given area of Pennsylvania during the entire Atlantic hurricane season spanning from June to November. Note that this figure does not provide information on the probability of various storm intensities. However, based on historical data between 1944 and 1999, this map reveals there is approximately a 6 percent chance of experiencing a tropical storm or hurricane event between June and November of any given year in the County. This translates to a future occurrence of *possible*, as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

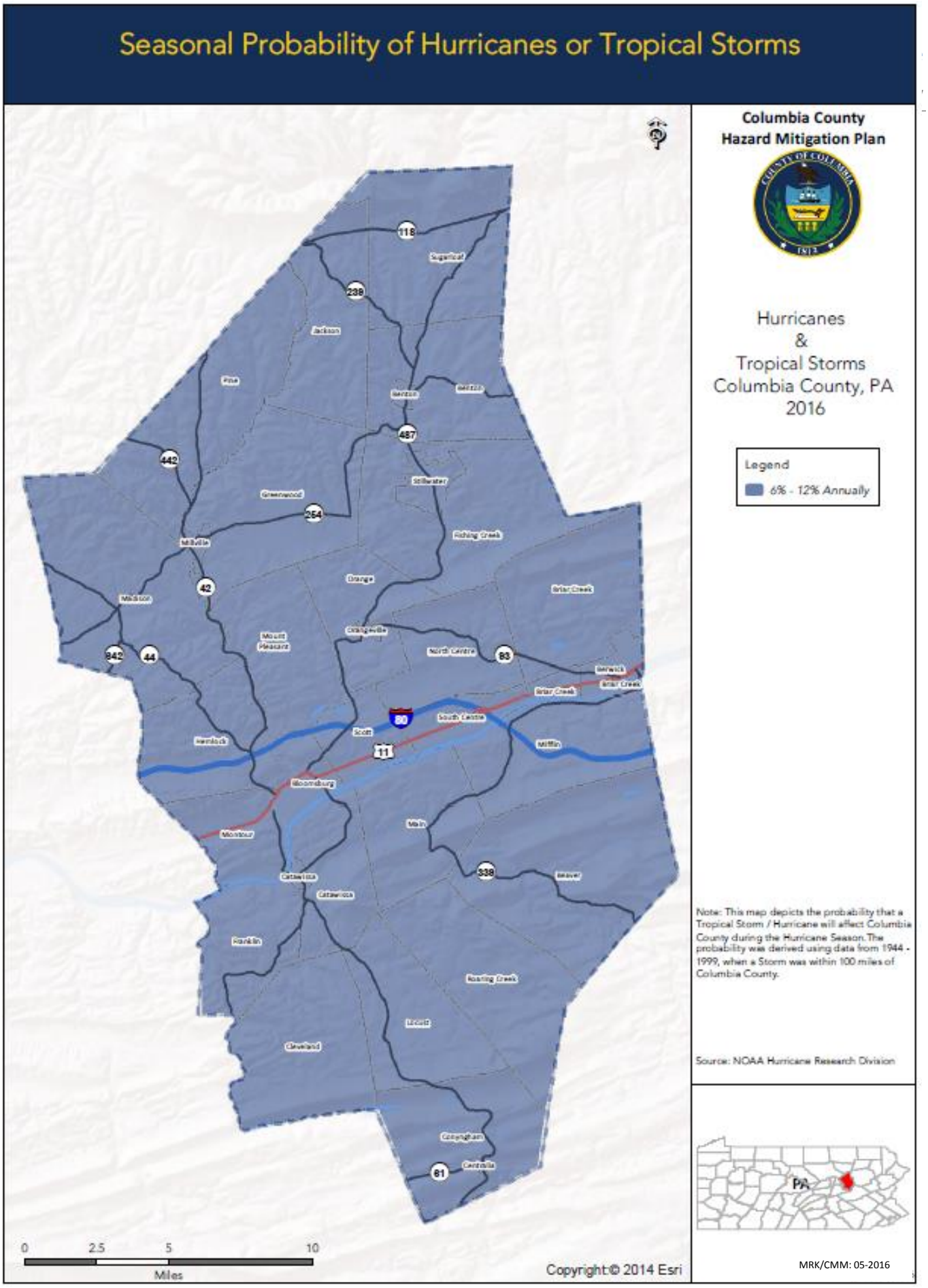


Figure 4.3.4-2: Seasonal probability of hurricanes or tropical storms striking Columbia County (Columbia County GIS, 2016).

4.3.4.5 Vulnerability Assessment

A vulnerability assessment for hurricanes and tropical storms focuses on the impacts of flooding and severe wind. Therefore, the assessment for flood-related vulnerability is addressed in Section 4.3.3.5., and vulnerability to wind damage is addressed in Section 4.3.8.5. The County is also vulnerable to severe winter weather impacts caused by Nor'easters which are evaluated in 4.3.10.5.

4.3.5 Landslide

4.3.5.1 Location and Extent

A rock fall occurs when a smaller rock-mass breaks free and disintegrates into blocks that bounce and roll down steep slopes. Rock falls and other slope failures often occur in areas with moderate to steep slopes, conducive geology and high precipitation. With the appropriate geology and topography, most slope failures are associated with precipitation events – periods of sustained above-average precipitation, specific rainstorms or snowmelt events. Other elements that determine slope stability are vegetative cover and slope. Contributing causes of landslides include erosion, removal of vegetation cover and earthquakes. Human activities that can contribute to slope failure include altering the slope gradient, increasing the soil water content and removing vegetation cover. The DCNR describes landslide susceptibility in Columbia County as "generally low" but includes local areas of high to moderate. Areas of higher risk would tend to be where there are steeper slopes, such as in the upper region of Columbia County.

As seen in Figure 4.3.5-1, the upper part of the County falls into mostly the low and partially moderate landslide incidence zone. The lower portion of Columbia County falls entirely under the combination high landslide susceptibility/incidence zone. Thus, landslides are deemed to be a fairly minor hazard in Columbia County.

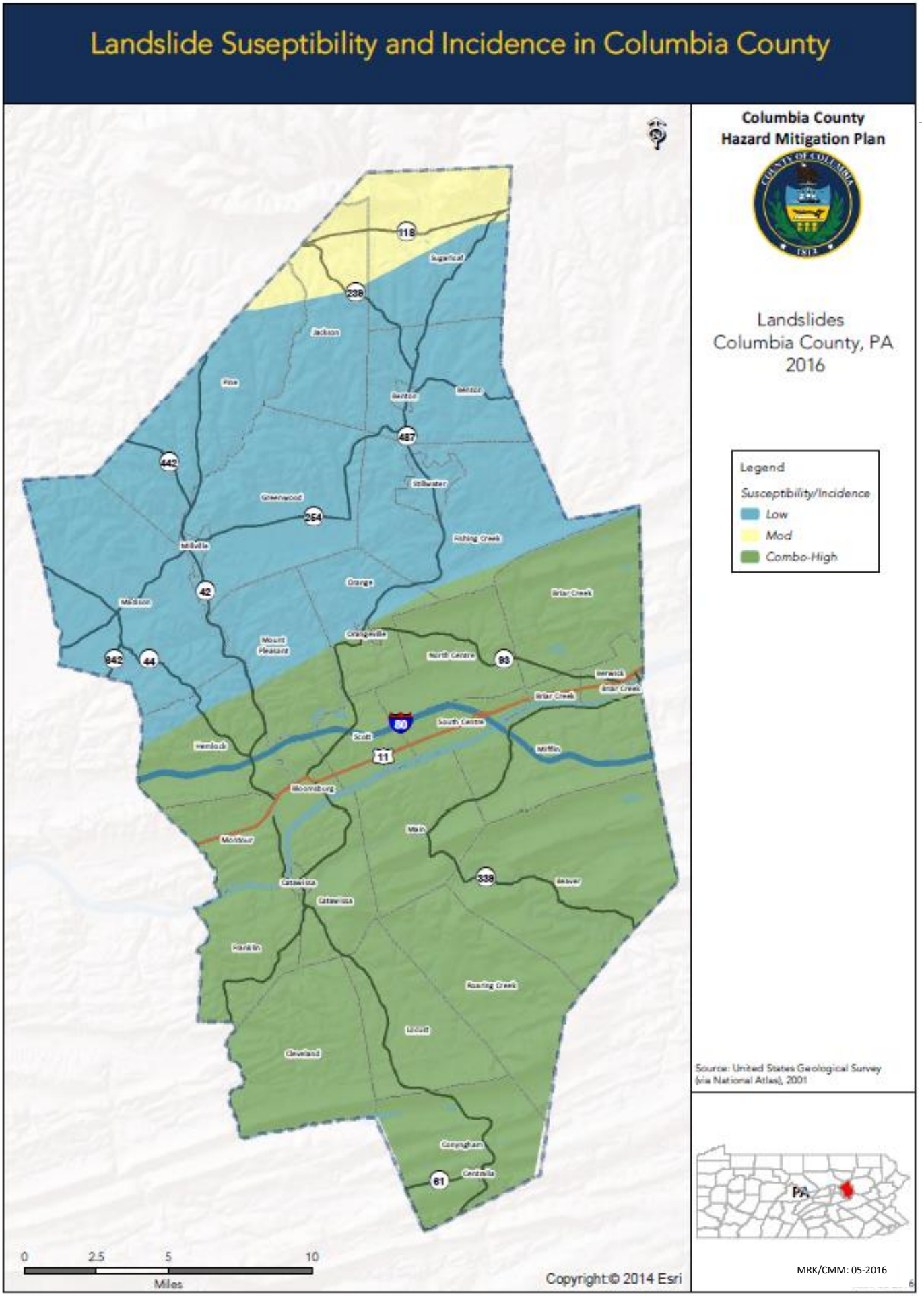


Figure 4.3.5-1: Landslide susceptibility and incidence for Pennsylvania and Columbia County (Columbia County GIS, 2016)

4.3.5.2 Range of Magnitude

Landslides cause damage to transportation routes, utilities, and buildings and can create travel delays and other side effects. Fortunately, deaths and injuries due to landslides are rare in Pennsylvania. Almost all of the known deaths due to landslides have occurred when rock falls or other slides along highways have involved vehicles. Storm-induced debris flows are the only other type of landslide likely to cause death and injury. However, as residential and recreational development increases on and/or near steep slopes, the hazard from these rapid events will also rise. Most Pennsylvania landslides are moderate to slow moving and damage property rather than people.

The Pennsylvania Department of Transportation (PennDOT) and large municipalities incur substantial costs due to landslide damage and to extra construction costs for new roads in known landslide-prone areas. A 1991 estimate showed an average of $10 million per year is spent on landslide repair contracts across the Commonwealth and a similar amount is spent on mitigation costs for grading projects (DCNR, 2010). Columbia County does not have or maintain information on the cost of recovering from and mitigating landslides.

The worst case scenario that could be caused by landslides in the County would involve a large landslide on I-80. As the major east-west connector road, a rock fall or debris flow along this road would not only snarl traffic and cause injuries or death but also could have a significant economic impact because the road connects many of Columbia County's major industries with the Interstate highway system.

4.3.5.3 Past Occurrence

There have been several land failures reported in Pennsylvania and within Columbia County. PEIRS data indicates that there has been one landslide in Columbia County from 2002-2009. On March 26, 2004, a landslide in Main Township severely damaged a home at the Wonderview Development. No injuries were reported from this incident. Also, the Columbia County EMA gives record of the March 2004 landslide and a mudslide that occurred on May 31, 2006 in Franklin Township. The mudslide caused State Route 487 to close near Knoebels Amusement Resort (Columbia County HVA, 2007). Finally, a landslide occurred on Route 42 in the winter of 2010-2011, causing significant road damage.

4.3.5.4 Future Occurrence

Based on historical events, landslide events resulting in loss of life and property damage are unlikely in Columbia County. However, with history of events occurring in the County and the mixed susceptibility to landslides, especially in the southern portions of the County, the probability of landslides occurring in the County is considered *possible* as defined by the Risk Factor ranking probability criteria (see Table 4.4-1). Mismanaged intensive development in steeply sloped areas could increase the frequency of occurrence.

4.3.5.5 Vulnerability Assessment

Communities in Columbia County have not been historically highly vulnerable to landslides. However, transportation roads flanked by high terrain and buildings constructed at the top or bottom of steep slopes should be considered vulnerable to this hazard. An inventory of these areas is not currently available. Table 4.3.5-1 illustrates the vulnerability of structures and critical facilities in Columbia County located in the high landslide susceptibility areas regardless

of the landslide incidence. The table indicates that Berwick Borough has the highest number of structures located within the combo-high landslide susceptibility area. Bloomsburg and Briar Creek, Scott, and Mifflin Townships all have over 1,000 of their addressable structures located within combo-high landslide susceptibility areas. The only jurisdictions without addressable structures in the combo-high susceptibility areas include Benton, Centralia, Millville, and Stillwater Boroughs and Benton, Fishing Creek, Greenwood, Jackson, Madison, Pine, and Sugarloaf Townships.

Table 4.3.5-1 also shows the number of critical facilities located in the landslide combo-high zones by jurisdiction. A total of 218 critical facilities are located in the combo-high landslide susceptibility areas. Critical facilities vulnerable to landslide events are concentrated in Berwick Borough, Bloomsburg, Scott Township and South Centre Township. For a complete list of critical facilities, a map of these facilities, and their vulnerability to landslide hazards, please see **Appendix E**. It is important to note that the vulnerability of each individual structure and critical facility will depend on a number of factors including slope, topography, and underlying geology and soil.

Table 4.3.5-1: Number of addressable structures and critical facilities located in areas with high susceptibility to landslide. (Columbia County GIS, 2016)

Municipality	Total Addressable Structures	Number of Addressable Structures in Combo-High Landslide Susceptibility Areas	Total Assessed Value of Structures in Combo-High Landslide Susceptibility Areas	Number of Critical Facilities in Combo-High Landslide Susceptibility Areas
Beaver Township	461	461	$28,943,901	5
Benton Borough	426	-	$0	-
Benton Township	651	-	$0	-
Berwick Borough	4,719	4,719	$266,408,847	57
Town of Bloomsburg	4,016	4,016	$351,555,235	138
Briar Creek Borough	326	326	$41,715,513	12
Briar Creek Township	1,578	1,558	$62,569,013	14
Catawissa Borough	689	689	$31,059,896	14
Catawissa Township	477	477	$32,097,520	10
Centralia Borough	3	3	$0	3
Cleveland Township	584	584	$46,239,536	7
Conyngham Township	436	436	$20,437,445	10
Fishing Creek Township	866	-	$0	-
Franklin Township	313	313	$43,295,200	10
Greenwood Township	897	-	$0	-
Hemlock Township	1,014	893	$112,739,671	16

Jackson Township	342	-	$0	-
Locust Township	755	755	$47,184,150	14
Madison Township	758	-	$0	-
Main Township	563	563	$36,813,840	7
Mifflin Township	1,056	1,056	$73,277,369	19
Millville Borough	442	-	$0	-
Montour Township	629	629	$45,586,099	16
Mt. Pleasant Township	652	274	$21,016,533	2
North Centre Township	903	903	$62,569,013	11
Orange Township	631	287	$23,196,085	3
Orangeville Borough	168	109	$7,206,005	9
Pine Township	559	-	$0	-
Roaring Creek Township	378	378	$20,394,307	2
Scott Township	2,601	2,601	$238,094,859	40
South Centre Township	968	968	$133,863,492	25
Stillwater Borough	122	-	$0	-
Sugarloaf Township	732	-	$0	-
Total	29,715	22,998	$1,746,263,530	444

Table 4.3.5-2 shows the various types of structure land uses throughout the landslide-prone areas of Columbia County. Residential structures are the most common buildings in the County in general, so it is unsurprising that the type of structure geographically at risk to a landslide is a residential one. Berwick Borough and Bloomsburg have the most at-risk residential, vacant, exempt, and commercial structures located in the landslide combo-high zone.

Table 4.3.5-3 shows the various types of parcel land uses throughout the landslide-prone areas of Columbia County. Like the structure land use, residential is the most common type of parcel. However, the next highest parcel land use in the landslide-prone area are vacant parcels, followed by agricultural and then trailers.

Table 4.3.5-2: Land-Use of Structures within areas of High Susceptibility to Landslide (Columbia County GIS, 2016).

Municipality	Agricultural	Commercial	Exempt	Industrial	Residential	Tower	Trailer	Utility	Vacant	Total
Beaver Township	146	1	7	-	254	-	29	1	10	448
Benton Borough	-	-	-	-	-	-	-	-	-	-
Benton Township	-	-	-	-	-	-	-	-	-	-
Berwick Borough	2	611	108	69	3,707	13	205	18	51	4,784
Town of Bloomsburg	3	947	209	12	2,738	3	35	12	70	4,029
Briar Creek Borough	5	50	50	1	140	-	129	2	4	381
Briar Creek Township	150	20	31	5	1,048	1	248	-	34	1,537
Catawissa Borough	1	99	36	6	513	2	28	3	6	694
Catawissa Township	84	6	15	-	338	10	21	-	18	492
Centralia Borough	-	-	3	-	-	-	-	-	-	3
Cleveland Township	189	24	4	-	324	-	28	2	12	583
Conyngham Township	2	5	21	-	375	2	18	1	10	434
Fishing Creek Township	-	-	-	-	-	-	-	-	0	0
Franklin Township	109	5	9	-	147	2	24	-	11	307
Greenwood Township	-	-	-	-	-	-	-	-	-	-
Hemlock Township	100	52	16	2	680	4	24	1	22	901
Jackson Township	-	-	-	-	-	-	-	-	-	-
Locust Township	194	16	20	1	474	-	99	4	13	821
Madison Township	-	-	-	-	-	-	-	-	-	-
Main Township	93	14	64	-	363	-	77	1	13	625
Mifflin Township	129	36	14	3	747	2	107	3	18	1,059
Millville Borough	-	-	-	-	-	-	-	-	-	-
Montour Township	53	43	12	-	430	5	84	3	10	640
Mt. Pleasant Township	63	17	2	-	184	-	13	-	3	282
North Centre Township	108	14	13	-	538	3	229	2	8	915
Orange Township	39	5	3	-	180	-	56	3	5	291
Orangeville Borough	1	5	5	-	96	-	1	2	1	111

Pine Township	-	-	-	-	-	-	-	-	-	-
Roaring Creek Township	195	-	2	-	128	1	37	-	20	383
Scott Township	23	326	40	1	1,801	2	254	9	151	2,607
South Centre Township	16	63	27	18	596	5	261	102	13	1,101
Stillwater Borough	-	-	-	-	-	-	-	-	-	-
Sugarloaf Township	-	-	-	-	-	-	-	-	-	-
Totals	1,705	2,359	711	118	15,801	55	2,007	169	503	23,428

Table 4.3.5-3: Land-Use of Parcels within areas of High Susceptibility to Landslide (Columbia County GIS, 2016).

Municipality	Agricultural	Commercial	Exempt	Industrial	Residential	Tower	Trailer	Utility	Vacant	Total
Beaver Township	343	2	26	-	275	-	46	1	620	1,313
Benton Borough	-	-	-	-	-	-	-	-	-	-
Benton Township	-	-	-	-	-	-	-	-	-	-
Berwick Borough	6	378	142	70	3,483	1	221	20	350	4,671
Town of Bloomsburg	7	406	217	14	2,447	7	31	21	240	3,390
Briar Creek Borough	10	38	11	1	143	-	127	2	46	378
Briar Creek Township	195	19	56	6	1,064	1	221	4	386	1,952
Catawissa Borough	1	58	61	5	493	1	30	5	40	694
Catawissa Township	137	8	37	-	347	10	20	-	178	737
Centralia Borough	-	-	171	-	-	-	-	-	63	234
Cleveland Township	276	58	7	-	350	-	33	6	255	985
Conyngham Township	3	15	126	5	398	1	18	5	251	822
Fishing Creek Township	-	-	2	-	-	-	-	-	4	6
Franklin Township	168	8	15	-	142	6	136	-	124	599
Greenwood Township	-	-	-	-	-	-	-	-	-	-
Hemlock Township	159	45	65	1	724	4	24	2	199	1,223
Jackson Township	-	-	-	-	-	-	-	-	-	-
Locust Township	261	56	30	1	452	-	361	3	211	1,375

Madison Township	-	-	-	-	-	-	-	-	-	-
Main Township	133	10	20	-	382	-	61	1	135	742
Mifflin Township	202	30	45	3	749	3	178	6	250	1,466
Millville Borough	-	-	-	-	-	-	-	-	-	-
Montour Township	76	48	41	-	450	9	151	3	165	943
Mt. Pleasant Township	86	5	5	-	192	-	33	-	66	387
North Centre Township	171	6	19	-	551	5	207	2	200	1,161
Orange Township	54	5	9	-	188	-	43	2	45	346
Orangeville Borough	3	6	9	-	95	-	1	1	15	130
Pine Township	-	-	-	-	-	-	-	-	-	-
Roaring Creek Township	268	-	6	-	143	3	45	-	161	626
Scott Township	46	150	104	1	1,801	2	235	10	291	2,640
South Centre Township	28	53	24	19	608	3	230	5	134	1,104
Stillwater Borough	-	-	-	-	-	-	-	-	-	-
Sugarloaf Township	-	-	-	-	-	-	-	-	-	-
	2,633	**1,404**	**1,248**	**126**	**15,477**	**56**	**2,452**	**99**	**4,429**	**27,924**

4.3.6 Pandemic

4.3.6.1 Location and Extent

A pandemic is the sudden outbreak of a new flu virus that spreads easily from one person to another and attacks the population of an extensive region, including several countries and/or continents. There have been four flu pandemics during the last century; the Spanish Flu, the Asian Flu, the Hong Kong Flu, and most recently, the Swine Flu.

Generally, pandemic diseases cause sudden, pervasive illness in all age groups on a global scale. Pandemic events cover a wide geographic area and can affect large populations, including the entire population of Columbia County, depending on the disease. The exact size and extent of an infected population is depending upon how easily the illness is spread, the mode of transmission, and the amount of contact between infected and non-infected persons.

Columbia County is primarily concerned with the possibility of pandemic outbreaks of various forms of influenza, West Nile Virus, or the Zika virus. Pandemic influenza planning began in response to the H5N1 (avian) flu outbreak in Asia, Africa, Europe, the Pacific, and the Near East in the late 1990s and early 2000s. H5N1 did not reach pandemic proportions in the United States, but the County began actively planning for an occurrence of an influenza pandemic. As stated in the Pennsylvania Department of Health Influenza Pandemic Response Plan, “an influenza pandemic is inevitable and will probably give little warning” (PA DOH, 2005). Influenza, also known as “the flu”, is a contagious disease that is caused by the influenza virus and most commonly attacks the respiratory tract in humans. Influenza is considered to have pandemic potential if it is novel, meaning that people have no immunity to it, virulent, meaning that it causes deaths in normally healthy individuals, and easily transmittable from person-to-person.

Listed below are basic descriptions of identified diseases with identified pandemic potential and their expected impact:

- The Bird Flu is a disease of wild, domesticated and farm birds. The newer type of bird flu referred to as highly pathogenic avian influenza (HPAI) H5N1 is of concern. HPAI has the potential to spread to humans who have had direct or close contact with sick or dead poultry that were infected with the virus. Human infections are considered to be rare, but 60% of those infected have died. Most cases of human transmission have occurred in other countries; however, the first case of human infection in the Americas was reported in Canada in January 2014.

- The West Nile Virus is carried by mosquitoes and can infect birds, animals and people. Most species of mosquitoes found in Pennsylvania do not carry the virus. In some cases, the virus could cause encephalitis in humans, which is an infection of the brain. The peak season is usually April through October.

- Influenza continues to remain a concern in Pennsylvania due to the potential to spread quickly. During the 2015/2016 flu season, there were 162 confirmed cases of influenza. It is estimated that the numbers are much higher because most do not seek treatment for this virus. According to the Pennsylvania Department of Health, it is estimated that 5 to 20 percent of Pennsylvanians contract the flu each year, and 120 to 2,000 die from complications associated with influenza.

- The Zika virus is a mosquito-borne flavivirus that is transmitted primarily by Aedes mosquitoes. According to the World Health Organization, it is of particular concern because it is believed to cause microcephaly and Guillain-Barre syndrome. It has also been linked to other neurological complications.

4.3.6.2 Range of Magnitude

The magnitude of a pandemic in Columbia County will range significantly depending on the aggressiveness of the virus in question and the ease of transmission. Pandemic influenza is fairly easily transmitted from person-to-person compared to West Nile, but advances in medical technologies have greatly reduced the number of deaths caused by influenza over time. In terms of lives lost, the impact various pandemic influenza outbreaks have had globally over the last century has declined (see Table 4.3.5-1). The 1918 Spanish flu pandemic remains the worst-case pandemic event on record. While mortality figures were probably under-reported, in the first month of the pandemic alone, 8,000 Pennsylvanians died from the flu or its complications (US Department of Health and Human Services, 2010).

In contrast, the severity of illness from recent influenza viruses has varied, with the gravest cases occurring mainly among those considered at high risk. High risk populations considered more vulnerable include children, the elderly, pregnant women, and chronic disease patients with reduced immune system capacity. Most people infected with H1N1 (swine flu) in 2009 and 2010 outbreak recovered without needing medical treatment. This strain of the flu has continued to circulate in the United States. The 2014 season is the first since 2009 that H1N1 has been so predominant in the United States.

The magnitude of a pandemic may be exacerbated by the fact that pandemics occur over large areas and will cause outbreaks across the United States, thus limiting the ability to transfer assistance from one jurisdiction to another. Additionally, effective preventative and therapeutic measures, including vaccines and other medications, will likely be in short supply or will not be available.

There are no true environmental impacts in pandemic disease outbreaks, but there may be significant economic and social costs beyond the possibility of deaths. Widespread illness may increase the likelihood of shortages of personnel to perform essential community services. In addition, high rates of illness and worker absenteeism occur within the business community, and these contribute to social and economic disruption. Social and economic disruptions could be temporary but may be amplified in today's closely interrelated and interdependent systems of trade and commerce. Social disruption may be greatest when rates of absenteeism impair essential services, such as power, transportation, and communications.

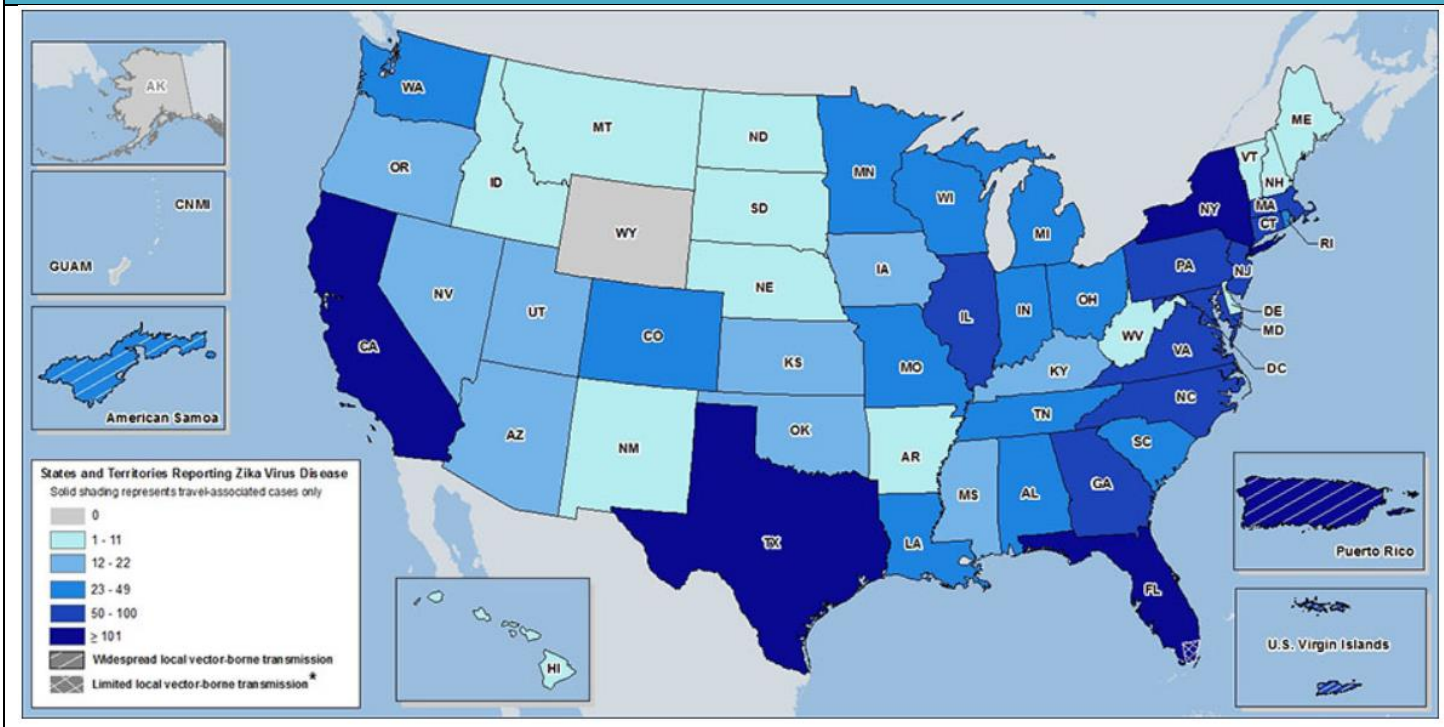
4.3.6.3 Past Occurrence

The West Nile Virus has been found in Columbia County; however, it hasn't yet affected any humans. The first case of the virus in humans in Pennsylvania occurred in York County in 2006 (PA DOH, 2006). There have been 10 positive mosquito samples in Columbia County between 2013 and 2016. Three of the positive samples were found in 2015 and seven in 2013.

As of September 2016, there were 95 CDC confirmed cases of Zika virus in Pennsylvania. It is important to note, however, the cases of Zika documented in Pennsylvania were

associated with travel and were not locally acquired cases with the exception of one case which was found to be due to laboratory transmission. As of the 2017 plan update, Florida was the only state in the United States with locally acquired cases. Figure 4.3.6-1 below illustrates the distribution of Zika cases throughout the United States,

Figure 4.3.6-1: Laboratory-Confirmed Zika Cases in the United States as of September 2016 (CDC, 2016)



There have been several pandemic influenza outbreaks which have occurred over the past 100 years. A list of events worldwide is shown in Table 4.3.6-1. According to flu.gov this information on Pandemic influenza is still the most current available as of the 2017 plan update.

Table 4.3.6-1: List of previous significant outbreaks of influenza over the past century (Global Security, 2009; World Health Organization, 2009).

DATE	PANDEMIC NAME/SUBTYPE	WORLDWIDE DEATHS (APPROXIMATE)
1918-1920	Spanish Flu / H1N1	50 million
1957-1958	Asian Flu / H2N2	1.5-2 million
1968-1969	Hong Kong Flu / H3N2	1 million
2009-2010	Swine Flu / 2009 H1N1	17,700

Deaths occurred in the United States as a result of the Spanish Flu, Asian flu, and Hong Kong Flu outbreaks. The Spanish Flu claimed 500,000 lives in the United States, and there

were 350,000 cases in Pennsylvania. This outbreak affected healthy adults between 20-50 years old. Most deaths resulting from the Asian flu occurred between September, 1957 and March, 1958; there were about 70,000 deaths in the United States and approximately 15% of the population of Pennsylvania was affected. The Asian flu affected both the very young and the very old. The first cases of the Hong Kong Flu in the U.S. were detected in September of 1968 with deaths peaking between December, 1968 and January, 1969 (Global Security, 2009). Those most affected by this flu were the very old and those with underlying medical conditions. More recently, 41 cases of 2009 H1N1 were confirmed in Columbia County, and one death occurred (PA DOH, 2010). Again, the very young and persons with other medical conditions were the most vulnerable to Swine flu (PA DOH, 2010).

4.3.6.4 Future Occurrence

Based on historical events, Columbia County is expected to experience pandemic influenza outbreaks approximately every 11 to 41 years. The precise timing of pandemic influenza is uncertain, but occurrences are most likely when the Influenza Type A virus makes a dramatic change, or antigenic shift, that results in a new or "novel" virus to which the population has no immunity. This emergence of a novel virus is the first step toward a pandemic (US Health and Human Services, 2009).

West Nile Virus could potentially impact Columbia County in the future as it is carried and spread by mosquitoes. The probability of the virus infecting animals or humans in the County is low, because most species of mosquitoes found in Pennsylvania don't carry the virus, and the state as a whole has taken precautions to avoid the spread of the virus such as killing mosquito larvae and by trapping and monitoring birds, mosquitoes, people, and horses. Evidence of the success is shown by samples taken of mosquitoes and birds in 2011, all of which tested negative for West Nile.

On the whole, the future probability of a pandemic event in Columbia County can be considered possible as defined by the Risk Factor ranking probability criteria (see Table 4.4-1).

4.3.6.5 Vulnerability Assessment

Certain population groups are at higher risk of pandemic flu infection. This population group includes people 65 years and older, children younger than 5 years old, pregnant women and people of any age with certain chronic medical conditions. Such conditions include but are not limited to diabetes, heart disease, asthma and kidney disease (CDC, 2009). Schools, convalescent centers, and other institutions serving those younger than 5 years old and older than 65 years old, are locations conducive to faster transmission of pandemic influences since populations identified as being at high risk are concentrated at these facilities. The highest concentration of these institutions is found in the Town of Bloomsburg. For the general public, health care professionals advise that a good diet, proper exercise and good sanitary habits help to lessen a person's chance of ever being a victim of a pandemic. Standing water is one of the main sources of mosquito problems on private property, so residents and their livestock will be less vulnerable if they eliminate any standing water or any old tires or water containers where mosquitoes could breed (PA West Nile Control Project, 2011). The most vulnerable time of year for this disease is between April and October and the most vulnerable population for complications with the disease includes people over 50 years of age and persons with weakened immune systems.

Bloomsburg University indicates that the students and staff would be vulnerable to a pandemic if it were to occur locally. With a high concentration of young people living in close quarters, a virulent disease could cause major damage. Continuity of operations would be a key issue for them during a pandemic event. To reduce their vulnerability, the University has developed and is implementing a pandemic plan to prepare for this hazard.

4.3.7 Radon

4.3.7.1 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, but it was not until the 1980s that the wide geographic distribution of elevated values in houses and the possibility of extremely high radon values in houses were recognized. In 1984, routine monitoring of employees leaving the Limerick nuclear power plant near Reading, PA while it was still under construction and not yet functional, showed that readings on a construction worker at the plant frequently exceeded expected radiation levels. However, only natural, nonfission-product radioactivity was detected on him.

Subsequent testing of the employee's home in the Reading Prong section of Pennsylvania showed extremely high radon levels around 2,500 pCi/L (pico Curies per Liter). To put this amount in perspective, the Environmental Protection Agency (EPA) guidelines state that actions should be taken if radon levels exceed 4 pCi/L in a home, and uranium miners have a maximum exposure of 67 pCi/L. As a result of this event, the Reading Prong became the focus of the first large-scale radon scare in the world.

Radon is a gas that cannot be seen or smelled. It is a noble gas that originates by the natural radioactive decay of uranium and thorium. Like other noble gases (e.g., helium, neon, and argon), radon forms essentially no chemical compounds and tends to exist as a gas or as a dissolved atomic constituent in groundwater. Two isotopes of radon are significant in nature, 222Rn and 220Rn, formed in the radioactive decay series of 238U and 232Th, respectively. The isotope thoron (i.e. 220Rn) has a half-life (time for decay of half of a given group of atoms) of 55 seconds, barely long enough for it to migrate from its source to the air inside a house and pose a health risk. However, radon (i.e. 222Rn), which has a half-life of 3.8 days, is a widespread hazard. The distribution of radon is correlated with the distribution of radium (i.e. 226Ra), its immediate radioactive parent, and with uranium, its original ancestor. Due to the short half-life of radon, the distance that radon atoms can travel from their parent before decay is generally limited to distances of feet or tens of feet. Each county in Pennsylvania is classified as having a *low*, *moderate*, or *high* radon hazard potential. Columbia County is classified as having a high hazard, meaning there is a predicted indoor radon level of greater than 4 pCi/L (see Figure 4.3.7-1).

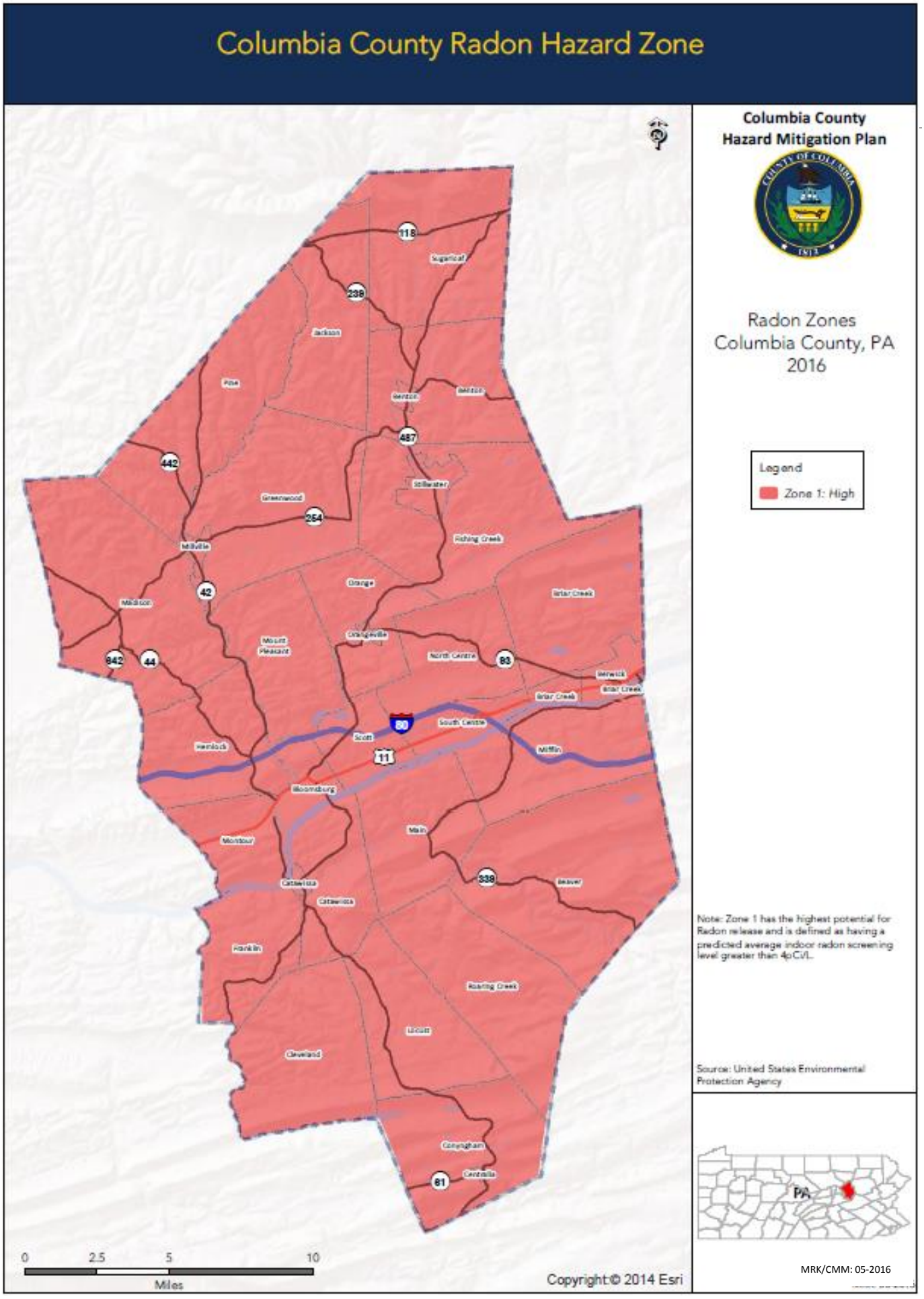
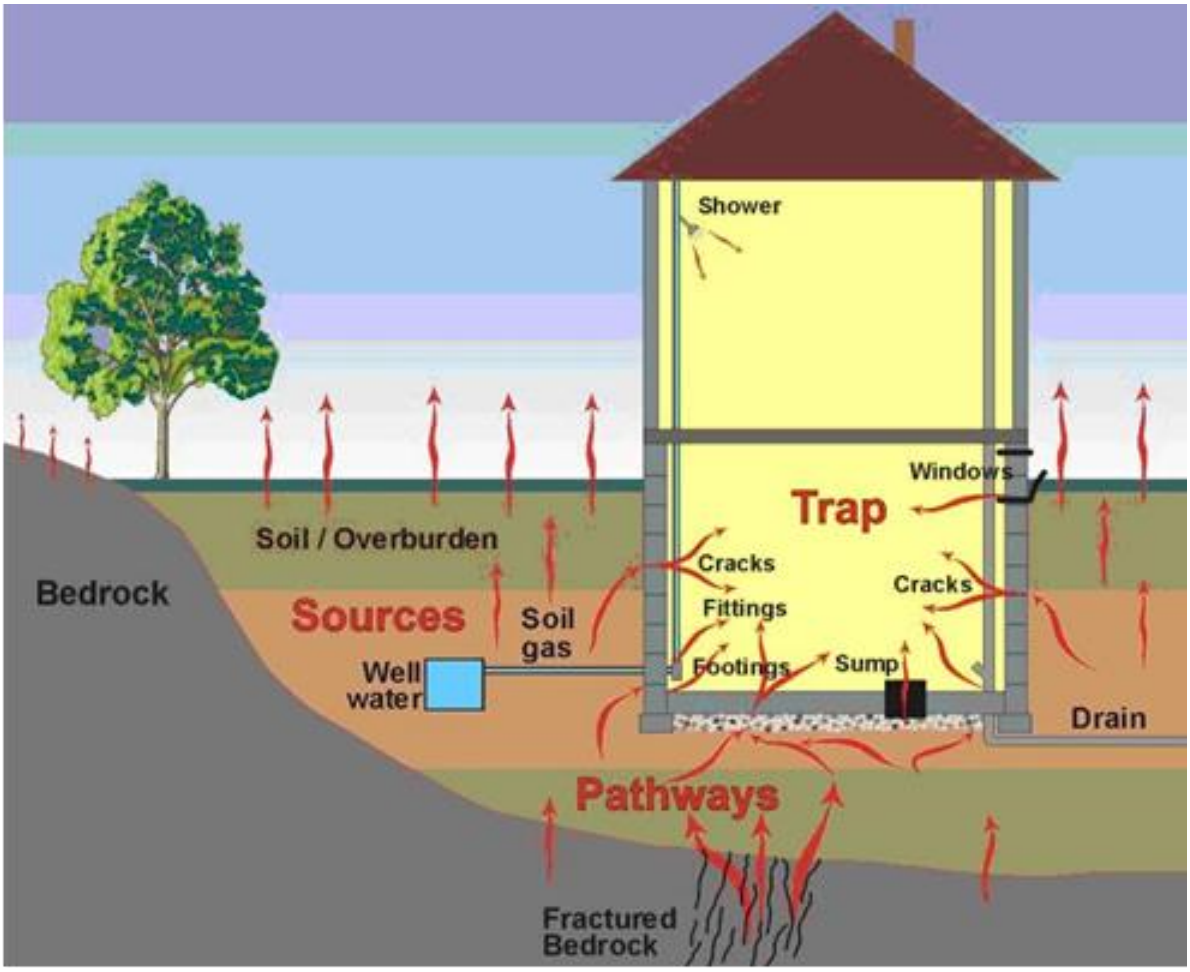


Figure 4.3.7-1: Columbia County Radon Hazard Zone (Columbia County GIS, 2016).

Three sources of radon in houses are now recognized (shown in Figure 4.3.7-2):

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

Figure 4.3.7-2: Sketch of radon entry points into a house (Arizona Geological Survey, 2006)



High radon levels were initially thought to be exacerbated in houses that are tightly sealed, but it is now recognized that rates of air flow into and out of houses, plus the location of air inflow and the radon content of air in the surrounding soil, are key factors in radon concentrations. Outflows of air from a house, caused by a furnace, fan, thermal “chimney” effect, or wind effects, require that air be drawn into the house to compensate. If the upper part of the house is tight enough to impede influx of outdoor air (radon concentration generally <0.1 pCi/L), then an appreciable fraction of the air may be drawn in from the soil or fractured bedrock through the foundation and slab beneath the house, or through cracks and openings for pipes, sumps, and similar features (see Figure 4.3.7-2). 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.

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

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

- Areas of very elevated uranium content (>50 ppm) around uranium deposits and prospects. Although very high levels of radon can occur in such areas, the hazard normally is restricted to within a few hundred feet of the deposit. In Pennsylvania, such localities occupy an insignificant area.
- Areas of common rocks having higher than average uranium content (5 to 50 ppm). In Pennsylvania, such rock types include granitic and felsic alkali igneous rocks and black shales. In the Reading Prong, high uranium values in rock or soil and high radon levels in houses are associated with Precambrian granitic gneisses commonly containing 10 to 20 ppm uranium, but locally containing more than 500 ppm uranium. In Pennsylvania, elevated uranium occurs in black shales of the Devonian Marcellus Formation, the primary geologic formation in Columbia County (PA DCNR, 2007). High radon values are locally present in areas underlain by these formations. This is most likely the cause of high radon levels in Columbia County.
- Areas of soil or bedrock that have normal uranium content but properties that promote high radon levels in houses. This group is incompletely understood at present. Relatively high soil permeability can lead to high radon, the clearest example being houses built on glacial eskers. Limestone-dolomite soils also appear to be predisposed for high radon levels in houses, perhaps because of the deep clay-rich residuum in which radium is concentrated by weathering on iron oxide or clay surfaces, coupled with moderate porosity and permeability. This is unlikely to be the culprit of high radon readings in Columbia County, as there is little-to-no limestone-dolomite soil.

4.3.7.2 Range of Magnitude

Exposure to radon is the second leading cause of lung cancer after smoking. It is the number one cause of lung cancer among non-smokers. Radon is responsible for about 21,000 lung cancer deaths every year; approximately 2,900 of which occur among people who have never smoked. Lung cancer is the only known effect on human health from exposure to radon in air and thus far, there is no evidence that children are at greater risk of lung cancer than are adults (EPA, March 2010). The main hazard is actually from the radon daughter products (218Po, 214Pb, 214Bi), which may become attached to lung tissue and induce lung cancer by their radioactive decay.

Table 4.3.7-1: Radon risk for smokers and non-smokers (EPA, 2016).

RADON LEVEL (cCi/L)	IF 1,000 PEOPLE WERE EXPOSED TO THIS LEVEL OVER A LIFETIME…*	RISK OF CANCER FROM RADON EXPOSURE COMPARES TO…**	ACTION THRESHOLD
SMOKERS			
20	About 260 people could get lung cancer	250 times the risk of drowning	Fix Structure
10	About 150 people could get lung cancer	200 times the risk of dying in a home fire	
8	About 120 people could get lung cancer	30 times the risk of dying in a fall	
4	About 62 people could get lung cancer	5 times the risk of dying in a car crash	
2	About 32 people could get lung cancer	6 times the risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 20 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	About 3 people could get lung cancer	(Average outdoor radon level)	
NON-SMOKERS			
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	
8	About 15 people could get lung cancer	4 times the risk of dying in a fall	
4	About 7 people could get lung cancer	The risk of dying in a car crash	
2	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 2 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4		(Average outdoor radon level)	

NOTE: Risk may be lower for former smokers. * Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003). ** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

According to the EPA, the average radon concentration in the indoor air of homes nationwide is about 1.3 pCi/L. The EPA recommends homes be fixed if the radon level is 4 pCi/L or more. However, because there is no known safe level of exposure to radon, the EPA also recommends that Americans consider fixing their home for radon levels between 2 pCi/L and 4 pCi/L. Table 4.3.7-1 shows the relationship between various radon levels, probability of lung cancer, comparable

risks from other hazards, and action thresholds. As is shown in Table 4.3.4- 1, a smoker exposed to radon has a much higher risk of lung cancer.

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

4.3.7.3 Past Occurrence

The EPA has estimated that the national average indoor radon concentration is 1.3 pCi/L and the level for action is 4.0 pCi/L; however, they have estimated that the average indoor concentration in Pennsylvania basements is about 7.1 pCi/L and 3.6 pCi/L on the first floor (PADEP, 2011). In Columbia County, PA DEP Bureau of Radiation Protection test results of nearly 5,000 samples, shown in Table 4.3.7-2, indicate that the County has higher radon levels than the state-wide comparison data. This is particularly evident at the higher-end concentrations from 20 pCi/L and above. The County average reading of 14.4 pCi/L is also well above the statewide average of approximately 7 pCi/L.

Table 4.3.7-2: Countywide radon test results (Lewis, 2016).

RANGE	SAMPLE SIZE FOR COLUMBIA COUNTY	% OF TESTS IN COLUMBIA COUNTY IN RANGE	% OF TESTS IN PA IN RANGE
< 4 pCi/L	4437	52.7%	61%
4 – 9.99 pCi/L	1828	21.7%	23%
10-19.9 pCi/L	914	10.8%	9.2%
20-49.9 pCi/L	705	8.4%	5.3%
50-99.9 pCi/L	313	3.7%	1.3%
>100 pCi/L	216	2.6%	0.4%

On a municipal level, the Bureau of Radiation Protection provides information for homeowners on how to test for radon in their houses. If a test is reported to the Bureau over 4 pCi/L, then the Bureau works to help the homeowners make repairs to their houses to mitigate against high radon levels. The total number of tests reported to the Bureau since 1990 and their results are provided by zip code on the Bureau's website; it is important to note that the zip codes do not perfectly align with municipal boundaries. However, this information is only provided if over 30 tests total were reported in order to best approximate the average for the area. In Columbia County, eight of the ten zip codes had sufficient tests reported to the Bureau to report their findings, which are shown in Table 4.3.7-3. The highest average radon levels occur in zip codes 17814, the northern portion of the County, and in 17820. This corresponds with a number of documented uranium occurrences in the Devonian period rocks in this area (McCauley, 1961).

Table 4.3.7-3: Radon level tests and results in Columbia County zip codes (PADEP, 2016).

ZIP CODE	AREA OF COLUMBIA COUNTY	NUMBER OF TESTS	MAXIMUM RESULT (pCi/L)	AVERAGE RESULT (pCi/L)
17814	Sugarloaf Township, Jackson Township, Benton Township, Benton Borough	142	370	22.4
17815	Part of Hemlock Township, Part of Montour Township, Part of Orange Township, Part of N. Centre Township, South Centre Township, Scott Township, Mount Pleasant Township, Main Township, Town of Bloomsburg	1515	627.5	14.2
17820	Catawissa Township, Catawissa Borough, Franklin Township, Cleveland Township, Locust Township, Roaring Creek Township	210	269.3	26.1
17846	Madison Township, Millville Borough, Pine Township, Greenwood Township	104	215	16.1
17859	Part of Fishing Creek Township, Part of Orange Township, Orangeville Borough	84	130	20
17878	Stillwater Borough, Part of Fishing Creek Twp	42	200	20
17888	Part of Conyngham Township	Insufficient data	Insufficient data	Insufficient data
17985	Centralia Borough, Part of Conyngham Township	Insufficient data	Insufficient data	Insufficient data
18603	Briar Creek Borough, Briar Creek Township, Part of N Centre Township, Berwick Borough, Part of Luzerne County	673	343.3	10.1
18631	Beaver Township, Part of Schuylkill County	66	150.5	11.3

4.3.7.4 Future Occurrence

Radon exposure is inevitable given present soil, geologic, and geomorphic factors in Columbia County. However, future occurrence of high radon level hazards can be considered *possible* as

defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

Development in areas where previous radon levels have been significantly high will continue to be more susceptible to exposure. Exposure can be limited with proper testing for both past and future development.

4.3.7.5 Vulnerability Assessment

As Table 4.3.7-3 shows, houses in Columbia County, especially in the northern and southern area of the County, could be susceptible to high levels of radon. Smokers can be up to ten times more vulnerable to lung cancer from high levels of radon depending on the level of radon they are exposed to (see Table 4.3.7-1). Older houses that have crawl spaces or unfinished basements are more vulnerable as well because of the increased exposure to soils which could be releasing higher levels of radon gas. Additionally, houses that rely on wells for their water may face an additional risk, although this type of exposure is low and rare in Pennsylvania.

Proper testing for radon levels will determine the level of vulnerability that residents face in their homes, as well as in their businesses and schools. The Pennsylvania Department of Environmental Protection Bureau of Radiation Protection provides short and long term tests to determine radon levels as well as information on how to mitigate high levels of radon in a building. A radon mitigation system costs approximately $1,200, according to the EPA.

4.3.8 Tornado, Windstorm

4.3.8.1 Location and Extent

A tornado is a rapidly rotating column of air extending from a thunderstorm to the ground that has the potential to cause significant damage to anything in its path. Although tornadoes occur in many parts of the world, these destructive forces of nature are found most frequently in the United States east of the Rocky Mountains during the spring and summer months. In an average year, 800 tornadoes are reported nationwide, resulting in 80 deaths and over 1,500 injuries. With wind speeds in excess of 250 mph, tornadoes are considered nature's most violent storms. Damage paths can be as wide as 1 mile and over 50 miles long.

Tornadoes are related to larger vortex formations and often form in convective cells such as thunderstorms or in the right forward quadrant of a hurricane, far from the hurricane eye. Tornadoes in the winter and early spring are often associated with strong frontal systems that form in the central states and move east. Occasionally, large outbreaks of tornadoes occur with this type of weather pattern. Several states may be affected by numerous severe thunderstorms and tornadoes. It is interesting to note that tornadoes may appear nearly transparent until dust and debris are picked up or a cloud forms in the funnel. Tornadoes and wind storms can occur throughout Columbia County though events are usually localized. However, severe thunderstorms may result in conditions favorable to the formation of numerous or long-lived tornadoes. Tornadoes can occur at any time during the day or night, but are most frequent during late afternoon into early evening, the warmest hours of the day, and most likely to occur during the spring and early summer months of March through June.

Straight-line winds and windstorms are experienced on a more region-wide scale. While such winds usually accompany tornadoes, straight-lined winds are caused by the movement of air from areas of higher pressure to areas of lower pressure. Stronger winds are the result of greater differences in pressure. Windstorms are generally defined with sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for

any duration.

4.3.8.2 Range of Magnitude

Each year, tornadoes account for $1.1 billion in damages and cause over 80 deaths nationally (NCAR, 2001). 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. The width of tornadoes can vary greatly, but generally range in size from less than 100 feet to over a mile in width. Some tornadoes never touch the ground and are short-lived and are called funnel clouds, while others may touch the ground several times. 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. The forward motion of the tornado path can be a few hundred yards or several hundred miles in length.

Damages and deaths can be especially significant when tornadoes move through populated, developed areas. Typically, tornadoes cause the greatest damages to structures of light construction such as mobile homes. The destruction caused by tornadoes ranges from minor to extreme depending on the intensity, size and duration of the storm as defined by the Enhanced Fujita Scale. The Enhanced Fujita Scale, also known as the “EF-Scale,” measures tornado strength and associated damages. The EF-Scale is an update to the earlier Fujita Scale, also known as the “F-Scale,” that was published in 1971. It classifies United States tornadoes into six intensity categories, as shown in Table 4.3.8-1, based upon the estimated maximum winds occurring within the wind vortex. Since its implementation by the National Weather Service in 2007, the EF-Scale has become the definitive metric for estimating wind speeds within tornadoes based upon damage to buildings and structures. F-Scale categories with corresponding EF-Scale wind speeds are provided in Table 4.3.6-1 since the magnitude of previous tornado occurrences is based on the F-Scale.

Table 4.3.8-1: Enhanced Fujita Scale (EF-Scale) categories with associated wind speeds and description of damages.

EF- SCALE NUMBER	WIND SPEED (mph)	F-SCALE NUMBER	TYPE OF DAMAGE POSSIBLE
EF0	65–85	F0-F1	**Minor damage**: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86-110	F1	**Moderate damage**: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111–135	F1-F2	**Considerable damage**: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136–165	F2-F3	**Severe damage**: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166–200	F3	**Devastating damage**: W ell-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	F3-F6	**Extreme damage**: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft.); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation.

Section 4.3.4.1 described the wind speed zones developed by the American Society of Civil Engineers based on tornado and hurricane historical events. These wind speed zones are intended to guide the design and evaluation of the structural integrity of shelters and critical facilities. Since Columbia County falls within Zone III, design wind speeds for shelters and critical facilities should be able to withstand a 3-second gust of up to 200 mph, regardless of whether the gust is the result of a tornado, coastal storm, or windstorm event. Therefore, these structures should be able to withstand the wind speeds experienced in an EF4 tornado event.

The worst tornado on record in Columbia County occurred in April, 1982. This F2 event was 30 yards wide and 4 miles long. In the course of its track it caused an estimated $25,000 in damage and one injury (NCDC 2011).

Since tornado events are typically localized, environmental impacts are rarely widespread. However, where these events occur, severe damage to plant species is likely. This includes

loss of trees and an increased threat of wildfire in areas where dead trees are not removed. Hazardous material facilities should meet design requirements for the wind zones identified in Figure 4.3.4-1 in order to prevent release of hazardous materials into the environment.

4.3.8.3 Past Occurrence

Tornadoes have occurred in all seasons and all regions of Pennsylvania, but the northern, western, and southeastern portions of the Commonwealth have been struck more frequently. A list of tornado events that have occurred in Columbia County between 1950 and 2010 is shown in Table 4.3.8-2 with an associated Fujita Tornado Scale magnitude. Few injuries have occurred in Columbia County's tornado events; the only reported injuries occurred during the 1982 event, when one person was injured. The F2 event described in Section 4.3.6.2 has been the largest tornado ever recorded in Columbia County. However, since it occurred in a heavily forested area with few residential structures, it did not cause any damages except downed trees. In contrast, the F1 magnitude tornado of April 2002 touched down near Jerseytown and moved east northeast, traveling about six miles before lifting off over Orange Township. The path of the tornado was about 6 miles long with varying widths up to 300 yards. The top wind speed was estimated at nearly 100 miles per hour. It damaged 11 structures, of which one home was completely destroyed and 4 other homes were seriously damaged. The others were barns and out buildings, garages and workshops that were destroyed. Hundreds of trees were uprooted, power lines downed and highways closed by fallen trees and power lines. Structural damages were estimated at over $360,000 with untold numbers of trees that had to be removed from power/telephone lines and state and local highways. A map showing the approximate location of previous events from 1950-2004 is included in Figure 4.3.8-1.

(The information included in table 4.3.8-2 is the most current information available according to the NCDC website as of the 2017 update. The last tornado to affect Columbia County was in 2004.)

Table 4.3.8-2: Previous tornado events between 1950 and 2016 in Columbia County (NCDC, 2016).

LOCATION	DATE	ESTIMATED LENGTH	ESTIMATED WIDTH	MAGNITUDE	ESTIMATED PROPERTY DAMAGE ($)
Columbia County	03/26/1964	0.10 mi	13 yards	F1	2,500
Columbia County	04/17/1982	4.00 mi	30 yards	F2	25,000
Columbia County	07/26/1989	4.00 mi	50 yards	F1	25,000
Columbia County	07/15/1992	0.10 mi	10 yards	F1	0
Bloomsburg	06/27/1994	0.25 mi	75 yards	F1	500,000
Catawissa	05/27/2001	0.10 mi	35 yards	F0	0
Jerseytown	04/28/2002	6.00 mi	30 yards	F1	90,000
Millville	06/17/2004	1.00 mi	20 yards	F1	0

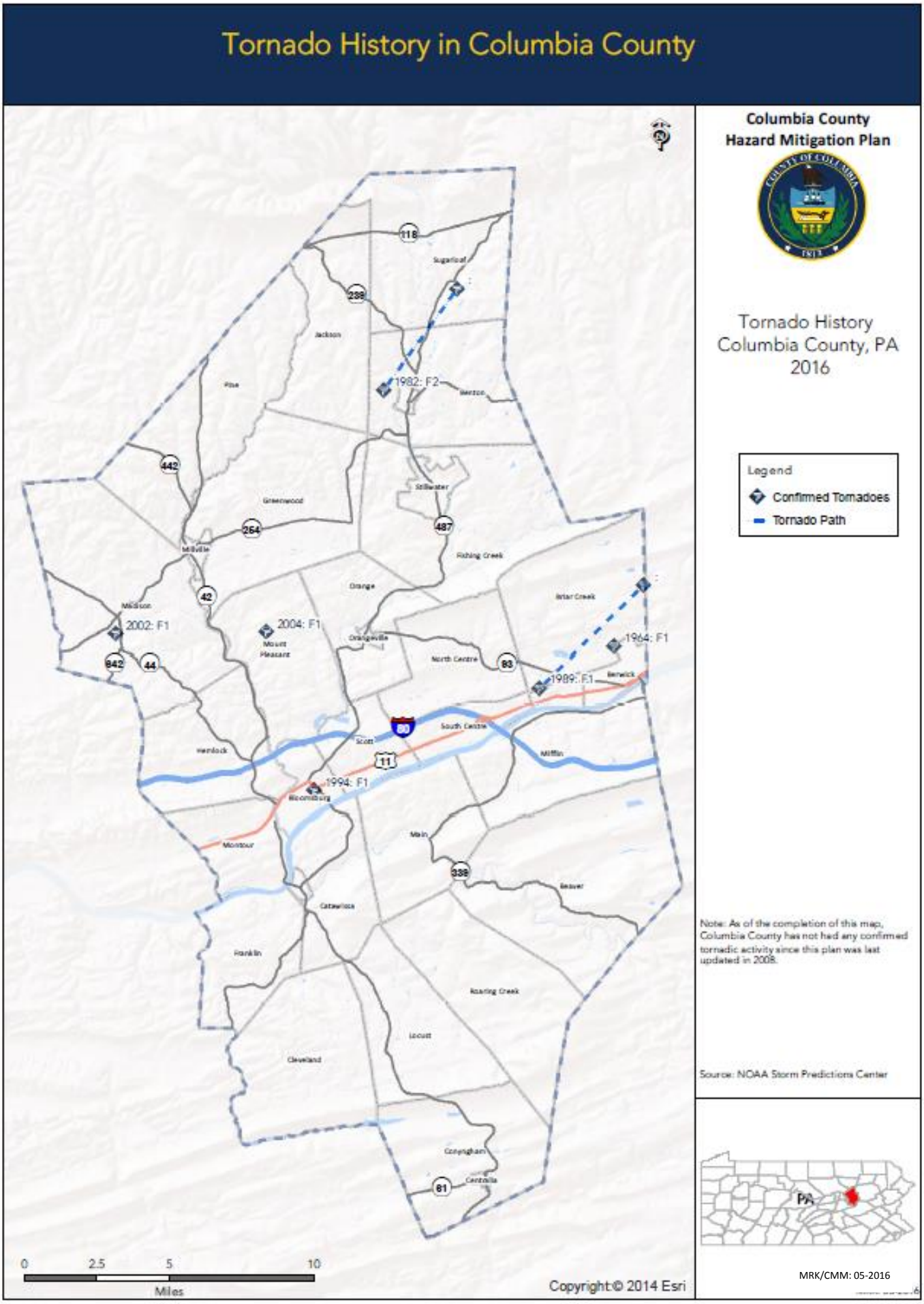


Figure 4.3.8-1: Previous tornado events in Columbia County (Columbia County GIS, 2016)

Windstorm events may be the result of thunderstorms, hurricanes, tropical storms, winter storms, or nor'easters. There have been 69 events with wind speeds of greater than 50 knots. In 2003 the County experienced high winds during a strong cold front in excess of 71 knots, or 81.7 miles per hour. While its damaging effects were limited to downed trees and utility outages in Columbia County, this storm caused a barn to blow over in Cambria County, a vacant building to collapse in Bedford County, roofs to rip off of homes in Franklin County and Johnstown, Pennsylvania, and three fatalities in south central Pennsylvania. The total property damage was reported to be $50,000 (NCDC, 2011). The most damaging thunderstorm Columbia County has ever experienced occurred in April 1982, which resulted in excessive wind gusts and approximately $266,000 in damages. This complex of severe thunderstorms caused considerable wind damage from fallen trees, blown off roofs, damaging mobile homes and downing power lines. A list of events greater than 50 knots that have occurred since 1950 is shown in Table 4.3.8-3.

Table 4.3.8-3: Previous windstorm events greater than 50 knots in Columbia County between 1950 and 2016 (NCDC, 2016). "Multiple Counties" indicates a regional event that impacted Columbia County.

LOCATION	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Columbia	4/17/1982	60	0
Columbia	9/23/1986	52	0
Millville	4/23/1996	52	0
Briar Creek	5/3/1997	51	0
Millville	5/6/1997	51	0
Bloomsburg	5/19/1997	51	0
Millville	7/18/1997	51	0
Berwick	7/18/1997	51	0
Millville	8/16/1997	51	0
Bloomsburg	5/29/1998	51	0
Millville	5/31/1998	51	0
Lime Ridge	6/2/1998	51	0
Benton	6/16/1998	51	0
Benton	6/16/1998	51	0
Benton	6/16/1998	51	0
Bloomsburg	6/30/1998	51	0
Catawissa	7/17/1998	51	0
Catawissa	8/25/1998	51	0
Multiple Counties	9/16/1999	60	100,000
Multiple Counties	9/29/1999	60	100,000
Multiple Counties	4/9/2000	58	15,000
Catawissa	6/30/2001	50	0
Catawissa	7/1/2001	50	0
Bloomsburg	7/17/2001	50	3,000

LOCATION	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Bloomsburg	8/28/2001	50	0
Berwick	10/16/2001	50	0
Bloomsburg	3/9/2002	50	0
Multiple Counties	3/9/2002	50	50,000
Catawissa	7/18/2003	50	0
Bloomsburg	7/21/2003	50	0
Multiple Counties	11/13/2003	71	50,000
Catawissa	5/26/2004	50	0
Benton	6/17/2004	50	0
Numidia	11/25/2004	50	0
Millville	6/6/2005	60	0
Bloomsburg	6/6/2005	50	0
Benton	6/6/2005	50	0
Stillwater	6/6/2005	50	0
Benton	7/13/2005	75	0
Almedia	7/13/2005	50	0
Catawissa	7/13/2005	50	0
Bloomsburg	7/26/2005	50	0
Bloomsburg	7/27/2005	50	0
Bloomsburg	11/6/2005	50	10,000
Bloomsburg	5/30/2006	50	0
Bloomsburg	6/22/2006	50	0
Berwick	8/26/2006	50	0
Numidia	12/1/2006	50	10,000
Benton	6/8/2007	50	0
Benton	6/12/2007	50	0
Light Street	6/12/2007	50	0
Dennis Mills	6/27/2007	50	0
Buckhorn	6/27/2007	50	0
Millville	8/17/2007	50	0
Bloomsburg Muni Airport	8/25/2007	50	0
Catawissa	8/25/2007	50	0
Bloomsburg	6/10/2008	50	0
East Bloomsburg	6/10/2008	50	0
Multiple Counties	2/12/2009	50	50,000
Bloomsburg	7/11/2009	50	5,000
Buckhorn	7/11/2009	50	5,000
Catawissa	8/18/2009	50	5,000
Berwick	6/6/2010	50	5,000

LOCATION	DATE	ESTIMATED WIND SPEED (knots)	ESTIMATED PROPERTY DAMAGE ($)
Bloomsburg	7/24/2010	50	5,000
Fernville	7/25/2010	50	10,000
Jerseytown	9/22/2010	50	5,000
Orangeville	9/22/2010	50	5,000
Berwick	9/22/2010	50	10,000
Bloomsburg	9/30/2010	50	5,000
Catawissa	4/28/2011	50	5,000
Numidia	6/9/2011	50	5,000
Buckhorn	7/19/2011	50	5,000
Lightstreet	7/25/2011	50	5,000
Bloomsburg	5/29/2012	50	5,000
Benton	7/7/2012	50	5,000
Berwick	7/15/2012	50	5,000
Berwick	7/26/2012	50	5,000
Columbia County	10/29/2012	50	0
Forks	4/19/2013	500	0
Millville	6/24/2013	52	0
Bloomsburg	6/27/2013	50	2,500
Forks/Eyersgrove	7/20/2013	50	4,000
Berwick	9/12/2013	50	2,000
Almedia	10/7/2013	50	2,000
Catawissa	11/1/2013	50	0
Coles Creek	7/2/2014	50	1,000
Slabtown	7/3/2014	50	2,000
Forks	7/8/2014	50	1,000
Fowlersville	5/31/2015	50	500
Jamison City	6/8/2015	50	500
Wilburton/Numidia	6/11/2015	50	1,500
Lightstreet/Rupert	6/30/2015	50	2,000

4.3.8.4 Future Occurrence

According to the National Weather Service, the Commonwealth of Pennsylvania has an annual average of ten tornadoes with two related deaths. While the chance of being hit by a tornado is small, the damage that results when the tornado arrives is devastating. An F4 tornado can have wind velocities of 200 mph, resulting in a force of more than 100 pounds per square foot of surface area. This is a "wind load" that exceeds the design limits of most buildings. Unlike some hazards, tornadoes are not specific to select parts of the County. Rather, a tornado could strike in any part of the County, and at any time, and could cause as much or as little damage as possible for the given magnitude event.

Based on tornado activity information for Pennsylvania between 1950 and 1998, most of Columbia County lies within an area that has experienced six to fifteen F3, F4, or F5 tornadoes per 3,700 square miles (see Figure 4.3.8-2). A small portion in the northeastern portion of the county has experienced one to five F3, F4, or F5 tornadoes per 3,700 square miles. This equals a 30 percent to 39 percent chance that the planning area will be affected by a Category F3, F4, or F5 tornado each year. Therefore, the future occurrence of tornadoes and windstorms should be considered *possible* as defined by the Risk Factor ranking probability criteria (see Table 4.4- 1). Wind storms and tornadoes have become more frequent and are expected to continue this trend causing more extensive damage to structures due to the increased development near and within forested areas.

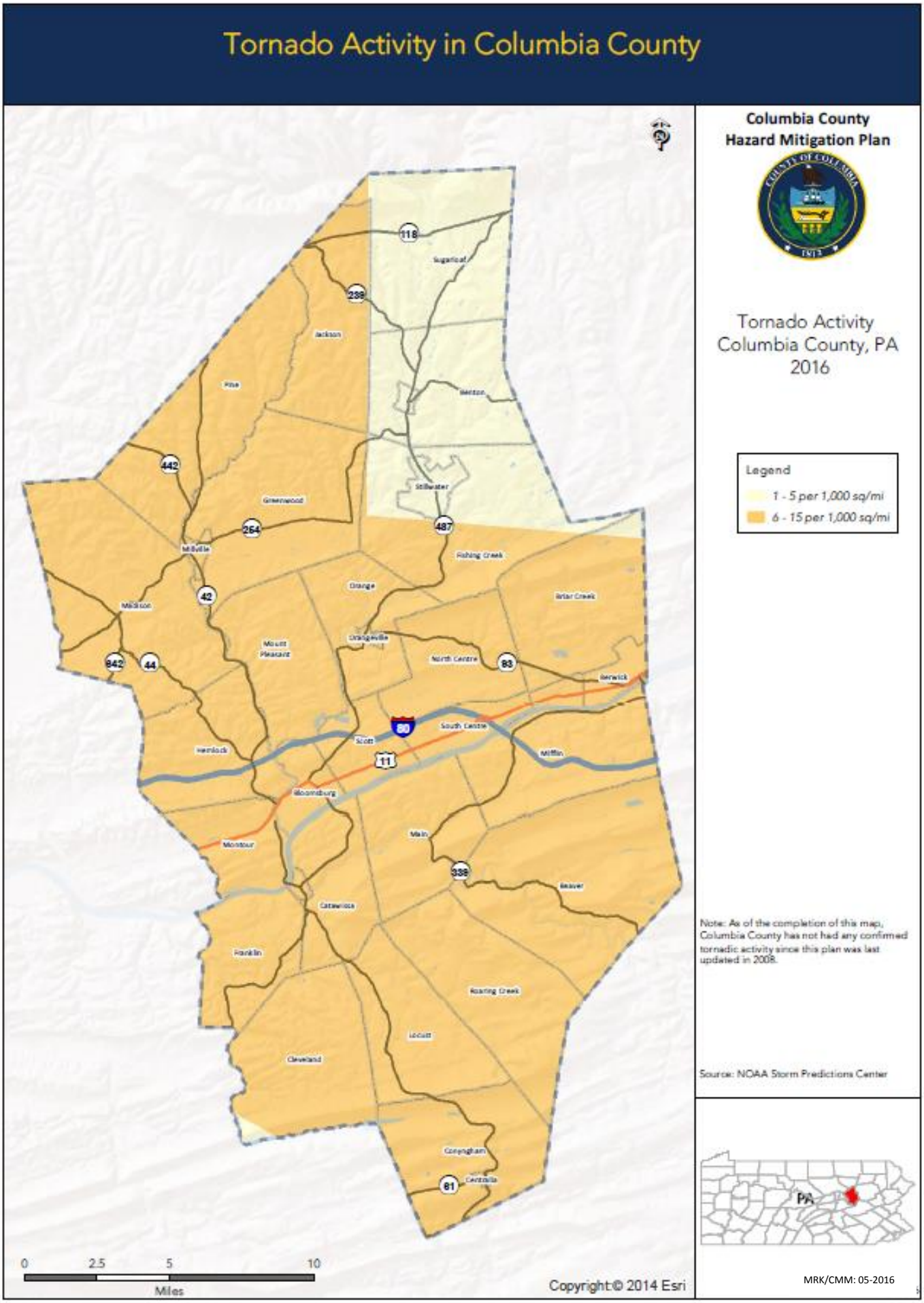


Figure 4.3.8-2: Tornado activity in Columbia County (Columbia County GIS, 2016)

4.3.8.5 Vulnerability Assessment

Based on historical events, tornado and windstorm events are likely to occur across the County. While the frequency of windstorms and minor tornadoes is expected to remain relatively constant or grow slightly, vulnerability increases in more densely developed areas. Since high wind events may affect the entire County, it is important to identify specific critical facilities and assets that are most vulnerable to the hazard. For most assets, this would require site-specific analysis. However, due to their lightweight and often unanchored design, manufactured homes are most often extremely vulnerable to high winds. Table 4.3.8-4 lists the number of each of these trailer structures in each municipality. Countywide there are approximately 3,000 trailers. Centralia Borough does not have any trailer type homes, so it is expected that they will not be as vulnerable to wind impacts. At the other end of the spectrum, Berwick Borough, Briar Creek, North Centre, Orange, Scott, and South Centre Townships each have over 200 addressable trailers, indicating that they may be more vulnerable to tornado and windstorm events.

Table 4.3.8-4: Trailers in Columbia County (Columbia County GIS, 2016).

MUNICIPALITY	# OF TRAILERS	PERCENT OF ADDRESSABLE STRUCTURES THAT ARE TRAILERS
Beaver Township	29	6.3%
Benton Borough	46	10.0%
Benton Township	67	14.5%
Berwick Borough	205	44.5%
Bloomsburg, Town of	35	7.6%
Briar Creek Borough	131	28.4%
Briar Creek Township	266	57.7%
Catawissa Borough	28	6.1%
Catawissa Township	23	5.0%
Centralia Borough	-	-
Cleveland Township	36	7.8%
Conyngham Township	18	3.9%
Fishing Creek Township	85	18.4%
Franklin Township	24	5.2%
Greenwood Township	96	20.8%
Hemlock Township	37	8.0%
Jackson Township	40	8.7%
Locust Township	107	23.2%
Madison Township	83	18.0%
Main Township	77	16.7%
Mifflin Township	107	23.2%
Millville Borough	9	2.0%
Montour Township	84	18.2%
Mt Pleasant Township	55	11.9%
North Centre Township	229	49.7%
Orange Township	295	64.0%

Orangeville Borough	2	0.4%
Pine Township	68	14.8%
Roaring Creek Township	38	8.2%
Scott Township	301	65.3%
South Centre Township	261	56.6%
Stillwater Borough	7	1.5%
Sugarloaf Township	98	21.3%
TOTAL	**2,987**	**20.2%**

Bloomsburg University is no more or less vulnerable to a windstorm than the rest of the County. The vulnerability of individual structures will depend on building age, type of construction, and condition/maintenance of structures. At this time no such inventory of structures exists. However, the University does have wind load criteria for new construction in its building standards. This should reduce vulnerability to windstorms over time.

4.3.9 Wildfire

4.3.9.1 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.

Because a majority- about 54 percent - of Columbia County's land cover is forestland, the potential geographic extent of wildfires is quite large (Columbia County Comprehensive Recreation, Parks, Greenways, and Open Spaces Plan, 2007). Under dry conditions or droughts, wildfires have the potential to burn forests as well as croplands. The greatest potential for wildfires is in the spring months of March, April, and May, and the autumn months of October and November; 83% 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.

4.3.9.2 Range of Magnitude

Wildfire events can range from small fires that can be managed by local firefighters to large fires impacting many acres of land. Large events may require evacuation from one or more communities and necessitate regional or national firefighting support. The impact of a severe wildfire can be devastating.

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 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.

4.3.9.3 Past Occurrence

While wildfires are a constant threat in Columbia County, their impact has not been as severe or as extensive as in other areas of Pennsylvania. There have been 575 wildfire events reported to the Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry from 2011-2015 for the Weiser Forest District. This number does not include wildfires that were not reported to DCNR or that were controlled solely by the volunteer fire departments in the County, this is the most comprehensive list of wildfire occurrences available for Columbia County. Table 4.3.9-1 shows the list of wildfire events reported to the DCNR from 2011-2015.

(Columbia County is located in the Weiser Forest District. This district includes Dauphin, Carbon, Columbia, Lebanon, Montour, Northumberland, and Schuylkill Counties. The Weiser district encompasses 28,000 acres. Forest fire statistics are collected by forestry district and are not broken down by individual counties. As of the 2017 HMP update the data included in table 4.3.9-1 was the most current data available through the Pennsylvania Department of Conservation and Natural Resources)

Table 4.3.9-1: Forest Fire Statistics from 2011 – 2016 for District 18, Weiser Forest. (PA DCNR, 2016)

Year	Spring Fires		Fall Fires		Totals	
	# of Fires	Total Acres Burned	# of fires	Total Acres Burned	# of Fires	Total Acres Burned
2011	30	32.6	11	8.1	41	40.7
2012	135	466.0	15	35.6	150	501.6
2013	111	91.1	23	11.4	134	110.5
2014	95	103	27	113	122	216
2015	108	2058	20	13	128	2071
Totals	**479**	**2750.7**	**96**	**181.1**	**575**	**2939.8**

4.3.9.4 Future Occurrence

Over the five-year period between 2011 and 2015, 14,227 acres of state forest have burned in Pennsylvania and 3239 fires were reported to PA DCNR. Previous events indicate that wildfire events will continue to occur annually. Weather conditions like drought can increase the likelihood of wildfires occurring. Any fire, without the quick response or attention of fire-fighters, forestry personnel, or visitors to the forest, has the potential to become a wildfire.

The probability of a wildfire occurring in Columbia County is *possible* in any given year, according to the Risk Factor Methodology probability category (see Table 4.4-1). However, the likelihood of one of those fires attaining significant size and intensity is unpredictable and highly dependent on environmental conditions and firefighting response.

4.3.9.5 Vulnerability Assessment

The Pennsylvania Bureau of Forestry has conducted an independent wildfire hazard risk assessment for the various municipalities across Columbia County. Results of that assessment are shown in Figure 4.3.9-2. *Wildfire hazard* is defined based on conditions that affect wildfire ignition and/or behavior such as fuel, topography and local weather. Based on this assessment, fourteen jurisdictions in Columbia County have a *high* wildfire rating: Beaver, Briar Creek, Catawissa, Conyngham, Jackson, Locust, Main, Mifflin, North Centre, Orange, Roaring Creek, South Centre, and Sugarloaf Townships and Benton Borough.

Eleven municipalities within Columbia County have a *medium* wildfire hazard potential: Cleveland, Fishing Creek, Franklin, Greenwood, Hemlock, Madison, Montour, Mount Pleasant, Pine, and Scott Townships and Berwick Borough. Briar Creek, Catawissa, Centralia, Millville, Orangeville, and Stillwater Boroughs and Benton Township are considered to have *low* wildfire hazard potential. The individual vulnerability of communities will differ based on the design of the urban/wildland interface, the number of ingress and egress points into a community, and the availability of water to fight fires. However, as this assessment suggests, Columbia County's boroughs are relatively less vulnerable to wildfire events than its townships. Table 4.3.9-2 shows the total addressable structures and critical facilities in the high wildfire hazard areas.

Table 4.3.9-2: Structures and critical facilities within high wildfire hazard areas in Columbia County (Columbia County GIS, 2016)

MUNICIPALITY	TOTAL ADDRESSABLE STRUCTURES IN HIGH WILDFIRE HAZARD AREAS	TOTAL CRITICAL FACILITIES IN HIGH WILDFIRE HAZARD AREAS
Beaver Township	461	5
Benton Borough	426	11
Benton Township	-	-
Berwick Borough	-	-
Town of Bloomsburg	-	-
Briar Creek Borough	3	12
Briar Creek Township	1,578	16

Catawissa Borough	-	-
Catawissa Township	477	10
Centralia Borough	-	-
Cleveland Township	-	-
Conyngham Township	436	10
Fishing Creek Township	-	-
Franklin Township	-	-
Greenwood Township	-	-
Hemlock Township	-	-
Jackson Township	342	6
Locust Township	755	14
Madison Township	-	-
Main Township	563	7
Mifflin Township	1,056	19
Millville Borough	-	-
Montour Township	-	-
Mt. Pleasant Township	-	-
North Centre Township	903	11
Orange Township	631	7
Orangeville Borough	-	-
Pine Township	-	-
Roaring Creek Township	378	2
Scott Township	-	-
South Centre Township	968	25
Stillwater Borough	-	-
Sugarloaf Township	732	10
TOTAL	**9709**	**165**

When looking at the types of at-risk structures, almost 6,000 of the structures vulnerable to wildfires are residential structures, with the highest number of at-risk residential structures in Briar Creek Township. Also, over 16% of all the addressable structures vulnerable to wildfire are agricultural. Table 4.3.9-3 shows the number of vulnerable structures in each municipality by structure type.

Table 4.3.9-3: Type of structure by municipality located in wildfire high-hazard areas.(Columbia County GIS, 2016)

Municipality	Agricultural	Commercial	Exempt	Industrial	Residential	Tower	Trailer	Utility	Vacant	Total
Beaver Township	146	1	7	0	254	0	29	1	10	448
Benton Borough	6	68	18	10	282	0	46	3	1	434
Briar Creek Township	150	20	31	5	1,051	2	248	0	34	1,541
Catawissa Township	84	6	15	0	338	10	21	0	18	492
Conyngham Township	2	5	21	0	375	2	18	1	10	434
Jackson Township	155	2	8	2	143	0	39	0	13	362
Locust Township	194	16	20	1	474	0	99	4	13	821
Main Township	93	14	64	0	363	0	77	1	13	625
Mifflin Township	128	36	14	3	747	2	106	3	18	1,057
North Centre Township	107	14	13	0	538	3	209	2	8	894
Orange Township	123	12	6	0	374	0	124	7	9	655
Roaring Creek Township	195	0	2	0	128	1	37	0	20	383
South Centre Township	16	63	27	18	594	5	261	3	13	1,000
Sugarloaf Township	188	11	40	2	243	0	97	3	15	599
Total	**1587**	**268**	**286**	**41**	**5,904**	**25**	**1411**	**28**	**195**	**9,745**

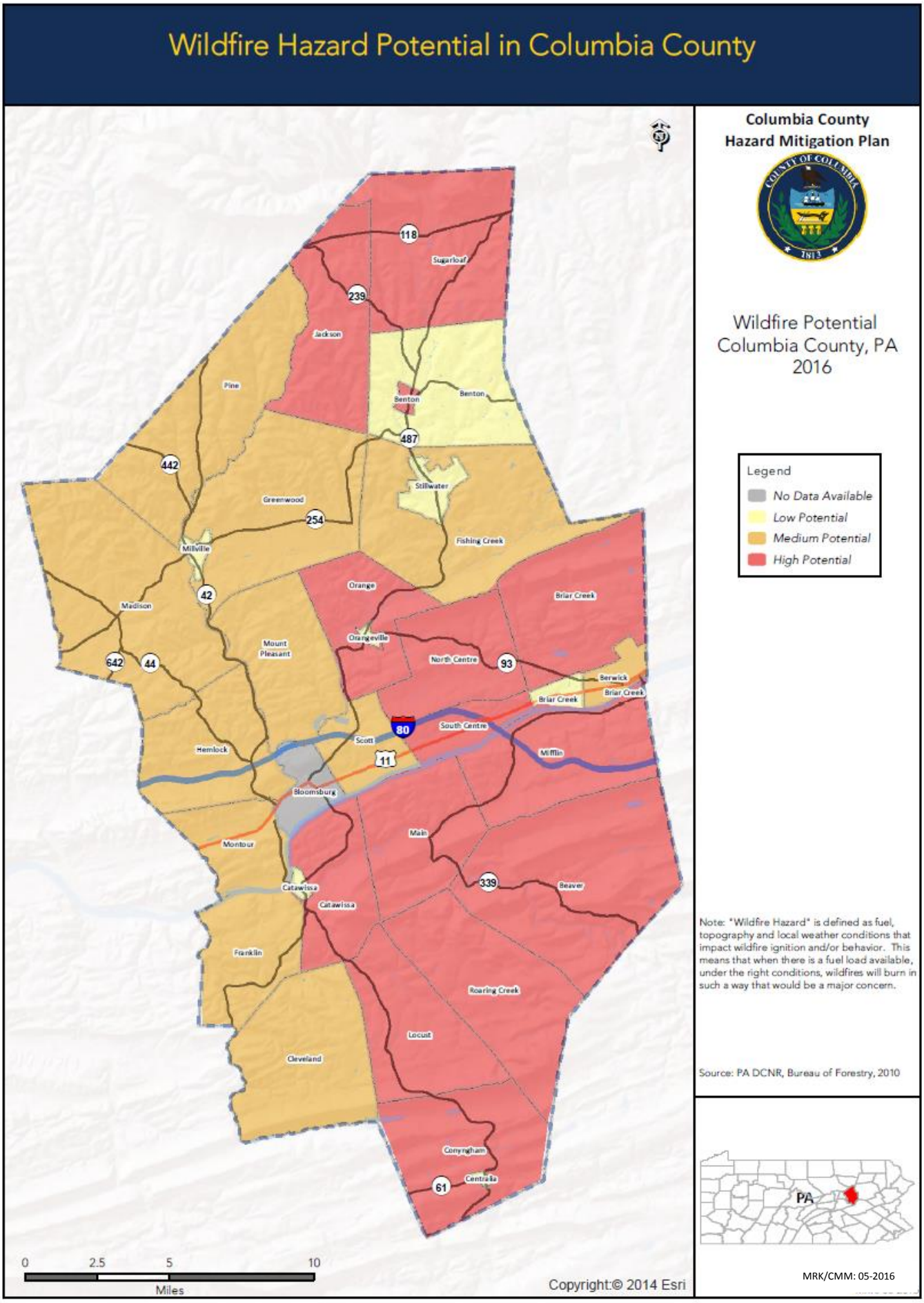


Figure 4.3.9-1: Wildfire hazard potential per municipality in Columbia County (Columbia County GIS, 2016).

4.3.10 Winter Storm

4.3.10.1 Location and Extent

Winter storms are regional events. Every county in the Commonwealth, including Columbia, is subject to severe winter storms.

Within Columbia County there are variations in the average amount of snowfall that is received throughout different parts of the County because of terrain differences; higher elevations experience greater snowfalls than lower-lying areas. Generally, the average annual snowfall in the County is 40 to 50 inches, as shown in Figure 4.3.10-1.

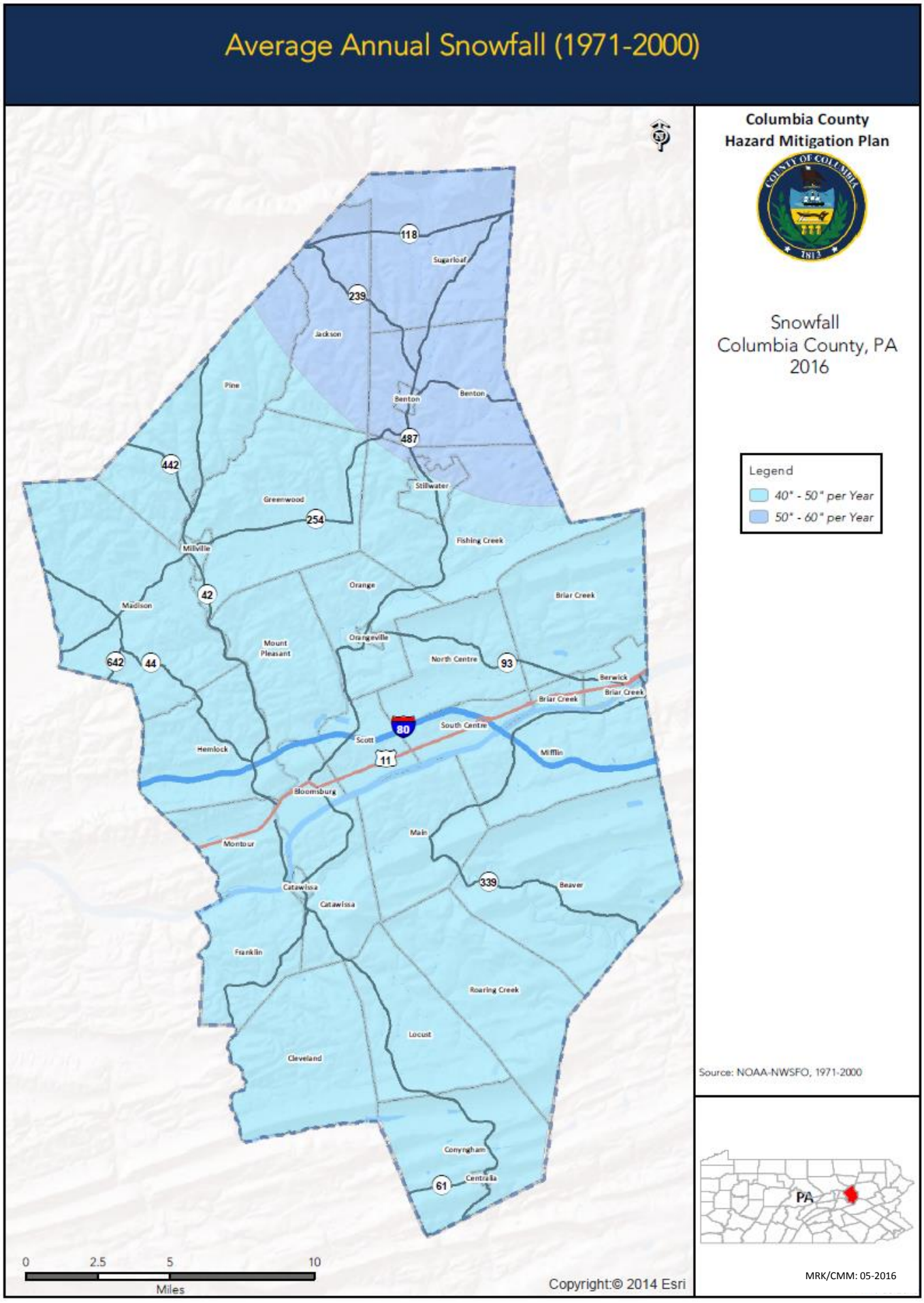


Figure 4.3.10-1: Average Annual Snowfall for Pennsylvania and Columbia County (Columbia County GIS, 2016)).

4.3.10.2 Range of Magnitude

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

A winter storm can adversely affect roadways, utilities, business activities, and can cause frostbite or loss of life. These storms may include one or more of the following weather events:

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

Any of the above events can result in the closing of major or secondary roads, particularly in rural locations, stranded motorists, transportation accidents, loss of utility services, and depletion of oil heating supplies. 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. Gradual melting of snow and ice provides excellent groundwater recharge. However, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding.

Figure 4.3.10-1 shows mean annual snowfall in Columbia County to be between 40 and 50 inches. Four of the thirteen Presidential Disaster and Emergency Declarations affecting Columbia have been in response to hazard events related to winter storms (see Table 4.2-1). Other reported winter storm events, including those associated with Disaster Declarations, are listed in Table 4.3.10-1.

Columbia County experienced major winter storms in 1972, two storms in 1978, 1993, 1994, and 1996. There have been numerous other winter storms recorded every year, those that occurred after 1993 are listed in Table 4.3.8-1. These storms have caused power failures and communications outages of four hours or more, road closings, stranded motorists requiring emergency transportation or temporary shelter, as well as county residents requiring provisions.

The worst-case winter storm event for Columbia County happened in the winter of 2005. In January, snow and sleet began precipitating across much of central Pennsylvania. Freezing

rain started to fall and accumulated on power lines and tree limbs, causing both power outages and tree damage. A severe ice storm followed a few days later, greatly impacting the higher ridge tops of Columbia County and neighboring Schuylkill and Sullivan Counties. More ice accumulated on trees and power lines, leading to downed trees and further power outages (NCDC, 2011). The County does not have local information on losses for this storm.

Throughout the region over 238,000 customers lost power across the region, over 30,000 of these still did not have power when the second ice storm struck the area on January 8th. Over $25 million of repairs were needed to restore power lines and clear roads.

4.3.10.3 Past Occurrence

Columbia County and the Commonwealth of Pennsylvania have a long history of severe winter weather. There have been 70 winter storm events that have affected Columbia County since 1993, according to the NCDC. The NCDC data on past occurrence for winter storm events since 1993 is the most comprehensive list of data available for the County. The County does not currently have or maintain data on the damages caused by winter storms on the local level.

There have been a number of key past winter storm events. In the winter of 1993-1994, Pennsylvania was hit by a series of protracted winter storms. The severity and nature of these storms combined with accompanying record-breaking frigid temperatures posed a major threat to the lives, safety and well-being of Commonwealth residents and caused major disruptions to the activities of schools, businesses, hospitals and nursing homes.

Another devastating winter storm occurred that winter in early January with record snowfall depths in many areas of the Commonwealth, strong winds, and sleet/freezing rain. Numerous storm-related power outages were reported and as many as 600,000 residents were without electricity, in some cases for several days at a time. A ravaging ice storm followed which closed major arterial roads and downed trees and power lines. Utility crews from a five-state area were called to assist in power restoration repairs. Officials from PPL Corporation stated that this was the worst winter storm in the history of the company; related damage-repair costs exceeded $5,000,000.

Serious power supply shortages continued through mid-January because of record cold temperatures at many places, causing sporadic power generation outages across the Commonwealth. The entire Pennsylvania-New Jersey-Maryland grid and its partners in the District of Columbia, New York and Virginia experienced 15-30-minute rolling blackouts, threatening the lives of people and the safety of the facilities in which they resided. Power and fuel shortages affecting Pennsylvania and the East Coast power grid system required the Governor to recommend power conservation measures be taken by all commercial, residential and industrial power consumers.

The record cold conditions resulted in numerous water-main breaks and interruptions of service to thousands of municipal and city water customers throughout the Commonwealth. Additionally, the extreme cold in conjunction with accumulations of frozen precipitation resulted in acute shortages of road salt. As a result, trucks were dispatched to haul salt from New York to expedite deliveries to Pennsylvania Department of Transportation storage sites.

Most recently, Columbia County experienced a severe winter storm in February 2003 that

resulted in almost 16-21 inches of accumulated snowfall county-wide and a disaster declaration by the Governor. Snow removal costs exceeded $100,000.00, closed schools for 2 days and impeded emergency and home heating fuel delivery while virtual white-out conditions stalled travel. However, the blizzard and heavy snow storms of January 1996 followed immediately by the flood from the sudden meltdown of the snow pack in that same month resulted in structural and infrastructure damages that exceeded $470,000.00. Schools, government buildings, industry and businesses were closed for several days (CCPC, 2006).

In addition to the events described above, other winter storm events are listed in Table 4.3.10-1.

Table 4.3.10-1: Previous winter storm events impacting Columbia County since 1994 (NCDC, 2016). Events with the location "Multiple Counties" include Columbia County.

LOCATION	DATE	TYPE
Multiple Counties	11/27/1994	Freezing Rain And Sleet
Multiple Counties	12/09/1994	Freezing Rain
Multiple Counties	12/31/1994	Freezing Rain
Multiple Counties	01/06/1995	Winter Storm
Multiple Counties	01/11/1995	Freezing Rain
Multiple Counties	01/31/1995	Freezing Rain
Multiple Counties	02/03/1995	Heavy Snow
Multiple Counties	02/15/1995	Freezing Rain
Multiple Counties	02/26/1995	Freezing Rain Sleet And Light
Multiple Counties	02/27/1995	Freezing Rain
Multiple Counties	03/08/1995	Snow
Columbia, Sullivan, York Counties	11/11/1995	Snow
Multiple Counties	11/14/1995	Winter Storm
Multiple Counties	12/19/1995	Winter Storm
Multiple Counties	01/02/1996	Heavy Snow
Multiple Counties	01/12/1996	Heavy Snow
Multiple Counties	03/07/1996	Heavy Snow
Multiple Counties	02/13/1997	Winter Storm
Multiple Counties	12/29/1997	Heavy Snow
Multiple Counties	01/15/1998	Ice Storm
Multiple Counties	01/22/1998	Ice Storm
Multiple Counties	02/23/1998	Heavy Snow
Multiple Counties	01/02/1999	Winter Storm
Multiple Counties	01/08/1999	Winter Storm
Multiple Counties	01/14/1999	Winter Storm
Columbia, Northern Lycoming, Southern Lycoming, Sullivan Counties	02/07/1999	Heavy Snow
Multiple Counties	03/14/1999	Heavy Snow
Multiple Counties	01/25/2000	Heavy Snow
Multiple Counties	01/30/2000	Heavy Snow
Multiple Counties	02/13/2000	Ice Storm
Multiple Counties	02/18/2000	Winter Storm

Multiple Counties	12/13/2000	Winter Storm
Multiple Counties	01/20/2001	Heavy Snow
Multiple Counties	03/04/2001	Heavy Snow
Multiple Counties	01/06/2002	Heavy Snow
Multiple Counties	12/05/2002	Heavy Snow
Multiple Counties	12/10/2002	Ice Storm
Multiple Counties	12/25/2002	Heavy Snow
Multiple Counties	01/01/2003	Ice Storm
Multiple Counties	01/02/2003	Heavy Snow
Multiple Counties	02/16/2003	Heavy Snow
Multiple Counties	12/05/2003	Heavy Snow
Multiple Counties	01/27/2004	Heavy Snow
Multiple Counties	02/06/2004	Ice Storm
Multiple Counties	03/16/2004	Heavy Snow
Multiple Counties	03/19/2004	Heavy Snow
Multiple Counties	01/05/2005	Winter Storm
Multiple Counties	01/08/2005	Ice Storm
Multiple Counties	01/22/2005	Winter Storm
Multiple Counties	03/01/2005	Heavy Snow
Multiple Counties	12/09/2005	Heavy Snow
Multiple Counties	12/16/2005	Winter Storm
Columbia, Southern Lycoming Counties	02/13/2007	Winter Storm
Multiple Counties	03/16/2007	Heavy Snow
Multiple Counties	02/01/2008	Winter Storm
Multiple Counties	02/12/2008	Ice Storm
Multiple Counties	12/19/2008	Winter Storm
Multiple Counties	01/06/2009	Ice Storm
Multiple Counties	01/27/2009	Winter Storm
Columbia, Sullivan	02/09/2010	Winter Storm
Columbia, Montour, Northern Lycoming, Schuylkill, Tioga Counties	02/25/2010	Winter Storm
Multiple Counties	02/01/2011	Winter Storm
Multiple Counties	03/23/2011	Winter Storm
Multiple Counties	10/29/2011	Heavy Snow
Multiple Counties	12/26/2012	Winter Storm
Multiple Counties	12/14/2013	Winter Storm
Multiple Counties	02/04/2014	Winter Storm
Multiple Counties	02/13/2014	Heavy Snow
Multiple Counties	11/25/2014	Heavy Snow
Multiple Counties	01/22/2016	Winter Storm

4.3.10.4 Future Occurrence

Winter storms are a regular, annual occurrence in Columbia County and should be considered *highly likely,* based on the Risk Factor probability criteria (see Table 4.4-1). The probability of

an increase in winter storm-related problems appears to be significant. Approximately thirty-five winter storm events occur across Pennsylvania and about two to three in Columbia County annually (NCDC, 2011). Table 4.3.10-2 shows the probability of receiving measureable snowfall by month in Columbia County. These probabilities are based on data collected over a minimum of 24 years. There is slight variation in the probabilities of snowfall, especially in April, May, and October, in different locations in Columbia County. The probability of an increase in winter storm-related problems appears to be significant. Lengthy power outages and increased traffic accidents have resulted and will continue to increase as we experience more frequent winter storms.

Table 4.3.10-2: Probability of Measurable Snowfall in Columbia County by Snow Station Location (NCDC, 2011).

MONTH	PROBABILITY (%)	
	BERWICK	MILLVILLE 2 SW
January	100.00%	97.60%
February	96.60%	95.00%
March	86.70%	84.20%
April	16.70%	21.40%
May	0.00%	0.00%
June	0.00%	0.00%
July	0.00%	0.00%
August	0.00%	0.00%
September	0.00%	0.00%
October	3.20%	2.50%
November	46.90%	56.10%
December	90.60%	87.50%

4.3.10.5 Vulnerability Assessment

Based on the information available, all communities in Columbia County are essentially equally vulnerable to the direct impacts of winter storms. However, residents of the mountainous areas of the County may be more susceptible during severe storms, especially when emergency medical assistance is required. There are rural areas which are susceptible to isolation due to winter storms, however these are decreasing as new roads and development continues. Vulnerability to the effects of winter storms on buildings is also dependent on the age of the building type, construction material used and condition of the structure. Table 4.3.10-3 below shows that a large portion of housing units in Columbia County were built before 1940 (US Census ACS, 2010-2014). Over 10,000 housing units, or 36% of the total housing units, are 60 or more years old. This does not, however, account for non-residential building occupancies; this information is not collected by the County or federal governments. Additional information on construction type and building codes enforced at time of construction would allow a more thorough assessment of the vulnerability of structures to winter storm impacts such as severe wind and heavy snow loading. However, based on the available information Catawissa

Borough, Orangeville Borough, Millville Borough, Berwick Borough, Conyngham Township, and Benton Borough face the largest risk to their housing structures, as each jurisdiction has over fifty percent of their housing units built before 1940. Centralia Borough has 100 percent of their housing built prior to 1940, but there are only two units, so the risk is contained to a very small population.

Table 4.3.10-3: Age of Housing Units in Columbia County (US Census, ACS, 2010-2014).

MUNICIPALITY	NUMBER OF HOUSING UNITS BUILT PRIOR TO 1940	PERCENT OF TOTAL HOUSING UNITS
Beaver Township	139	32%
Benton Borough	301	66%
Benton Township	151	28%
Berwick Borough	2440	52%
Bloomsburg, Town of	2503	46%
Briar Creek Borough	68	19%
Briar Creek Township	244	17%
Catawissa Borough	413	56%
Catawissa Township	125	27%
Centralia Borough	2	100%
Cleveland Township	203	36%
Conyngham Township	204	56%
Fishing Creek Township	238	35%
Franklin Township	111	44%
Greenwood Township	361	41%
Hemlock Township	203	21%
Jackson Township	83	27%
Locust Township	332	45%
Madison Township	135	20%
Main Township	121	23%
Mifflin Township	243	25%
Millville Borough	273	60%
Montour Township	141	23%
Mount Pleasant Township	105	16%
North Centre Township	57	6.5%
Orange Township	86	17%
Orangeville Borough	133	82%
Pine Township	142	30%
Roaring Creek Township	130	41%
Scott Township	408	17%
South Centre Township	160	18%

Stillwater Borough	39	42%
Sugarloaf Township	243	32%
Total	**10,537**	**Average 36%**

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

Additional vulnerability exists due to icy and snow covered roads. This is a potential risk on all roads, even the most commonly used interstates in the County. However, most problems from ice and snow occur along I-80 as it is the main thoroughfare through the County.

Bloomsburg University is no more or less vulnerable to winter storms than the rest of the County. The vulnerability of individual structures will depend on building age, type of construction, and condition/maintenance of structures. At this time no such inventory of structures exists. The University's building code should also assist with ensuring new construction can withstand snow loads of more than six inches.

HUMAN-MADE HAZARDS

4.3.11 Dam Failure

Due to the sensitive nature of dam information in Pennsylvania, the Dam Failure Profile can be found in **Appendix G**.

4.3.12 Environmental Hazards

Columbia County has the potential to experience three kinds of environmental hazards: hazardous material releases, oil and gas well incidents, and coal mining incidents. Hazardous material releases can occur at facilities or along transportation routes. These releases can result in injury and death and contaminate air, water and soils. Activities associated with coal mines and oil and gas wells can cause fire and pollute streams and drinking water.

4.3.12.1 Location and Extent

A. HAZARDOUS MATERIALS RELEASES

Hazardous materials fall into several categories such as flammable and combustible materials, compressed gases, explosive and blasting agents, radioactive materials, oxidizing materials, poisons, and corrosive liquids. Hazardous materials incidents are generally

unintentional, and associated with transportation accidents or accidents at fixed facilities. However, hazardous materials can be released as a criminal or terrorist act. Any release can result in injury and death and may contaminate air, water and/or soils.

Facilities that use, manufacture, or store hazardous materials in Pennsylvania must comply with both Title III of the federal Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA), and the Commonwealth's reporting requirements under the Hazardous Materials Emergency Planning and Response Act (1990-165), as amended. The community right-to-know reporting requirements keep communities abreast of the presence and release of chemicals at individual facilities. EPCRA was designed to ensure that state and local communities are prepared to respond to potential chemical accidents through Local Emergency Planning Committees (LEPCs). LEPCs are charged with developing emergency response plans for SARA Title III facilities; these plans cover the location and extent of hazardous materials, establish evacuation plans, response procedures, methods to reduce the magnitude of a materials release, and establish methods and schedules for training and exercises.

The principal classes of hazardous materials reported to the Columbia County LEPC are flammable liquids, corrosives, and flammable gases. The most common substances appear to be diesel fuel, propane, and fuel oils. Chlorine and sulfuric acid remain the most common EHS reported. Since 1999 no fixed facility has reported the release of hazardous materials exceeding federal standards, according to the Columbia County LEPC.

There are nineteen facilities classified as using or storing extremely hazardous substances as defined by the United States Environmental Protection Agency (SARA Title III). Because SARA Title III facilities are covered under their own unique planning process and are continually evaluated through the LEPC, they will not be discussed in depth in this plan.

For a complete listing of SARA Title III facilities, please see **Appendix H**.

Transportation of hazardous materials on highways involves tanker trucks or trailers. Unsurprisingly, large trucks are responsible for the greatest number of hazardous material release incidents. Hazardous material releases from rail transport are also of concern due to collisions and derailments that result in large spills.

Columbia County has a road and railway network that may pose a risk for hazardous material incidents. These networks transport hazardous materials daily on Interstate 80, US Route 11, PA 93, PA 42, and PA 487. These major roads pass through the more populous areas. Similarly, rail lines pass through cities and boroughs where larger numbers of people could be vulnerable should a serious accident occur in these places. These major transportation routes are also shown on Figure 4.3.12-1.

The Atlantic Sunrise Expansion Project will bring a natural gas pipeline through nearly the entire length of Columbia County. This proposed pipeline will begin in Jackson Township where is connects with the existing TransContinental Pipeline. It will exit Columbia County in Cleveland Township and will continue down through to Lancaster County. There is a proposed compressor station in Hemlock Township. This project has raised concern among local residents. The potential exists for accidents to occur as with the transportation of any hazardous material.

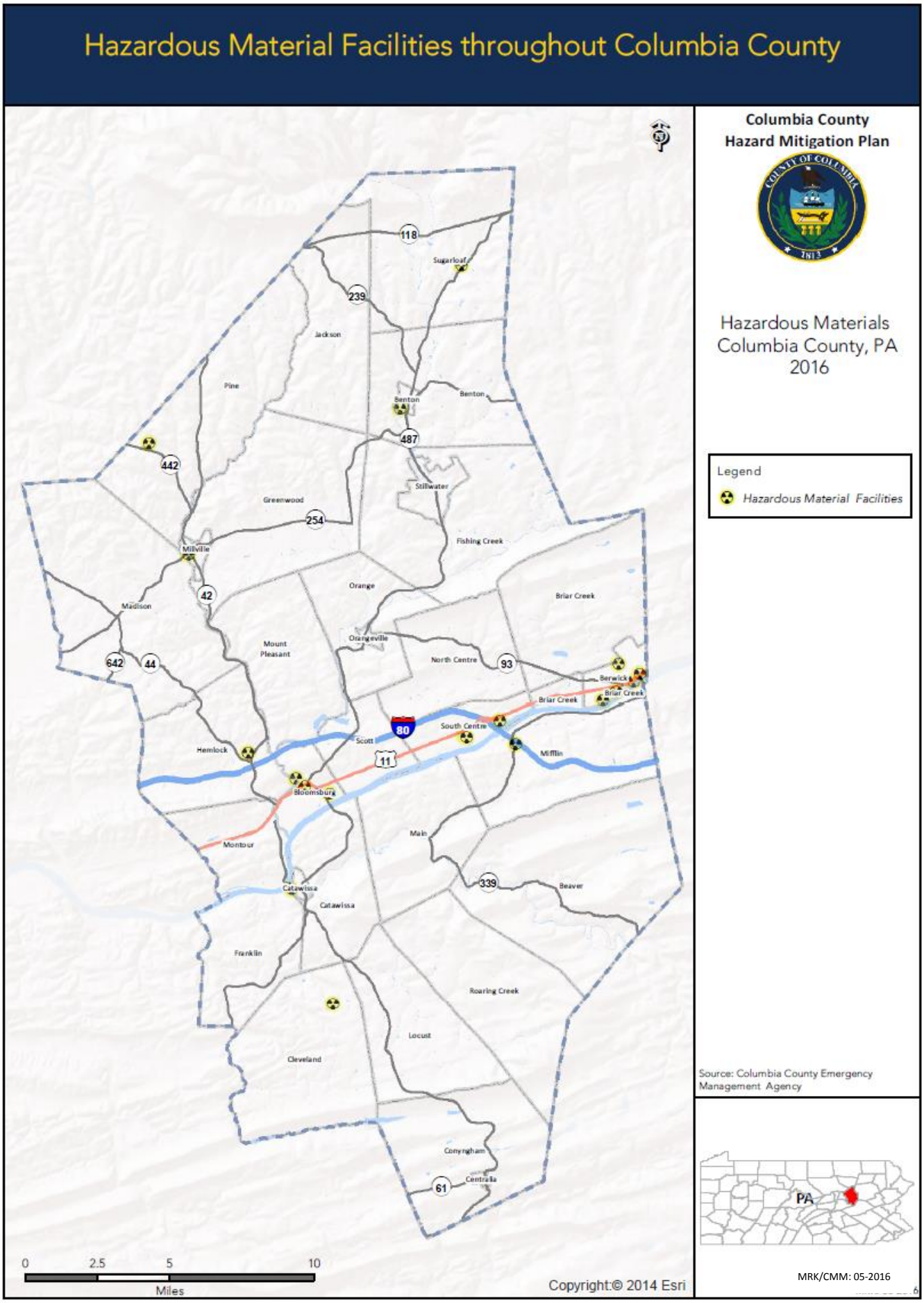


Figure 4.3.12-1: Columbia County hazardous material facilities and major roadways (Columbia County GIS Office, 2016).

B. OIL AND GAS WELLS

Columbia County has three plugged traditional oil and gas wells, all located in the northern portion of the County. Figure 4.3.12-2 shows the location of the plugged gas wells in Columbia County. These traditional oil and gas wells have not had great impact on the county in the past, but there is growing concern in the County about the Marcellus Shale. While more heavily drilled in neighboring counties, it has now spread to Columbia County. The Marcellus Shale is rich, organic, black shale formation that lies below Columbia County. In the past, the formation was not thought of as a key resource, but now that the technology for extracting natural gas from shale has been proven, drilling companies are flocking to the region. As of now, there are no active Marcellus Shale wells. In the future, though, Marcellus Shale wells can be drilled anywhere the formation exists.

The Marcellus Shale formation covers about two-thirds of northern and western Pennsylvania. Within Columbia County, there is an estimated one trillion cubic feet of natural gas in the shale deposits (CCEMA, 2007). Figure 4.3.12-2 also shows the extent of the Marcellus Shale Formation. Columbia County lies almost completely within the shale formation, so the region is vulnerable to shale drilling.

C. COAL MINING

Coal mining has historically been and continues to be a major industry in Pennsylvania. Columbia County has a small cluster of coal mining industry in the Western Middle Anthracite Field found at the southern tip of the County.

Figure 4.3.12-3 shows the location of the 34 coal mines in the County. Both Conyngham Township and Centralia Borough are at risk for environmental hazards resulting from coal mining activities as they are underlain by coal deposits. These hazards include mine-related subsidence, groundwater and surface water contamination, coal slurry impoundments, and waste piles.

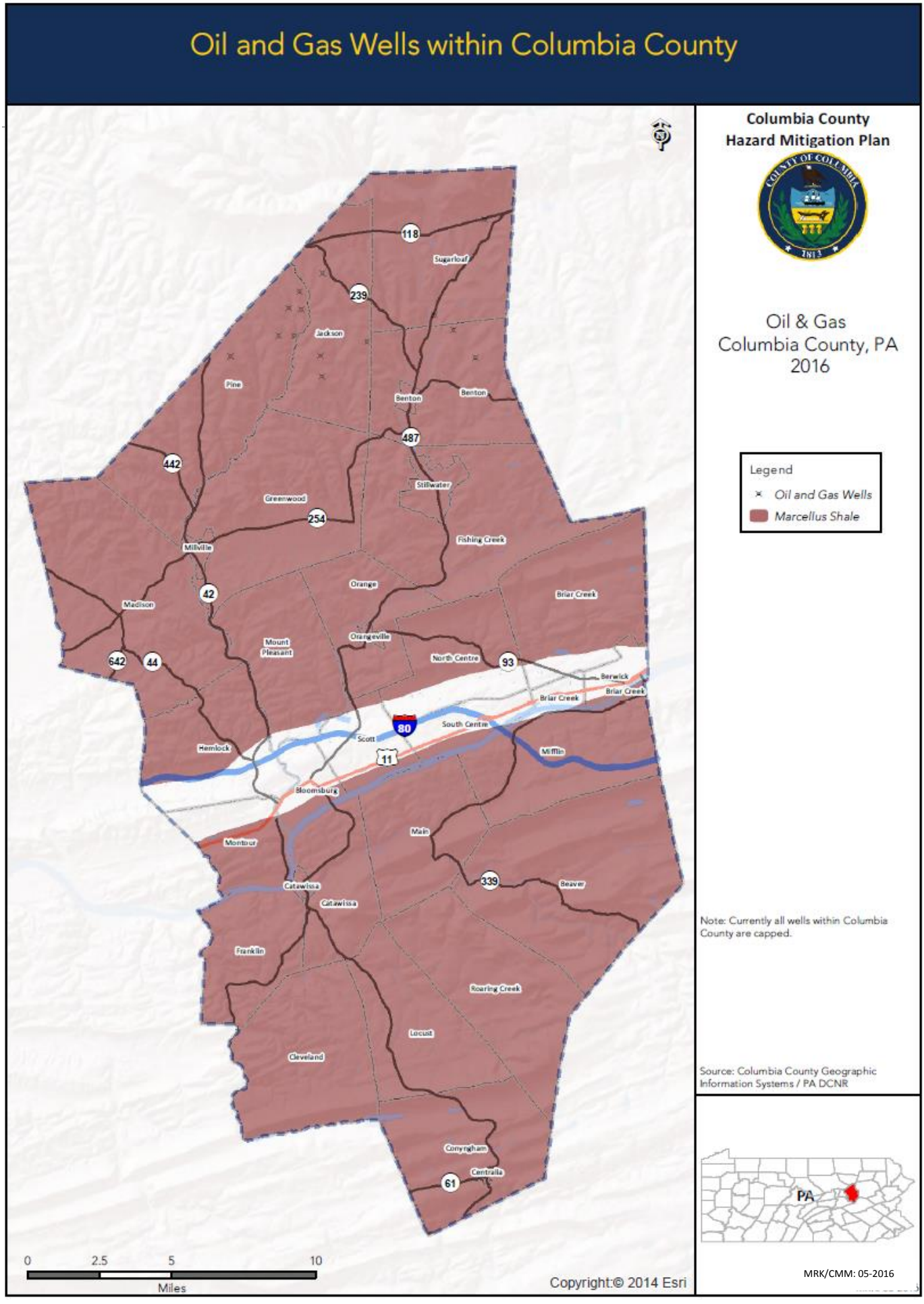


Figure 4.3.12-2: Proposed Oil and Gas well sites within Columbia County (Columbia County GIS, 2016). **Note: only three were drilled and they are currently capped**

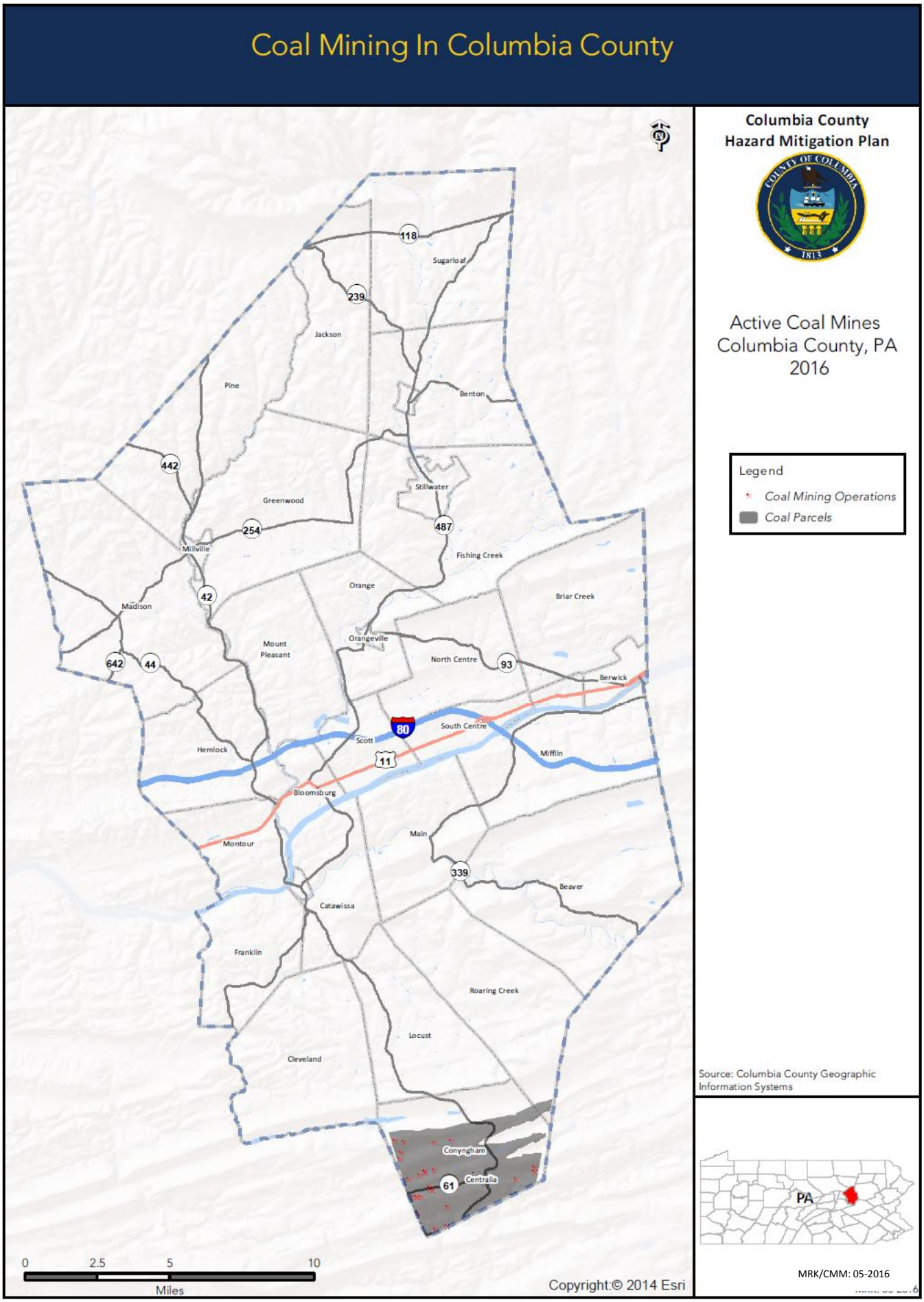


Figure 4.3.12-3: Active Coal Mines and Coal Parcels within Columbia County (Columbia County GIS, 2016)

4.3.12.2 Range of Magnitude

A. HAZARDOUS MATERIALS RELEASE

Hazardous material releases can contaminate air, water and soils, possibly resulting in death and/or injuries. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events. Hazardous materials can include toxic chemicals, radioactive materials, infectious substances and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

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

- **Weather conditions:** affects how the hazard occurs and develops
- **Micro-meteorological effects of buildings and terrain:** alters dispersion of hazardous materials
- **Non-compliance with applicable codes (e.g. building or fire codes) and maintenance failures (e.g. fire protection and containment features):** can substantially increase the damage to the facility itself and to surrounding buildings.

Whether or not a hazardous materials site is contained in the SFHA is also a concern, as there could be larger-scale water contamination during a flood event should the flood compromise the production or storage of hazardous chemicals. Such a situation could swiftly move toxic chemicals throughout a water supply and across great distances.

The severity of a given incident is dependent not only on the circumstances described above, but also with the type of material released and the distance and related response time for emergency response teams. The areas within closest proximity to the releases are generally at greatest risk, yet depending on the agent, a release can travel great distances or remain present in the environment for a long period of time (e.g. centuries to millennia for radioactive materials), resulting in extensive impacts on people and the environment.

The worst case scenario for a hazardous material release occurred in February 2004 when several thousand gallons of acid leaked from a tractor-trailer stopped at a rest area in Mifflin Township. The incident took place off of I-80 and resulted in I-80 closing for a minimum of ten hours and the evacuation of 1,000 residents (CCEMA, 2007).

B. OIL AND GAS WELLS

Oil and gas well drilling, including Marcellus Shale wells, can have a variety of effects on the environment. Abandoned oil and gas wells which are not properly plugged can contaminate groundwater and consequently drinking water wells. Surface waters and soil are sometimes polluted by brine, a salty wastewater product of oil and gas well drilling, and from oil spills occurring at the drilling site or from a pipeline breach. This can spoil public drinking water supplies and be particularly detrimental to vegetation and aquatic animals. Natural gas well fires,

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

Marcellus Shale drilling has introduced a new set of hazards to the oil and gas industry in addition to the normal risks associated with the industry. The Marcellus Shale formation exists at a depth normally between 5,000 and 8,000 feet and holds trillions of cubic feet of natural gas. Extraction from this depth was previously not feasible but as drilling technology has improved over the years, recovering natural gas from Marcellus Shale is now possible (PADEP-BOGM, 2010a).

This extraction process is different from traditional natural gas extraction in that it often requires horizontal drilling. Horizontal drilling is accomplished by hydraulic fracturing which involves pumping one to eight million gallons of water, mixed with sand and other additives including hydrochloric or muriatic acid, into the shale formation. The fluid or "frac fluid" that is recovered from this process must be properly treated as the water quality is very poor.

Frac fluid is extremely saline and can be three to six times as salty as sea water. Other contaminants can include barium, bromine, lithium strontium, sulfate, ammonium and very high concentrations of total dissolved solids. There is also some concern about normally occurring radioactive materials present in shale and potentially present in recovered drilling fluid but there is very little data available on the radioactivity of frac fluid in Pennsylvania (Kirby, 2010).

Currently there is no known technology to treat water with this level of salinity (Vidic, 2010). High levels of total dissolved solids, though not harmful to humans, can be extremely harmful to aquatic life and can damage industrial equipment. Often recovered frac fluid is stored in earthen impoundments and after treatment is taken to a sewage treatment facility. There is concern surrounding the toxic solid waste that remains after frac fluid is treated.

In addition to the traditional hazards associated with oil and gas well drilling, potential impacts from Marcellus Shale gas well drilling include:

- Surface water depletion from high consumptive use with low return rates affecting drinking water supplies, and aquatic ecosystems and organisms.
- Contaminated surface and groundwater resulting from hydraulic fracturing and the recovery of contaminated hydraulic fracturing fluid.
- Mishandling of solid toxic waste.

A possible worst-case scenario for oil and gas well incidents in Columbia County would be if one of the Marcellus Shale wells in the County were to experience a blowout. This would potentially cause an explosion coupled with the release of many gallons of contaminated frac fluid into nearby land and streams. This scenario would lead to a contamination of water supplies for nearby well-dependent populations.

C. COAL MINING

Coal mining is limited to the southern portion of the county. In the past, coal mining was the leading industry in both Centralia Borough and Conyngham Township. The primary environmental impacts of coal mining include mine-related subsidence, underground mine fire, stream contamination from mine drainage, modification of vegetation, and elevation changes. Beyond the environmental impacts, there are occupational hazards associated

with coal mining, including loss of life from mine collapse, entrapment, gases, inundation, explosion, fire, equipment malfunction, or drowning.

The worst case scenario for coal mining occurred in May 1962 in Centralia Borough. In an abandoned strip mine pit, a trash fire initiated a fire that continues to burn to this day. Though great effort was expended to extinguish the fire, it spread to active coal mining operations, and then began emitting harmful carbon monoxide (CCEMA, 2007). As sinkholes threatened residential and community structures and the toxic gases continued to leak from the ground, residents began to leave. Trees began dying in the area and people fainted in their homes from the fumes. The U.S. government decided to step in and buy up the property and demolish the homes resting on unsteady ground (O'Caroll, 2010). Additionally, the fire caused the buckling of pavement of PA 54/PA 61; the road had to be re-routed to bypass the Borough entirely. A few residents refused to give up their homes and continue to live in the Borough.

4.3.12.3 Past Occurrence

A. HAZARDOUS MATERIALS RELEASE

With some exceptions, the majority of incidents over the years has involved petroleum product spills along the highways or has involved leaks from a fixed source. Most of these are the result of collisions or leaks and have limited impact on people and the environment. The number and quantity of hazardous materials being produced, stored and transported continue to increase each year in Pennsylvania.

In Table 4.3.12-1, some of the past instances of vehicle accidents or fixed source leaks involving hazardous materials are listed.

Table 4.3.12-1: Previous hazardous materials incidents in Columbia County between 2001 and 2016 (CCEMA, 2016).

DATE	LOCATION	MATERIAL INVOLVED	TYPE OF INCIDENT/DETAILS
6/6/2016	Town of Bloomsburg	Gasoline	Gas pump leaking fuel
5/27/2016	Town of Bloomsburg	Natural Gas	Report of natural gas odor in Bloomsburg Hospital stairwell
3/29/2016	Briar Creek Township	Liquid Fertilizer	Liquid fertilizer truck leaking into a stream
3/23/2016	South Centre Township	Natural Gas	Gas leak outside of Central Columbia Middle School requiring evacuation
12/29/2015	Town of Bloomsburg	Diesel Fuel	Tractor trailer lost fuel tank spilling 20 – 25 gallons of diesel fuel
7/10/2015	Montour Township	Gasoline	Vehicle accident caused fuel to leak into the canal along the Susquehanna River
7/7/2015	Town of Bloomsburg	Gasoline	Tanker spilled approximately 30 gallons of gasoline at a gas station

6/28/2015	Scott Township	Gasoline	Vehicle fuel tank pierced and leaking fuel onto the roadway
6/23/2015	Mifflin Township	Diesel Fuel	Tractor trailer struck debris puncturing the fuel tank and leaking approximately 200 gallons of fuel on interstate 80
6/22/2015	Locust Township	Explosives	Blasting caps found in old farm equipment shed
5/13/2015	Scott Township	Diesel Fuel	Tractor trailer leaked approximately 50 gallons into a ditch/dry creek bed
5/1/2015	Briar Creek Township	Home Heating Oil	Resident spilled approximately 1 – 2 gallons of home heating fuel in grass
4/27/2015	Mifflin Township	Diesel Fuel	Approximately 60 – 70- gallons of fuel spilled in parking lot at Exxon Station
4/7/2015	Benton Borough	Home Heating Oil	A 375 gallon residential tank tipped & spilled most of its contents into a run which lead to West Creek
4/2/2015	Orangeville Borough	Home Heating Oil	A 275 gallon residential tank leaked spilling fuel on the ground and seeping into a nearby basement
1/19/2015	Millville Borough	Home Heating Oil	100 – 200 gallons of home heating fuel spilled and leaked into a storm drain
11/28/2014	Briar Creek Borough	Home Heating Oil	Residential tank tipped spilling 1000 – 150 gallons of home heating fuel into the grass
6/25/2014	Catawissa Township	Motor Oil	1 – 2 quarts of motor oil leaked into a small creek after a vehicle accident
4/1/2014	Madison Township	Unknown Fuel	Small fuel spill from unknown source into a small stream
1/25/2014	Mifflin Township	Oil Tank	Oil tank fire near a structure
1/5/2014	Town of Bloomsburg	Gasoline	Tractor trailer rollover accident leaking fuel into Fishing Creek
10/12/2013	Scott Township	Gasoline	Tractor trailer accident with approximately 50 gallons of fuel spilled
7/1/2013	Fishing Creek Township	Home Heating Oil	A 275 gallon residential home heating fuel tank leaked approximately half its contents into the ground
6/14/2013	Town of Bloomsburg	Home Heating Oil	A home heating fuel tank was removed spilling oil onto the ground

5/16/2013	Orange Township	Unknown	A hazardous materials dumping complaint was entered by the state with no further details
3/18/2013	Scott Township	Gasoline/Diesel Fuel	Tanker truck accident resulted in diesel fuel and gasoline leaking from truck
3/13/2013	Mifflin Township	Diesel Fuel	Approximately 150 gallons of diesel fuel was spilled on the roadway from a leaking tractor trailer
1/29/2013	Berwick Borough	Natural Gas	Natural gas leak in a home
1/10/2013	Montour Township	Home Heating Oil	Approximately 150 gallons of home heating fuel leaked from an overturned residential tank
12-21-12	Locust Twp	Heating Oil	Home heating oil tank collapsed spilling 200 gallons of kerosene onto the ground, into a storm drain and neighbors basement, DEP was advised
11-13-12	Bloomsburg	Fuel Oil	Fuel tank knocked over by heavy winds causing a release of fuel onto the ground
11-6-12	Hemlock Twp	Diesel Fuel	Diesel fuel leaking from a tractor trailer, cause unknown
10-2-12	N Centre Twp	Heating Oil	Home heating oil spilled and soaked into the soil, 60-70 gallons
6-27-12	Bloomsburg	Sodium Hydroxide	Water contaminated with sodium hydroxide accidentally entered the water treatment plant and then 20 gallons spilled onto the soil outside
4-25-12	Bloomsburg	Kerosene	Kerosene onto soil from storage tank
3-30-12	S Centre Twp	Hydraulic Oil	Hydraulic Oil spill of 25-50 gallons from a truck's broken hydraulic line
3-26-12	Main Twp	Propane	A tire suspected of being filled with propane exploded killing one individual
3-12-12	Catawissa Twp	Military Bomb	Individuals found a 3-4 foot long military bomb, PSP bomb squad was advised

2-3-12	Bloomsburg	Natural Gas	Odor of natural gas outside Bloomsburg Hospital and Professional Building
2-1-12	Berwick Borough	Mercury	Homeowner found a bottle of mercury, unopened, DEP was advised
2-1-12	Catawissa Twp	Coal Ash	Individual burying coal ash and storing it in containers that aren't sealed properly, fly ash issues
9-12-11	Bloomsburg	Diesel Fuel, Hydraulic Oil, and Fulpour Thermal Brake Part B (Polyol)	Release of spent hydraulic oil from storage/containment areas inside/outside, diesel fuel from storage tanks, polyol from 300 gallon chemical tote that floated inside with flood waters
9-12-11	Berwick Borough	Carbon Dioxide	CO2 Leak from a 500 lb. tank in the BIDA Complex, 60 homes evacuated, relief valve fixed, all returned home
9-9-11	Bloomsburg	Ammonia	Ammonia leak from a frozen food facility outside storage tank, building totally surrounded by flood waters, air monitoring was ongoing
8-30-11	Mifflin Twp	Diesel Fuel	Ruptured fuel tank on a tractor trailer, lost 30 gallons
8-24-11	Bloomsburg	Anhydrous Ammonia	Possibly 100 plus pounds of anhydrous ammonia was released from a split in a condenser coil, no injuries or evacuations
6-1-11	Mifflin Twp	Liquid Nitrogen Fertilizer	50 gallons of liquid nitrogen leaked from its container, spill was secured, no waterways impacted
5-22-11	N Centre Twp	Heating Oil	50 gallons of home heating oil leaked from its tank into the soil, no waterways impacted
2-22-11	Bloomsburg	Radiological materials	A student brought radiological materials to Bloomsburg High School; they were removed from the property
1-7-11	Hemlock Twp	Liquid Nitrogen	Tractor Trailer hauling liquid nitrogen venting product from rear of trailer
7-14-10	South Centre Township	Diesel fuel	250 gallons of diesel fuel spilled due to a tractor trailer accident
6-8-10	Hemlock Township	Chemical spill	A truck leaked a chemical from its cargo area

3-25-10	Beaver Township	Heating oil	Heating oil leaked from a residential tank into Scotch Valley Lake
7-31-09	Bloomsburg	Chemical spill	Sulfuric acid leaked from a tanker onto the driveway at Kawneer
7-13-09	Bloomsburg	Natural gas	A natural gas line was damaged by an excavator; a nearby student housing building on the Bloomsburg University campus was evacuated
3-12-09	Bloomsburg	Chemical spill	Acid spilled at the Bloomsburg Hospital Medical Building
8-11-08	North Centre Township	Dynamite	A PA State Police Bomb Team removed crystallized dynamite from a structure
1-10-08	Unknown	Heating oil	275 gallons of oil leaked from a residential tank into a floor drain and out into a nearby stream
12-24-07	Briar Creek Township	Heating oil	A residential tank leaked 100 gallons of oil
12-22-07	Madison Township	Heating oil	An unknown quantity of heating oil spilled into Hunlock Creek from an overturned residential tank
12-2-07	Berwick Borough	Dynamite	A residential structure contained two boxes of unstable, old dynamite; an EOD unit removed the materials
2-27-07	Unknown	Heating oil	At least 75 gallons of heating oil leaked from a basement tank into a small stream
12-7-06	Catawissa Township	Chemical spill	14,000 gallons of sodium hydroxide leaked from a twenty-one car derailment; regional rail traffic was shut down and SR 487 was closed for two
3-1-06	Hemlock Township	Chemical spill	A chemical tanker overturned at Buckhorn Plaza
7-05	South Centre Township	Hazardous & Radioactive materials	Clean-up began at a EPA superfund site, Safety Light Corporation
7-21-04	Bloomsburg	Chemical spill	At the Kawneer Plant, hydrogen peroxide leaked from several drums; the facility was evacuated

7-6-04	Fishing Creek Township	Fuel oil	Fuel oil leaked from an overturned Montour oil delivery truck
2-2-04	Mifflin Township	Chemical spill	Several thousand gallons of acid spilled at an I-80 rest area; I-80 closed for ten or more hours and about 1,000 local residents were evacuated
10-21-02	Bloomsburg	Chemical spill	Spill of chemicals occurred in the basement of the Columbia County Court House; evacuation of the building followed
8-23-02	South Centre Township	Chemical spill	Leak of chemicals occurred at Haddon Craftsman Company
9-24-010	South Centre Township	Diesel fuel	8,000 gallons of diesel fuel spilled from an overturned tank truck on US 11
11-13-01	Scott Township	Fuel oil	Oil leaked from an underground tank into a stream
3-20-01	Bloomsburg	Chemicals	Sewer system was leaking chemical fumes; three homes evacuated

B. OIL AND GAS WELLS

Environmental incidents including water contamination and fire spurring from oil and gas well drilling have occurred numerous times in Pennsylvania over the past century. Recently, there have been many natural gas incidents occurring in nearby counties as gas companies rush to develop the natural gas deposits from Marcellus Shale. In 1980 two people were killed in an explosion and subsequent fire during a salvage operation in Custer City in Bradford Township. The damage amounted to approximately $700,000. Another accident near West Virginia's northern panhandle occurred in June 2010. Drillers were working on an inactive mine, and hit a deposit of methane gas, resulting in an explosion and fire. The fire rose 50 feet in the air and burned for four days, injuring seven workers with burns and damaging the drilling rig (Hopey, 2010).

In Clearfield County, high gas pressure during the fracking process caused a rupture that discharged polluted water and explosive gas for sixteen hours. Though the drilling took place in a remote area at least a mile from any homes and no one was injured, it was still a major accident where the drilling process went out of control (ThePittsburghChannel, 2010). More recently, in April 2011, a large spill occurred in Bradford County during fracking operations, and seven families were asked to evacuate their homes. An unknown amount of contaminated fluids spilled from the well, and reportedly contaminated a local creek that runs into the Susquehanna River (Gilliland, 2011). At present, because only a few wells have been drilled in the northern regions of the County in Benton and Sugarloaf Townships, there have not been documented oil and gas well incidents, but the potential is there (CCEMA, 2011).

C. COAL MINING

While coal mining incidents were more significant in the 1800s when coal mining was the primary economic generator in southern Columbia County, there have been few recent coal mining incidents. The most recent incident that was the by-product of a coal mine was the mine fire incident occurring in 1993. Due to signs of potential collapse of the roadway, PennDOT decided to permanently close part of State Route 61 to the south of Centralia Borough as shown in Figure 4.3.12-4. As mentioned above, the Centralia Mine Fire was the worst incident to occur in the history of the County. The effects of the Centralia Mine Fire continue to impact Columbia County; in 2005, a mine-related subsidence event caused damage to Byrnesville Road, also known as Route 2002. In this event, a hole 20-25 feet deep opened in the road; the hole was filled with rock and capped with concrete and the repair closed the road for approximately three days. In total, the cost to the government for buying up the property and relocating residents and businesses was about $40 million.

Figure 4.3.12-4: : Centralia Mine Fire damage to PA Rt. 61 (Encyclopedia of Earth, 2006)

4.3.12.4 Future Occurrence

Overall, for all three types of environmental hazards, the probability of future occurrence is *likely*; according to the Risk Factor Methodology probability criteria (see Table 4.4-1). The following sections discuss any unique factors that may impact the future occurrence of each type of environmental hazard.

A. HAZARDOUS MATERIALS RELEASE

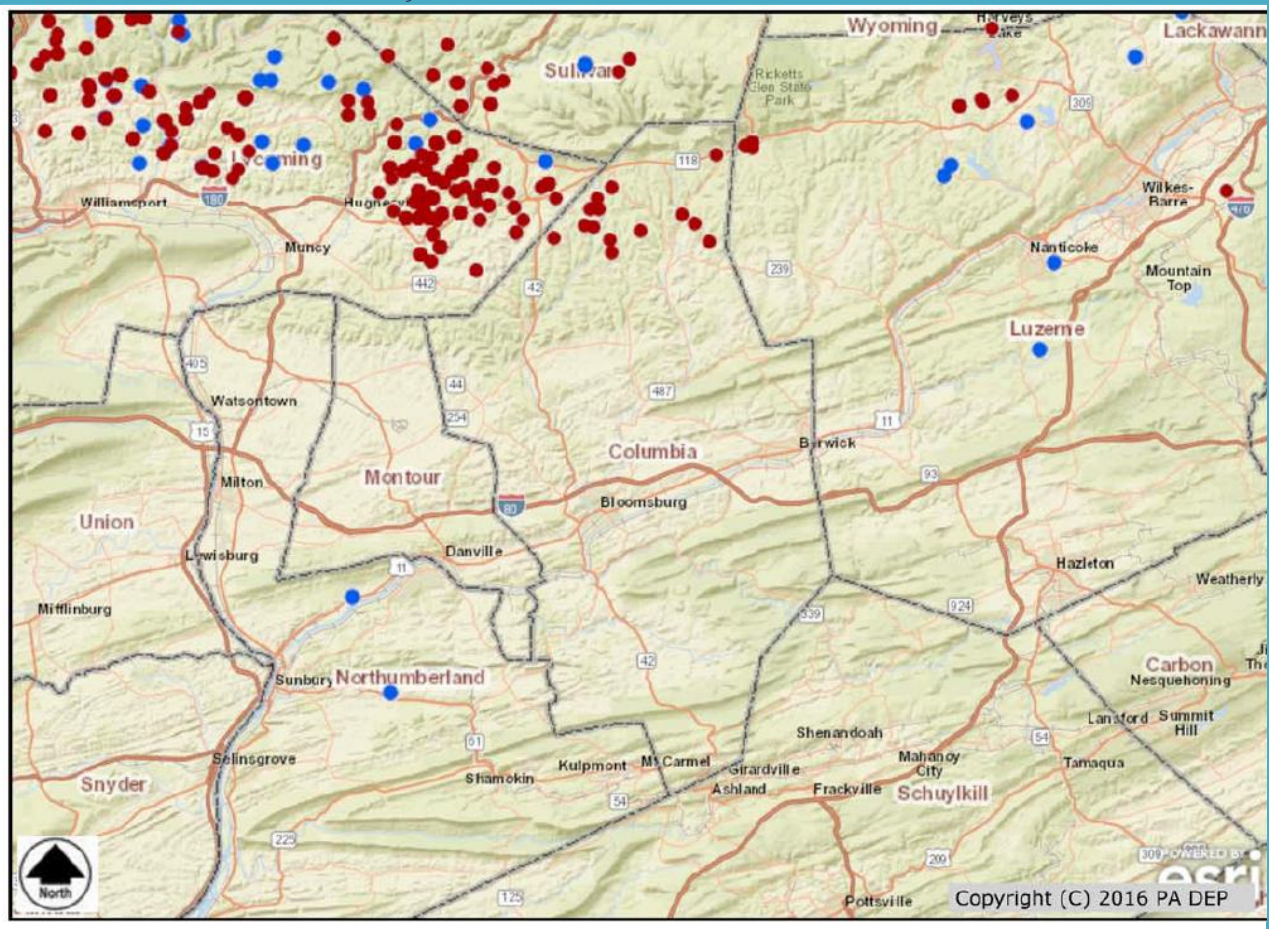
While many incidents involving hazardous materials releases have occurred in Columbia County in the past, they are generally difficult to predict. Any occurrence is largely dependent upon the

accidental or intentional actions of a person or group. Population growth, especially in areas close to transportation routes, can expose more people to these hazards if a release incident occurs. The transport, storage, and handling of hazardous materials are on the increase nationwide and with this is the potential for an increase in accidents.

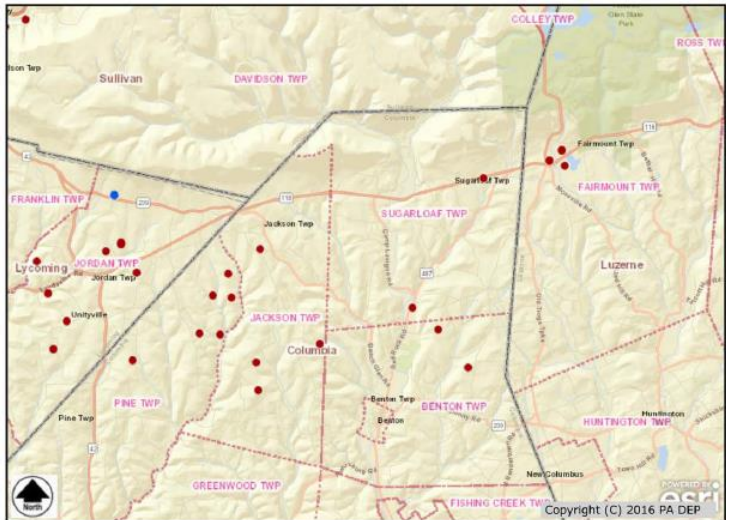
B. OIL AND GAS WELLS

It is difficult to predict when and where environmental hazards will arise. Stringent monitoring through the Pennsylvania Department of Environmental Protection will reduce the likelihood of potential impacts to the community and the environment. Incidents involving oil and gas well drilling are expected to remain relatively low, but may increase if development of Marcellus Shale continues to progress in Columbia County. Two Oil & Gas and 16 Gas well permits have been issued but only three wells have been drilled as of June 2016 (see Figure 4.3.12-5). Though Columbia County has been minimally affected so far, development in the County is likely to increase.

Figure 4.3.12-5: Map of Oil and Gas wells drilled in Columbia County (Pennsylvania Department of Environmental Protection, 2016)



- Conventional Wells
- Unconventional Wells



C. COAL MINING

While many incidents involving coal mining have occurred in Columbia County in the past, the mining industry is less prominent than in former days, so the chance of incidents occurring has mostly decreased. However, the risk of mine-related subsidence remains as there are still a number of coal mining operations in southern Columbia County

4.3.12.5 Vulnerability Assessment

A. HAZARDOUS MATERIALS RELEASE

There is approximately 20 miles of Interstate Route 80 that crosses east to west through Columbia County. This road is a major route that traverses the state of Pennsylvania and crosses into New Jersey on the east and Ohio on the west side. Various materials and substances are transported over this road, including high level radioactive waste so it is a vulnerable corridor for hazardous waste accidents. Other vulnerable sources include three natural gas transmission lines that cross the county and travel through highly populated areas such as Bloomsburg or Berwick Borough.

Jurisdictions that are home to one or more of the SARA Title III facilities should be considered vulnerable to hazardous materials releases from fixed facilities. Table 4.3.12-3 illustrates the number of SARA Title III sites by municipality in Columbia County. Bloomsburg has the most hazardous materials facilities with five; South Centre Township and Berwick Borough each have three, followed by Benton Borough, Catawissa Borough, Cleveland Township, Hemlock Township, Mifflin Township, Millville Borough, Pine Township, and Sugarloaf Township each with one facility. The remainder of the jurisdictions that don't have a hazardous materials facility within their borders have lower relative vulnerability to hazardous materials incidents.

Populations in and around the communities that are home to SARA Title III sites are more vulnerable to facility releases, particularly those within the evacuation/protection zone of the facility. There are 19 planning facilities within the county as of June 2016. Planning facilities are those that store, manufacture, or use extremely hazardous substances or store, manufacture, or use hazardous materials above the Threshold Planning Quantity (TPQ). Of the 19 planning facilities, only 5 have an extremely hazardous substance which has the potential to be released outside of the facility boundaries. Table 4.3.12-3 shows the number of planning facilities by jurisdiction and the number of critical facilities and population affected by a potential release at those facilities.

Jurisdictions without fixed hazardous materials facilities in general do not have vulnerable structures or critical facilities. However, it is important to note that even if a jurisdiction houses no hazardous materials sites or sites which pose little threat, it may be vulnerable to a release event occurring in an adjacent municipality. This is the case with Benton Township, Catawissa Township, Franklin Township, Hemlock Township, Mifflin Township, and Montour Township.

Table 4.3.12-2: Number of Hazardous Materials planning facilities per jurisdiction with associated critical facilities and population affected. (Columbia County EMA & GIS, 2016)

MUNICIPALITY	NUMBER OF PLANNING FACILITIES	NUMBER OF CRITICAL FACILITIES AFFECTED	POTENTIAL POPULATION AFFECTED
Beaver Township			
Benton Borough	1	6	890
Benton Township	0	2	179
Berwick Borough	5	18	3,568
Bloomsburg, Town of	3	33	4,424
Briar Creek Borough			
Briar Creek Township			
Catawissa Borough	1	10	1,372
Catawissa Township	0	2	42
Centralia Borough			
Cleveland Township	1	0	0
Conyngham Township			
Fishing Creek Township			
Franklin Township	0	0	16
Greenwood Township			
Hemlock Township	1	0	258
Jackson Township			
Locust Township			
Madison Township			
Main Township			
Mifflin Township	1	0	4
Millville Borough	1	0	0
Montour Township	0	0	78
Mt Pleasant Township			
North Centre Township			
Orange Township			
Orangeville Borough			
Pine Township	1	0	0
Roaring Creek Township			
Scott Township			
South Centre Township	3	12	614
Stillwater Borough			
Sugarloaf Township	1	0	0
TOTAL	**19**	**83**	**11,445**

In 2007 the Pennsylvania Emergency Management Agency rated Columbia County as having a low-to-moderate risk to both fixed hazardous material releases and releases during transit (PEMA, 2007). 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. Populations living within ¼ mile of major highways and railways should also be considered more vulnerable in the event of a transportation incident involving hazardous materials.

All of Bloomsburg University's campus is at equal risk from an off-campus hazardous material release. The University does have some hazardous material storage on-site, but quantities are less than 55 gallons. As a result, the University has the same vulnerability of a hazardous material release as the surrounding community.

B. OIL AND GAS WELLS

All 33 communities in Columbia County are vulnerable on some level, directly or indirectly, to environmental hazards resulting from oil and gas well activity. Surface waters closest to well sites are most vulnerable to damage and oil and gas industry workers are most likely to be affected by gas well fires.

One of the greatest fears of residents in Marcellus Shale counties is that groundwater will become contaminated as a result of developing the natural gas deposits. Groundwater is the main water supply for much of the rural communities in the County, although many of the more developed areas rely on municipal water systems.

The majority of Columbia County residents relying on groundwater obtain their water from wells drilled into bedrock. Private water supplies such as domestic drinking water wells in the vicinity of oil and gas wells are at risk of contamination from brine and other pollutants including methane which can pose a fire hazard. Ideally vulnerability of private drinking well owners would be established by comparing distance of drinking water well to known oil and gas well locations but this data is not available at this time. Currently, there are no active oil and gas wells within the county.

Pine Township has the greatest number of inactive oil and gas wells at six. If these wells were to become active wells again they may pose a threat to the residential wells in the area, however, they pose little threat at this time. The other three townships with inactive oil and gas wells are Benton Township, Jackson Township, and Sugarloaf Township. If oil and gas wells were placed in municipalities with higher numbers of drinking water wells, the magnitude of an accident occurring would be significantly higher.

Table 4.3.12-3 shows the various types of structures underlain with the Marcellus Shale. There are a total of 13,711 structures underlain by this formation, most of which are residential structures. It is important to note that geologically, any of these structures might be vulnerable to a Marcellus Shale well incident, but the hazard does not exist until a well is drilled near these structures. As such, this overestimates vulnerability of these structure types, especially in more densely populated areas of the municipalities where it is unlikely a well would be drilled.

Table 4.3.12-3: Structure land use of addressable structures underlain with the Marcellus Shale.(Columbia County GIS, 2016)

Municipality	Agricultural	Commercial	Exempt	Industrial	Residential	Tower	Trailer	Utility	Vacant	Total
Beaver Township	146	1	7	-	254	-	29	1	10	448
Benton Borough	6	68	18	10	282	-	46	3	1	434
Benton Township	201	26	22	144	330	2	65	4	19	813
Berwick Borough	-	74	5	144	346	-	33	-	4	606
Town of Bloomsburg	1	60	35	5	510	-	12	1	4	628
Briar Creek Borough	-	-	-	-	-	-	-	-	-	-
Briar Creek Township	136	7	27	-	779	2	213	3	20	1,187
Catawissa Borough	1	99	36	6	513	2	28	3	6	694
Catawissa Township	84	6	15	-	338	10	21	-	18	492
Centralia Borough	-	-	3	-	-	-	-	-	-	3
Cleveland Township	189	24	4	-	324	-	28	2	12	583
Conyngham Township	2	5	21	-	375	2	18	1	10	434
Fishing Creek Township	277	6	14	-	400	1	213	1	28	940
Franklin Township	109	5	9	-	147	2	24	-	11	307
Greenwood Township	254	19	22	1	512	2	94	-	20	924
Hemlock Township	86	2	5	5	377	1	26	-	4	506
Jackson Township	155	2	8	2	143	-	39	-	13	362
Locust Township	194	16	20	1	474	-	99	4	13	821
Madison Township	282	19	12	-	371	2	80	1	16	783
Main Township	93	14	64	-	363	-	77	1	13	625
Mifflin Township	128	36	13	3	697	2	106	3	18	1,006
Millville Borough	5	104	17	5	294	-	8	9	5	447
Montour Township	27	41	9	-	313	2	48	3	5	448
Mt. Pleasant Township	141	8	9	144	417	-	46	-	8	773
North Centre Township	80	6	9	-	380	2	47	-	3	527
Orange Township	123	12	6	-	374	-	124	7	9	655
Orangeville Borough	5	7	7	1	136	2	1	4	2	165

Pine Township	210	6	9	-	244	3	68	-	20	560
Roaring Creek Township	195	-	2	-	128	1	37	-	20	383
Scott Township	2	154	21	-	934	1	198	4	4	1,318
South Centre Township	1	15	9	4	343	-	56	1	-	429
Stillwater Borough	19	10	3	1	71	-	7	2	3	116
Sugarloaf Township	188	11	40	2	243	-	97	3	15	599
Total	**2765**	**522**	**333**	**169**	**8060**	**23**	**1541**	**46**	**252**	**13711**

C. COAL MINING

Columbia County's topography increases its vulnerability for land subsidence, and thus raises the risk of earth movement from the collapse of an abandoned coal mine shaft in the identified coal mine areas (CCEMA, 2007). Structures vulnerable to coal mining are vulnerable not only to mine-related subsidence but also all of the impacts described in Section 4.3.12-2. Table 4.3.12-7 shows the number of addressable structures and critical facilities within coal deposit areas. Only Conyngham Township and Centralia have structures vulnerable to coal mining incidents.

Table 4.3.12-7: Number of addressable structures and critical facilities within coal deposit areas (Columbia County GIS Dept., 2016)

MUNICIPALITY	TOTAL ADDRESSABLE STRUCTURES	TOTAL ADDRESSABLE STRUCTURES IN COAL DEPOSIT AREAS	TOTAL ASSESSEDVALUE OF ADDRESSABLE STRUCTURES IN COAL DEPOSIT AREAS	TOTAL CRITICAL FACILITIES IN COAL DEPOSIT AREAS
Centralia Borough	3	3	$ 752,848	3
Conyngham Township	436	397	$ 14,739,914	10
TOTAL	**439**	**400**	**$15,492,762.00**	**13**

4.3.13 Levee Failure

4.3.13.1 Location and Extent

Levee failures, like dam failures, have the potential to place large numbers of people and great amounts of property at risk. Unlike dams, levees are built parallel to a river or another body of water to protect the population and structures behind it from risks of casualty or damage during flooding events (FEMA, 2008). Levees do not serve a purpose beyond flood protection and, sometimes, as recreational space, unlike dams which can serve to store water or generate energy in addition to protect areas from flooding.

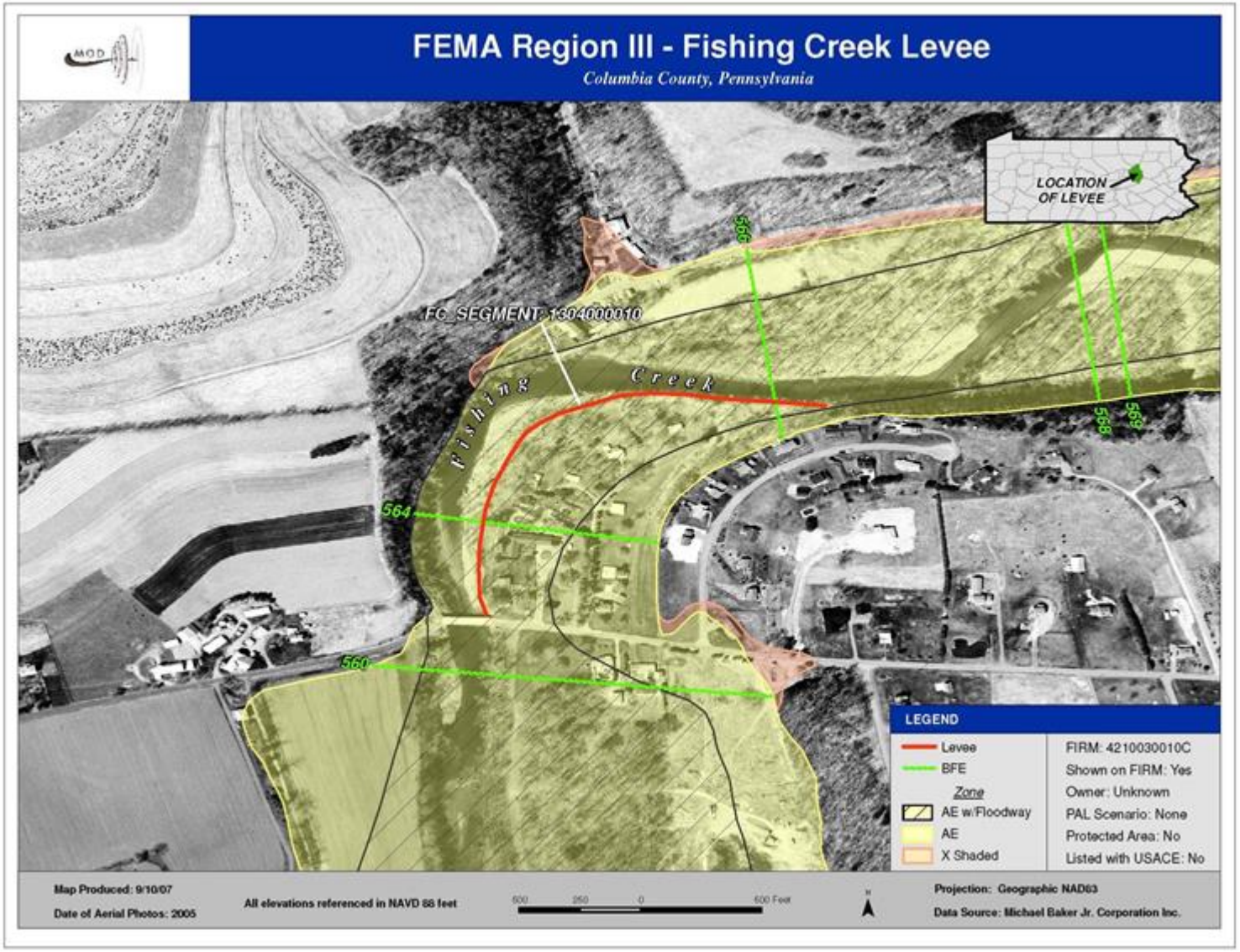
Levee failures can be caused by a number of factors, and they can cause catastrophic effects. Damage to the area beyond a levee if it fails could be more significant than if the levee was not present (FEMA, 2008). Levees are designed to provide a specific level of protection, so flooding events could overtop the levees if these events exceeded the levee specifications. Additionally, levees can also fail if they are allowed to decay or deteriorate, so regular maintenance of levees is critical.

According to the FEMA Region III Levee Inventory, dated May 2010, there is one levee in Columbia County, shown in Figure 4.3.13-1. The levee is located in Orange Township along Fishing Creek. The levee was built by the Pennsylvania Department of Environmental Protection in 1972 in response to the destruction from Hurricane Agnes, but the ownership and maintenance responsibilities of the levee were turned over to the "project sponsor" after construction. As of November 2011, Orange Township has been unable to find documentation of who the project sponsor is and thus the owner of the levee remains unknown. Action 69 in the 2012 Mitigation Action Plan sought to correct the lack of information on this and all levees

located in Columbia County.

In 2016 it was found that Orange Township officials had performed the reconstruction of the levee after the failure in 2011. Township officials now own and maintain the structure.

Figure 4.3.13-1: Fishing Creek Levee Location (FEMA Region III).



Since the last plan update, two additional levees have been constructed in Columbia County. Kawneer, a local manufacturing facility, constructed a levee using state and federal grants. This levee is private and is not a certified flood control structure. The second levee is part of the newly constructed Bloomsburg Flood Risk Management System and was constructed using a combination of state and federal grants and local government and industry contributions.

The Kawneer Company Inc. manufacturing facility in Bloomsburg, Pennsylvania is located on the east side of Ferry Road (SR 487) between the Bloomsburg Airport and Kinney's Run, approximately 1,100 feet north of the Susquehanna River. The entire Kawneer site is located within the FEMA designated Flood Fringe. The flood stage in Bloomsburg is 19'. Since 1904, approximately 35 flood events have occurred in Bloomsburg; 23 of these have taken place since 1955.

During a typical storm and subsequent flood event, the Kawneer site experiences two waves of flooding.

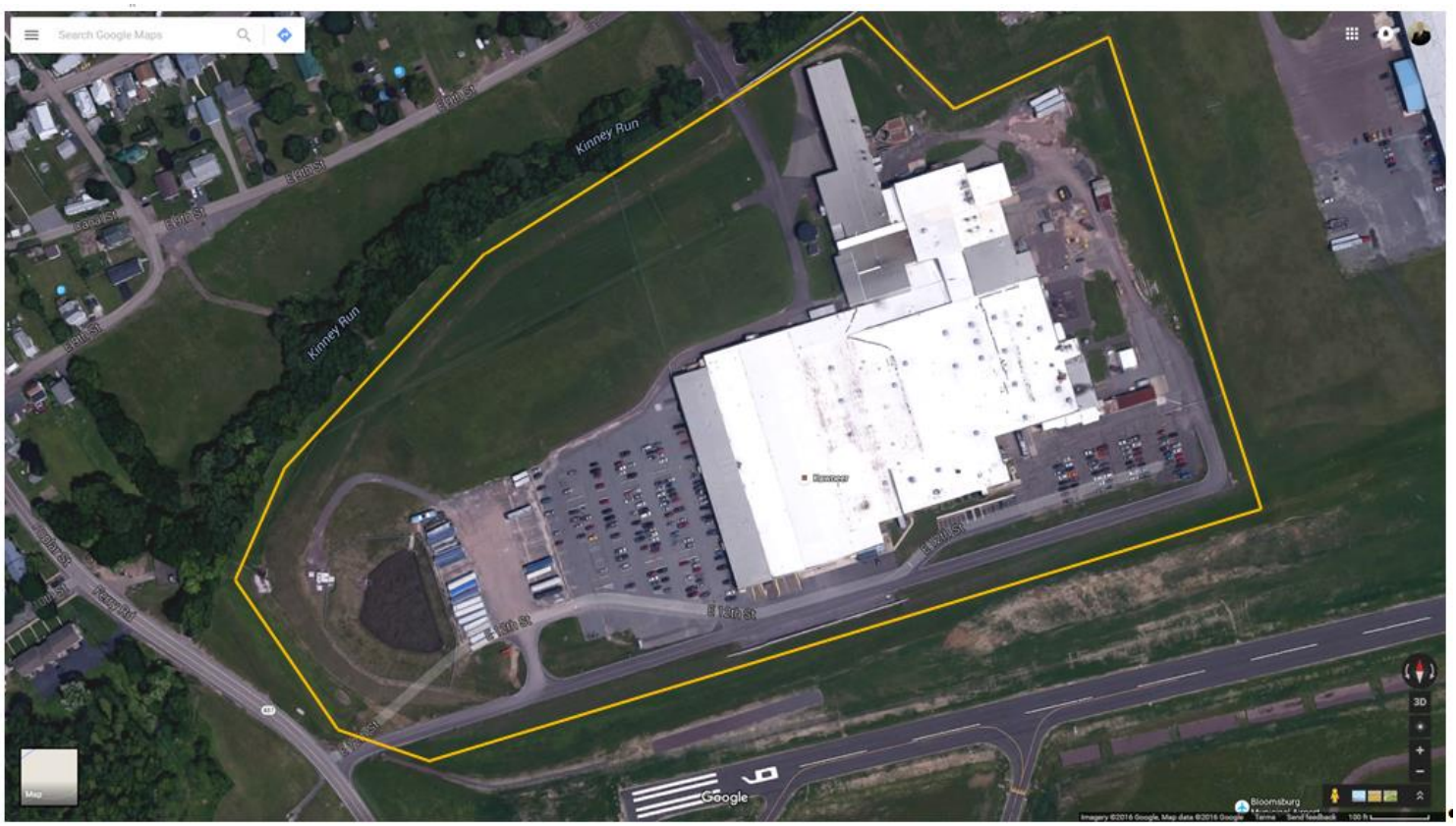
The first event occurs relatively quickly after the storm as Kinney's Run floods and overtops its banks but has limited out of bank flooding on the Kawneer property. After flash flooding from Kinney's Run has subsided, the Susquehanna River begins to rise. Water backs up from the mouth of Kinney's Run through the Town Park, under Catherine Street, under Ferry Road and onto the Kawneer site. Additional water also flows back to the site through an overflow culvert that runs under the airport runway to the river. This culvert was originally intended to mitigate flooding on Kinney's Run during large storm events by diverting water away from residential areas downstream. However, the elevation and size of the pipe, along with the fact that no backflow prevention device exists proves to be problematic during flood events occurring on the Susquehanna River. For higher elevation flood events the Susquehanna River inundates the site by overtopping the airport property.

Because of the extensive history of flooding, Kawneer maintains records of critical points on their site and at what flood stage they experience flooding. Any flood event over a stage of 19.7 feet closes the bridge on Ferry Road (SR 487), cutting off access to the plant from north, which includes the Town of Bloomsburg and connections to Interstate 80. Most of the flood events since 1955 have closed Ferry Road.

While the flooding and closure of Ferry Road is a major concern of Kawneer, other issues exist. Two sets of natural gas regulators are located on the north side of the building. When any flooding of this area is forecast, the gas company, PG Energy turns off the gas supply to Kawneer for fear that they will not be able to access the regulators in the case of a leak or rupture. Shutdown of the 'natural gas service requires the plant to close down some of their internal systems, which could take up to two weeks to return to service after they are restarted.

Updated FEMA flood mapping elevations estimate the 1% chance annual flood height to be between 1.3' and 1.8' higher than what was estimated in the original FEMA Flood Insurance Study. Officials from the USACE indicated that these increases are the result of better mapping for the Bloomsburg area and refined flood models for the Susquehanna River.

Figure 4.3.13-2: Approximate location of Kawneer Floodwall (Columbia County Resiliency, 2016)



The Bloomsburg Flood Risk Management System is located along the Susquehanna River, in the Town of Bloomsburg, Columbia County, Pennsylvania. The project includes 5,700 feet of levees and flood walls extending from Railroad Street (near Fifth Street) to Barton Street (near West Ninth Street) approximately 1,000 feet north of the right bank of the river. The entire levee system is located out of the floodways for Fishing Creek and the Susquehanna River.

The Bloomsburg Flood Risk Management System is located approximately 1,000 feet North of the right bank of the Susquehanna River in the Town of Bloomsburg, Columbia County, Pennsylvania, which is the north central portion of the Commonwealth of Pennsylvania approximately 40 miles west of Scranton and 90 miles northwest of Harrisburg, Pennsylvania. The project is in the Upper Susquehanna Basin along the North Branch of the Susquehanna River, approximately 8 miles above its confluence with the West Branch at Sunbury.

The Bloomsburg Flood Risk Management Project consists of the following Flood Risk Management System components: levee embankments; floodwalls; closure structures; pumping stations; control (drainage) structures (outfalls; culverts; sluice gates).

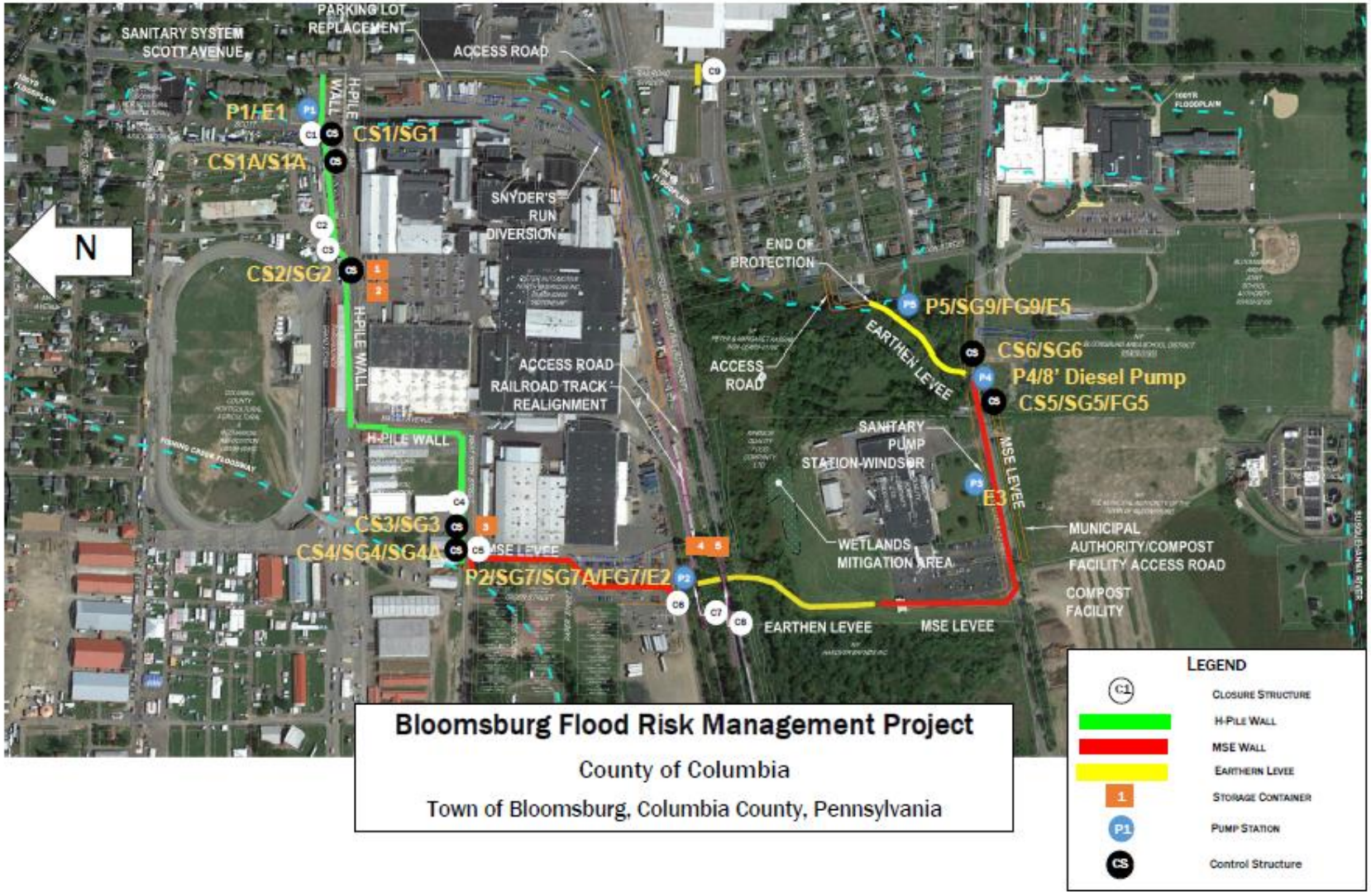
The Bloomsburg area has had several damaging flood events over the years, including the flood of 2011, which prompted the securing of Federal, State and Local industry funding, to construct the project. Significant flooding was also experienced in June 1972. Tropical Storm Lee crested

at a stage of 32.75 feet within the project area which caused significant damage to the town and the Autoneum and Windsor manufacturing facilities.

Prior to the Lee Flood of 2011, response to previous flood events, the USACE conducted a study, to evaluate construction of a Flood Risk Management System to protect against a recurrence interval of a 100-year storm. The study included preparation of General Design Memorandums (GDM), and an Environmental Impact Statement (EIS) for evaluation of the engineering, economic, and environmental feasibility of constructing the desired level of protection. The Project benefit to cost ratio did not meet federal criteria for Federal funding, thus, the project was not authorized.

The following existing upstream reservoirs provide additional flood risk management for the main stem of the Susquehanna River upstream of Bloom: Stillwater Lake; Aylesworth Creek Lake; Arkport Dam; East Sidney, Whitney Point; Almond Lake, Tioga-Hammond; and Cowanesque Dam. Tioga-Hammond Dam and Cowanesque Dam were built after Tropical Storm Agnes (1972).

Figure 4.3.13-3: Bloomsburg Flood Risk Management Project (Columbia County Resiliency, 2016)



4.3.13.2 Range of Magnitude

A levee failure or breach causes flooding in land areas adjacent to the structure. The failure of a levee or other flood protection structure could be devastating depending on the level of flooding for which the structure is designed and the amount of land development present. Large volumes of water may be moving at high velocities, potentially causing severe damage to buildings, infrastructure, trees and other large objects.

The environmental impacts of a levee failure result in significant water quality and debris disposal issues. Flood waters will back up sanitary sewer systems and inundate waste water 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. Hazardous materials may be released and distributed widely across the floodplain. Water supplies and waste water treatment could be off- line for weeks. 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. In addition, severe erosion is likely which can impact local ecosystems.

Levee failures are generally worse when they occur abruptly with little warning and result in deep, fast-moving water through developed areas. The worst case event for levee failure in Columbia County occurred during Tropical Storm Lee. According to the CCEMA, a portion of the Fishing Creek Levee washed away during the flooding associated with Lee, taking one residence and one cabin with it. There were no injuries or deaths associated with this levee breach, but those two structures were completely destroyed and the remaining nine homes and two businesses behind the levee experienced significant flood-related damages which, as of November 2011, are still being calculated. The repairs to the levee itself cost approximately $30,000

The effects of this levee failure, while devastating to those living in the surrounding community, are financially small compared to what could potentially take place if there were a failure of one of the levees in the town of Bloomsburg. Both levees in the Town of Bloomsburg protect major manufacturing businesses and the economic loss to our community would be significant.

4.3.13.3 Past Occurrence

As described in Section 4.3.13.2, there has been one levee failure in Columbia County. During Tropical Storm Lee, which occurred from September 3-9, 2011, the levee failed, flooding the entire area behind it, destroying one home and one cabin and causing severe flood-related damages. The levee has since been repaired by Orange Township.

4.3.13.4 Future Occurrence

Similarly, to dam failures, given certain circumstances, levee failures can occur at any time. However, the probability of future occurrence can be reduced through proper design, construction and maintenance measures. Most levees are designed to meet a specified level of flooding. While FEMA focuses on mapping levees that will reduce the risk of a 1%-annual-chance flood, other levees may be designed to protect against smaller or larger floods. Design specifications provide information on the percent-annual-chance flood a structure is expected to withstand, provided that it has been adequately constructed and maintained.

In addition, nonstructural flood risk management measures, such as flood forecasting and warning systems, have been evaluated and implemented. A flood forecasting and warning system is an integral part of any system, serving to further reduce flood damage and loss of life. A Flood Warning and Response System (FWRS) for use on the Susquehanna River in the Bloomsburg area of Pennsylvania was developed by the Susquehanna River Basin Commission and the National Weather Service and deployed in 1980. The system is being continuously updated and enhanced.

A flood forecasting and warning system is an integral part of the flood risk management project. To reduce damages and prevent loss of life, actions are required to warn and/or evacuate people should the anticipation of a flood condition be warranted. These actions should be planned in advance to the maximum extent practical. The County Emergency Management Plan (CEMP) helps to prepare for and manage any natural disaster or emergency that may occur in Columbia County. The County and Operator will coordinate with the National Weather Service (NWS) to monitor NWS forecasting of river stages. The CEMA works to ensure that residents of the County are well informed and prepared for emergency conditions that may be encountered. The CEMA also coordinates with and obtains flood data from the Susquehanna River Basin Commission Flood Warning and Response System (FWRS) which covers the main stem of the Susquehanna River in northeast and central Pennsylvania. The FWRS provides accurate and timely warnings that maximize response time for emergency management officials and floodplain residents.

While the network of data available for forecasting anticipated flood stages along the Susquehanna River is adequate, there is little forecasting data available for Fishing Creek. A majority of the new Flood Risk Management Project is designed to protect entities located in the floodplain and the confluence of Fishing Creek and the Susquehanna River. Adding additional rain gauges to Fishing Creek would allow the operator of the Flood Control structures, as well as EMA staff, to more accurately predict the timing, duration, and the estimated flood elevations occurring on Fishing Creek during an event. This increased monitoring would allow us to more accurately respond to flooding by activating the flood control structures associated with the flood control project at the appropriate time, thereby limiting the amount of damage done by a flood event.

If the levees in Columbia County are properly maintained and adequate warning is received to allow for the activation of the flood control structures the future occurrence of levee failure will continue to be considered *unlikely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

4.3.13.5 Vulnerability Assessment

After the devastation caused by Tropical Storm Lee, nine homes and two businesses remain behind the Fishing Creek Levee. These structures, along with any structures that may be constructed or re-constructed behind the levee as a part of the Tropical Storm Lee recovery effort, are considered vulnerable to levee failure in Columbia County.

According to Orange Township officials, as of 2016, there are currently 11 homes and 2 businesses behind the levee that remain vulnerable to levee failure at this location. Table 4.3.13-1 below outlines the values of commercial and residential structures that sit behind the three levees within the county. These figures are full values of the properties and while we may not see a total loss in any levee failure, this gives a picture of what the loss could be in case of total devastation due to a catastrophic failure.

Table 4.3.13-1: Value of residential and commercial structures protected by levees (Columbia County GIS, 2016)

Structure	Number and type of structures		Value of properties
	Residential	Commercial	
Orangeville Levee	11	2	$416,254
Kawneer	0	1	$3,286,707
Bloomsburg Flood Risk Management Project	0	3	$8,155,474

4.3.14 Nuclear Incidents

4.3.14.1 Location and Extent

The Nuclear Regulatory Commission encourages the use of Probabilistic Risk Assessments (PRA) to estimate quantitatively the potential risk to public health and safety considering the design, operations and maintenance practices at nuclear power plants. PRAs typically focus on accidents that can severely damage the core and that may challenge containment. FEMA, PEMA and county governments have formulated Radiological Emergency Response Plans to prepare for radiological emergencies at the five nuclear power generating facilities in the Commonwealth of Pennsylvania. These plans include a *Plume Exposure Pathway Emergency Planning Zone (EPZ)* with a radius of ten miles from each nuclear power facility and an *Ingestion Exposure Pathway EPZ* with a radius of fifty miles from each facility.

Columbia County is affected by both the ten-mile Plume Exposure Pathway EPZ and fifty-mile Ingestion Exposure Pathway EPZ for the Susquehanna Steam Electric Station nuclear facility, located less than five miles west of the boundary of Columbia County, along the Susquehanna River in Luzerne County, PA. Eight Columbia County municipalities are wholly or partially within the 10-mile *Plume Exposure Pathway Emergency Planning Zone* (EPZ) of the Susquehanna Steam Electric Station: Beaver Township, Berwick Borough, Briar Creek Borough, Briar Creek Township, Fishing Creek Township, Mifflin Township, North Centre Township, and South Centre Township. The entire County is within the *Ingestion Exposure Pathway* 50-mile (EPZ) for Susquehanna Steam Electric Station.

Figure 4.3.10-1 shows the population density and location of Columbia County in relation to the nuclear power facilities located in Pennsylvania. A very small portion of both Cleveland and Conyngham Townships are within 50 miles of Three Mile Island (located in Dauphin

County, PA). The remaining three nuclear plants in Pennsylvania are more than fifty miles away from Columbia County. This distance exceeds the Plume Exposure and Ingestion Exposure Pathway EPZs for nuclear emergencies; therefore, these facilities are considered a minimal threat to the County. However, in the event of an emergency, evacuees from distant EPZs may seek shelter in Columbia County.

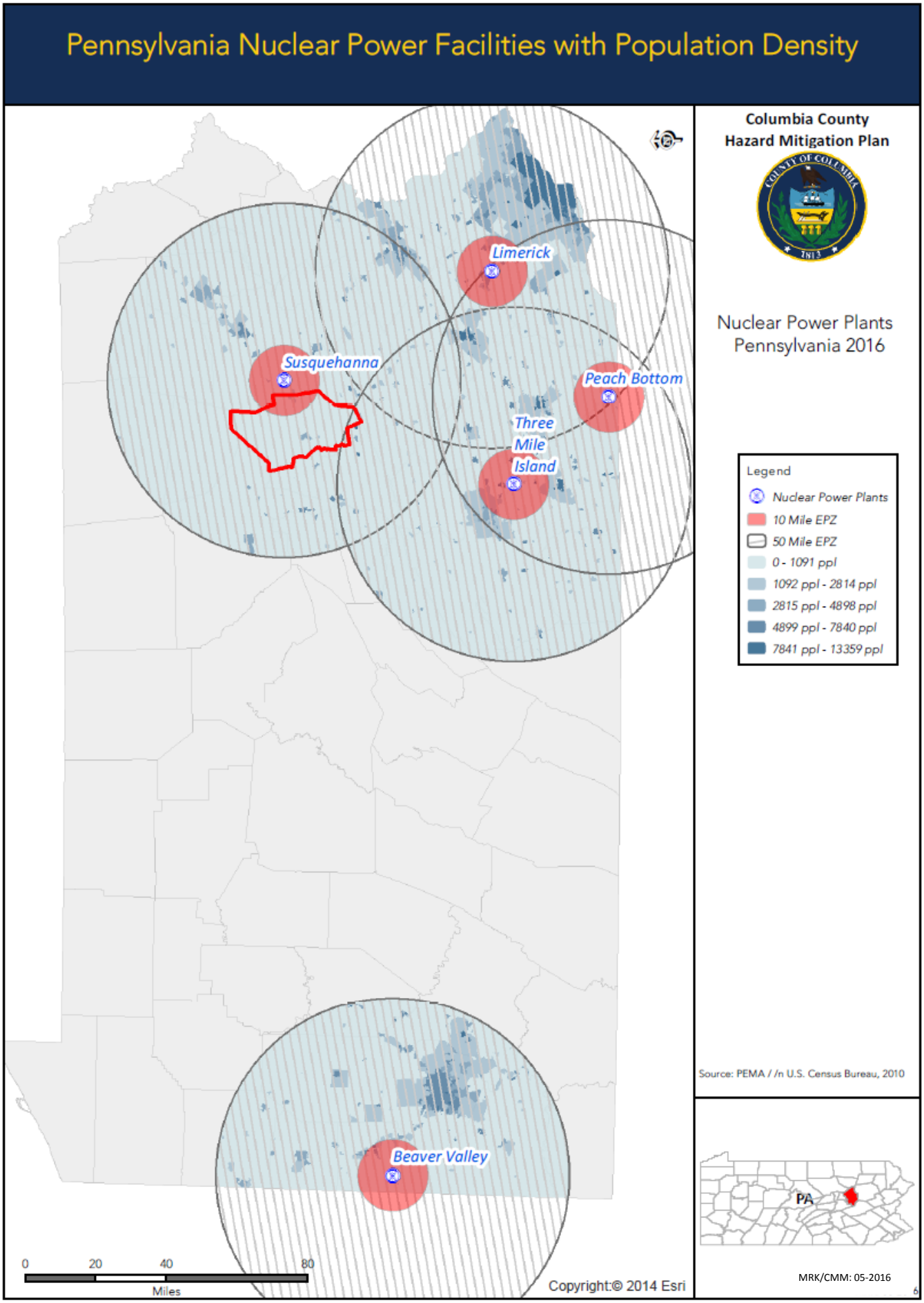


Figure 4.3.14-1: Columbia County's location and density with respect to Pennsylvania's nuclear power facilities (Columbia County GIS, 2016)

4.3.14.2 Range of Magnitude

The magnitude of a nuclear incident differs for those within the Plume Exposure Pathway EPZ and those within the Ingestion Exposure Pathway EPZ. The Plume Exposure Pathway refers to whole-body external exposure to gamma radiation from a radioactive plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. The Ingestion Exposure Pathway refers to exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation.

Nuclear accidents themselves are classified into three categories:

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

Nuclear facilities must notify the appropriate authorities in the event of an accident. The Nuclear Regulatory Commission uses four classification levels for nuclear incidents (Nuclear Regulatory Commission, 2014):

- **Unusual Event:** Under this category, events are in process or have occurred which indicate potential degradation in the level of safety of the plant. No release of radioactive material requiring offsite response or monitoring is expected unless further degradation occurs.
- **Alert:** If an alert is declared, events are in process or have occurred which involve an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the EPA Protective Action Guides.
- **Site Area Emergency:** A site area emergency involves events in process or which have occurred that result in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed the EPA PAGs except near the site boundary.
- **General Emergency:** A general emergency involves actual or imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity. Radioactive releases during a general emergency can reasonably be expected to exceed the EPA PAGs for more than the immediate site area.

After a nuclear incident, the primary concern is the effect on the health of the population near the incident. The duration of primary exposure could range in length from hours to months depending on the proximity to the point of radioactive release. External radiation and inhalation and ingestion of radioactive isotopes can cause acute health effects (e.g. death, severe health impairment), chronic health effects (e.g. cancers) and psychological effects. Additional potential impacts include the long-term effects of environmental or agricultural radioactive contamination.

Potential environmental impacts specific to the 50-mile Ingestion Exposure Pathway EPZ include the long-term effects of radioactive contamination in the environment and in agricultural products. Columbia County can expect some radioactive contamination in the case of a nuclear incident, and even a small amount of radiation will require protection of the food chain, particularly milk supplies. Small amounts of radiation ingested over time could lead to future health issues. As a result, in the case of a nuclear incident, foodstuffs, crops, milk, livestock feed and storage, and farm water supplies will need to be protected from and tested for contamination. Additionally, spills and releases of radioactive materials from accidents can result in the contamination of soil and public water supplies. Areas underlain by limestone and some types of glacial sediments are particularly susceptible to contamination.

The accident at the Three Mile Island Generating Station in March 1979 remains the nation's only nuclear incident at the *General Emergency level* and remains the worst nuclear incident on record in the Commonwealth and the nation. During this incident, equipment malfunctions, design-related problems, and worker errors led to a partial meltdown of the Three Mile Island Unit 2 reactor core at Three Mile Island. A worst-case scenario in Columbia County would be if a General Emergency were to occur at the Susquehanna Steam Electric Station, leading to a release of radioactivity, triggering an evacuation, and causing long-term health and food supply contamination.

The nuclear industry has adopted pre-determined, site-specific Emergency Action Levels (EALs). The EALs provide the framework and guidance to observe, address, and classify the severity of site-specific events and conditions that are communicated to off-site emergency response organizations (Nuclear Regulatory Commission, 2015). There are additional EALs that specifically deal with issues of security, such as threats of airborne attack, hostile action within the facility, or facility attack. These EALs ensure that appropriate notifications for the security threat are made in a timely manner. Each facility is also equipped with a public alerting system, which includes a number of sirens to alert the public located in the Plume Ingestion Pathway EPZ. This alerting system is activated by the counties of each specific EPZ. Emergency notifications and instructions are communicated to the public via the Emergency Alert System as activated by the Commonwealth of Pennsylvania Emergency Operations Center. State officials also have the capability to send emergency messages as text messages to mobile devices.

4.3.14.3 Past Occurrence

There have been two nuclear incidents above the *Alert* classification in the United States. In March 1979, a *Site Area Emergency* event occurred at Three Mile Island - Unit 2. This event is the most serious commercial nuclear accident in United States history. The resulting contamination and state of the reactor core led to the development of a ten-year cleanup and scientific effort. Despite the severity of the damage, no injuries due to radiation exposure occurred.

A second *Site Area Emergency* at Georgia Power Company's Vogtle Nuclear Plant on March 20, 1990. This event occurred when a truck struck a support column and power was cut to Unit 1. The Site Area Emergency was declared when power couldn't be restored after 15 minutes as the policy required. The Site Area Emergency was downgraded to an Alert after power was restored a short time later (Rossi, 2015).

There have been a number of minor incidents at the Susquehanna Steam Electric Station according to the Columbia County EMA. Recently, there have been five **Unusual Events**: one

each in 2003, 2004, 2005, 2011, and 2013 and three **Alerts**: one each in 2006, 2008, and 2010.

4.3.14.4 Future Occurrence

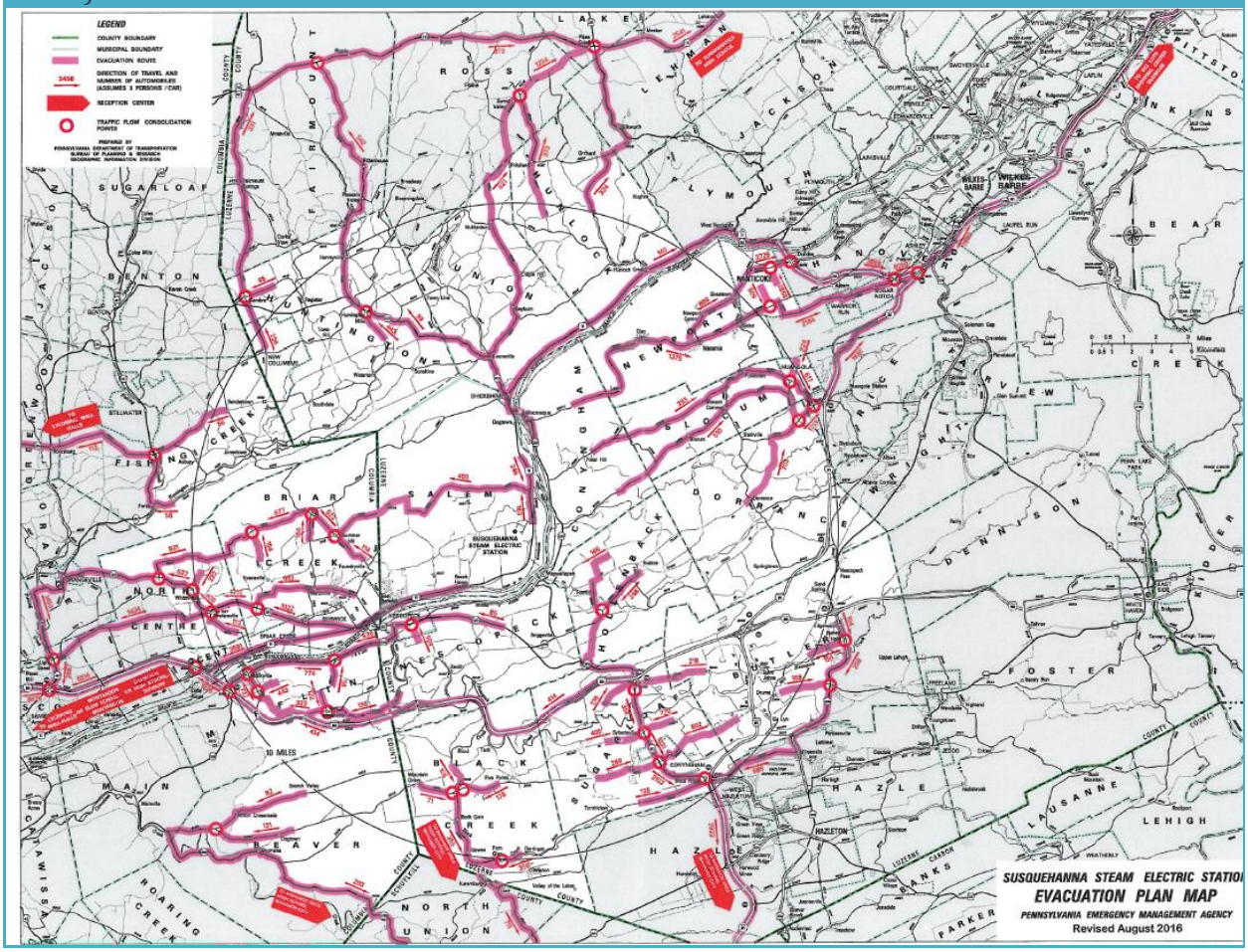
Pennsylvania is home to the only nuclear power plant General Emergency in the nation. Since the Three Mile Island incident, nuclear power has become significantly safer and is one of the most heavily regulated industries in the nation. Despite the knowledge gained since then, there is still the potential for a similar accident to occur again at one of the five nuclear generating facilities in the Commonwealth, or at the out-of-state facilities which are close to Pennsylvania. The Nuclear Energy Agency of the Organization for Economic Co-Operation and Development notes that studies estimate the chance of protective barriers in a modern nuclear facility at less than one in 100,000 per year (Nuclear Energy Agency, 2005).

Across the United States, a number of *Unusual Event* and *Alert* classification level events occur each year at the 100+ nuclear facilities that warrant notification of local emergency managers. Of these, *Alert* emergencies occur less frequently. Based on historical events, *Site Area Emergency* and *General Emergency* incidents are very rare. As a result, the probability of Columbia County experiencing a nuclear incident can be considered *unlikely* as defined by the Risk Factor “probability” criteria (see Table 4.4-1).

4.3.14.5 Vulnerability Assessment

As described in Section 4.3.14.1, eight municipalities in Columbia County are located within the 10-mile EPZ of the Susquehanna Steam Electric Station. The 10-mile EPZ and their 18,000 residents are considered vulnerable to direct radiation exposure if a significant event were to occur. Figure 4.3.14-2 shows the evacuation plan map that would be used in the event an evacuation from the nuclear facility would be necessary.

Figure 4.3.14-2: Evacuation plan map for the Susquehanna Steam Electric Station area (PEMA, 2016)



Much of Columbia County is outside of the emergency evacuation zone; however, the entire County would be affected on some level by such an event as is therefore considered at risk. The particular concern outside the 10-mile evacuation zone, as stated in Section 4.3.10.2, is food, soil, and water contamination. In terms of vulnerable land, the 122,743 acres of farmland held in Columbia County's 944 farms is vulnerable to radiological contamination in a nuclear incident. In 2012, the market value of all agricultural products of these farms exceeded $74.3 million.

Water contamination is also a concern in nuclear incidents. Public water supplies, coupled with the County's domestic drinking water wells are all vulnerable to the effects of a nuclear incident. While unlikely that all agricultural products would be lost in the event of a nuclear incident, the County could expect some portion of that $74.3 million to be lost. Time of year also impacts the vulnerability and losses estimated for a nuclear incident; an incident that occurs during the prime growing and harvesting season will have a larger impact on the County. For example, the incident at Three Mile Island occurred in the off-season; as a result, the Pennsylvania Department of Agriculture estimated that agricultural losses for the entire Commonwealth were not more than $1 million.

Bloomsburg University is within the 50-mile EPZ of the Susquehanna Steam Electric Station, so its vulnerability to a nuclear incident is equal to the rest of the jurisdictions in the 50-mile EPZ.

4.3.15 Utility Interruption

4.3.15.1 Location and Extent

Utility interruptions in Columbia County include disruptions in fuel, water, electric and telecommunications capabilities in the County, but the primary focus is on electric power failures. Utility interruptions are often a secondary impact of another hazard; for example, many wind storm events previously experienced in Columbia County have led to widespread power outages. Severe thunderstorms, tornados, and winter storms can also lead to more regional utility interruptions, while localized outages can be caused by traffic accidents or wind damage. Heat waves may also result in rolling blackouts where power may not be available for an extended period of time. Utility interruptions have the potential to take place throughout the County.

4.3.15.2 Range of Magnitude

Most severe utility interruptions and power failures are regional events. A loss of utilities can have numerous impacts including, but not limited to, food spoilage, loss of water supply (either because of a damaged pipeline or well pump failure), loss of heating or air conditioning, basement flooding (sump pump failure), lack of indoor lighting, and lack of telephone and internet service. These issues range from a minor nuisance to a full hazard event, but the degree of damage or harm depends on the population affected and the severity of the outage. For example, loss of heating and cooling capability is more dangerous in the winter and summer months, when heat sensitive populations like the elderly count on utilities to maintain a safe temperature.

At a minimum, utility interruptions can cause short term disruption in the orderly functioning of business, government, and private citizen functioning and activities like traffic signals, elevators, and retail sales. A possible worst-case scenario for a utility interruption would be if a winter storm caused a long-term regional utility outage, impairing the County's ability to function. An outage like this could cause injury or death, especially to the elderly, as people's ability to heat their homes would be impaired.

4.3.15.3 Past Occurrence

In Columbia County, minor utility interruptions occur annually, most often in conjunction with winter storms and wind storms. There is no complete or comprehensive list of utility interruption events for the County. Table 4.3.15-1 outlines utility interruption in Columbia County between 2002 and 2009. This data has not been recorded since that time, Table 4.3.15-2 outlines major outages from 2009 until 2015.

Table 4.3.15-1: Utility interruption at Columbia County from 2002-2009 (PEIRS, 2002-09).

DATE	LOCATION	TYPE OF INTERRUPTION
01/07/2002	Greenwood Township	Power Outage
03/21/2002	Berwick	Power Outage
03/22/2002	Beaver Township	Phone Outage
07/13/2003	Scott Township	Power Outage
08/11/2003	Scott Township	Power Outage
02/07/2004	Mifflin Township	Water Shortage
12/07/2004	Millville	Power Outage
02/07/2005	Berwick	Power Outage
03/24/2005	Briar Creek	Power Outage
04/28/2005	Bloomsburg	Power Outage
07/13/2005	Bloomsburg	Power Outage
06/02/2006	Bloomsburg	Power Outage
09/02/2006	Berwick	Power Outage
09/06/2006	Scott Township	Power Outage
10/23/2006	Franklin Township	Water Shortage
07/31/2007	South Centre Township	Water Main Break
11/19/2007	Fishing Creek Township	Power Outage
06/10/2008	Bloomsburg	Power Outage
06/16/2008	Berwick	Power Outage
09/12/2008	Millville	Power Outage
12/10/2008	Hemlock Township	Power Outage
05/21/2009	Catawissa Township	Phone Outage

Table 4.3.15-2: Major Utility Interruptions in Columbia County from 2009 until 2016 (Columbia County EMA, 2009-16).

DATE	LOCATIONS	TYPE OF INTERRUPTION
3-14-10	Sugarloaf Twp	Power Outage
11-30-10	Scott Twp	Power Outage
8-28-11	County Wide	Power Outage
10-30-11	Locust Twp	Power Outage
5-3-12	Bloomsburg	Power Outage
10-30-12	Sugarloaf Twp	Phone Outage
9-2-13	Sugarloaf Twp	Phone Outage
9-11-13	Bloomsburg	Power Outage
1-26-14	Bloomsburg	Water Shortage
5-27-15	Bloomsburg/Scott Twp	Power Outage

10-28-15	County Wide	Power Outage
12-8-15	Bloomsburg/Berwick Borough	Phone Outage
6/16/16	Bloomsburg to Berwick Borough	Power Outage
6/30/16	Bloomsburg, Hemlock Township, Mount Pleasant Twp.	Power Outage

4.3.15.4 Future Occurrence

Minor, short-term utility interruptions may occur several times a year for any given area in the County, while major, long-term events may take place once every few years, but utility interruptions are difficult to predict. However, because utility interruptions are frequent by-products of severe weather events, citizens should prepare for them during severe storms. Therefore, the future occurrence of utility interruptions should be considered *possible* as defined by the Risk Factor ranking probability criteria (see Table 4.4-1).

4.3.15.5 Vulnerability Assessment

Although the risk for future occurrence of utility interruptions is high across Columbia County due to the frequency of contributing factors – namely, severe weather – these interruptions are usually short lived. Hospitals and emergency medical facilities as well as retirement homes and senior centers are particularly vulnerable to power outages. While back-up power generators are often used at these facilities, loss of electricity may result in hot or cold temperatures for which elderly populations are particularly vulnerable.

4.4. Hazard Vulnerability Summary

4.4.1. Methodology

Ranking hazards helps communities set goals and priorities for mitigation based on their vulnerabilities. A Risk Factor (RF) is a tool used to measure the degree of risk for identified hazards in a particular planning area. The RF can also be used to assist local community officials in ranking and prioritizing those hazards that pose the most significant threat to their area based on a variety of factors deemed important by the planning team and other stakeholders involved in the hazard mitigation planning process. The RF system relies mainly on historical data, local knowledge, general consensus opinions from the planning team and information collected through development of the hazard profiles included in Section 4.3. The RF approach produces numerical values that allow identified hazards to be ranked against one another; the higher the RF value, the greater the hazard risk.

RF values were obtained by assigning varying degrees of risk to five categories for each of the thirteen hazards profiled in the 2012 HMPU. Those categories include: *probability*, *impact*, *spatial extent*, *warning time* and *duration*. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor is shown in Table 4.4-1. To calculate the RF value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the example equation:

Risk Factor Value = [(Probability x .30) + (Impact x .30) + (Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]

Table 4.4-1 summarizes each of the five categories used for calculating a RF for each hazard. According to the weighting scheme applied, the highest possible RF value is 4.0.

Table 4.4-1: Summary of Risk Factor approach used to rank hazard risk.

RISK ASSESSMENT CATEGORY	DEGREE OF RISK				WEIGHT VALUE
	LEVEL	**CRITERIA**		**INDEX**	
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	**UNLIKELY**	LESS THAN 1% ANNUAL PROBABILITY		**1**	**30%**
	POSSIBLE	BETWEEN 1% & 49.9% ANNUAL PROBABILITY		**2**	
	LIKELY	BETWEEN 50% & 90% ANNUAL PROBABILITY		**3**	
	HIGHLY LIKELY	GREATER THAN 90% ANNUAL PROBABILTY VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY		**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**	SHUTDOWN OF CRITICAL FACILITIES. MINOR INJURIES ONLY. MORE THAN 10% OF		**1**	**30%**
	LIMITED	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** - Level 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** - Level 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**	

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, Table 4.4-2 lists the Risk Factor calculated for each of the eleven potential hazards identified in the 2012 HMPU. Hazards identified as *high* risk have risk factors equal to or greater than 2.5. Risk Factors ranging from 2.0 to 2.4 were deemed *moderate* risk hazards. Hazards with Risk Factors 1.9 and less are considered *low* risk. Members of the HMPT were given the opportunity to review RF rankings and suggest changes on Part I the Countywide and Jurisdictional Risk Factor Evaluation Form; all changes have been incorporated into the final RF rankings.

Table 4.4-2: Ranking of hazard types based on Risk Factor methodology.

HAZARD RISK	HAZARD NATURAL (N) or MAN-MADE (M)	RISK ASSESSMENT CATEGORY					RISK FACTOR
		PROBABILITY	IMPACT	SPATIAL EXTENT	WARNING TIME	DURATION	
HIGH	Flood, Flash Flood, Ice Jam (N)	4	3	3	2	3	3.2
	Environmental Hazards (M)	3	3	3	4	2	3.0
	Winter Storm (N)	4	2	4	1	2	2.9
	Tornado, Windstorm (N)	4	2	3	2	1	2.7
MODERATE	Nuclear Incident (M)	1	2	3	4	4	2.3
	Dam Failure (M)	1	3	2	4	2	2.2
	Drought (N)	2	1	4	1	4	2.2
	Utility Interruption (M)	2	1	3	3	2	2.0
LOW	Hurricane, Tropical Storm, Nor'easter (N)	2	2	2	1	2	1.9
	Landslide (N)	2	1	3	2	2	1.9
	Radon Exposure (N)	2	1	1	4	4	1.9
	Levee Failure (M)	1	2	1	4	3	1.8
	Pandemic (N)	2	1	2	1	4	1.8
	Wildfire (N)	2	1	2	3	1	1.7
	Earthquake (N)	1	1	1	4	1	1.3

Based on these results, there are four *high* risk hazards, four *moderate* risk hazards and seven *low* risk hazards in Columbia County. Mitigation actions were developed for all high, moderate, and low risk hazards (see Section 6.4). Mitigation actions related to future public outreach and emergency service activities are identified to address low risk hazard events.

A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. Table 4.4-3 shows the different municipalities in Columbia County and whether their risk is greater than (>), less than (<), or equal to (=) the risk factor assigned to the County as a whole. This table was developed by the consultant team based on the findings in the hazard profiles of Section 4.3. Municipal officials had the opportunity to review the findings and make changes at the Risk Assessment Workshop using the Countywide and Jurisdictional Risk Factor Evaluation Form. Those changes are reflected in the table and comments can be viewed in **Appendix C.**

Table 4.4-3: Calculated Countywide Risk Factor by hazard and Comparative Jurisdictional Risk.

	Flood, Flash Flood, Ice Jam	Environmental Hazards Winter Storm	Tornado, Windstorm	Nuclear Incident	Dam Failure	Drought	Utility Interruption	Hurricane, Tropical Strom, Nor Easter	Landslide	Radon Exposure	Levee Failure	Pandemic	Wildfire	Earthquake	Comments
	3.2	**3.0**	**2.9**	**2.7**	**2.3**	**2.2**	**2.2**	**2.0**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.7**	**1.3**	
Beaver Township	=	=	=	=	>	>	=	=	=	=	=	=	=	>	=	
Benton Borough	>	=	=	=	=	=	=	=	=	<	=	=	=	>	=	
Benton Township	=	=	=	=	=	=	=	=	=	<	=	=	=	<	=	
Berwick Borough	=	=	=	=	>	>	=	=	=	=	=	=	>	=	=	
Bloomsburg, Town of	>	=	=	=	=	<	=	>	=	=	=	>	>	<	=	
Bloomsburg University	<	=	=	=	=	<	=	=	=	=	>	=	>	<	=	
Briar Creek Borough	=	=	=	=	>	>	=	=	=	=	=	=	=	<	=	
Briar Creek Township	=	=	=	=	>	>	=	=	=	=	=	=	=	>	=	
Catawissa Borough	>	=	=	=	=	=	=	=	=	=	=	=	=	<	=	
Catawissa Township	=	=	=	=	=	<	=	=	=	=	=	=	=	>	=	
Centralia Borough	<	=	=	=	=	<	=	=	<	=	=	=	=	<	=	

	Flood, Flash Flood, Ice Jam	Environmental Hazards	Winter Storm	Tornado, Windstorm	Nuclear Incident	Dam Failure	Drought	Utility Interruption	Hurricane, Tropical Strom, Nor Easter	Landslide	Radon Exposure	Levee Failure	Pandemic	Wildfire	Earthquake	Comments
	3.2	**3.0**	**2.9**	**2.7**	**2.3**	**2.2**	**2.2**	**2.0**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.7**	**1.3**	
Cleveland Township	=	=	=	=	=	=	=	=	=	=	=	=	=	<	=	
Conyngham Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	
Fishing Creek Township	=	=	=	=	>	=	=	=	=	<	=	=	=	<	=	
Franklin Township	=	=	=	=	=	<	=	=	=	=	=	=	=	<	=	
Greenwood Township	=	=	=	=	=	=	=	=	=	<	=	=	=	<	=	
Hemlock Township	>	=	=	=	=	<	=	>	=	=	=	=	=	=	=	
Jackson Township	=	=	=	=	=	<	=	=	=	=	=	=	=	=	=	
Locust Township	=	=	=	=	<	<	=	=	=	=	=	=	=	=	=	
Madison Township	=	=	=	=	=	<	=	=	=	<	=	=	=	<	=	
Main Township	=	=	=	=	=	<	=	=	=	=	=	=	=	=	=	
Mifflin Township	=	=	=	=	>	=	=	=	=	=	=	=	=	=	=	

	Flood, Flash Flood, Ice Jam	Environmental Hazards Winter Storm	Tornado, Windstorm	Nuclear Incident	Dam Failure	Drought	Utility Interruption	Hurricane, Tropical Strom, Nor Easter	Landslide	Radon Exposure	Levee Failure	Pandemic	Wildfire	Earthquake	Comments
	3.2	**3.0**	**2.9**	**2.7**	**2.3**	**2.2**	**2.2**	**2.0**	**1.9**	**1.9**	**1.9**	**1.8**	**1.8**	**1.7**	**1.3**	
Millville Borough	=	=	=	=	=	<	=	=	=	=	=	=	=	<	=	
Montour Township	>	=	=	=	=	=	=	>	=	>	=	=	=	<	=	
Mt. Pleasant Township	=	=	=	=	=	<	=	=	=	=	=	=	=	<	=	
North Centre Township	=	=	=	=	>	<	=	=	=	=	=	=	=	=	=	
Orange Township	=	=	=	=	=	<	=	=	=	=	=	>	=	=	=	
Orangeville Borough	=	=	=	=	=	<	=	=	=	=	=	=	=	<	=	
Pine Township	=	=	=	=	=	=	=	=	=	=	=	=	=	<	=	
Roaring Creek Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	
Scott Township	=	=	=	=	=	<	=	>	=	=	=	=	=	<	=	
South Centre Township	=	=	=	=	>	<	=	=	=	=	=	=	=	=	=	
Stillwater Borough	=	=	=	=	=	<	=	=	=	=	=	=	=	<	=	
Sugarloaf Township	=	=	=	=	=	=	=	=	=	>	=	=	=	=	=	

4.4.3. Potential Loss Estimates

Based on various kinds of available data, potential loss estimates were established for flood, flash flood, and ice jam, tornado and windstorms, drought, nuclear incident, and winter storms. Estimates provided in this section are based on information provided from the Columbia County GIS department, property values from the county tax assessment database, and previous events. Estimates are considered *potential* in that they generally represent losses that could occur in a countywide hazard scenario. In events that are localized, losses may be lower, while regional events could yield higher losses.

Potential loss estimates have four basic components, including:

- Replacement Value: Current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials.
- Content Loss: Value of building's contents, typically measured as a percentage of the building replacement value.
- Functional Loss: The value of a building's use or function that would be lost if it were damaged or closed.
- Displacement Cost: The dollar amount required for relocation of the function (business or service) to another structure following a hazard event.

The structure data used in this plan includes building values provided in the county tax assessment database. These values are representative of replacement value alone; content loss, functional loss, and displacement cost are not included. Figure 4.4-1 illustrates the range of structure assessed values in Columbia County at the parcel level by matching property PIN values.

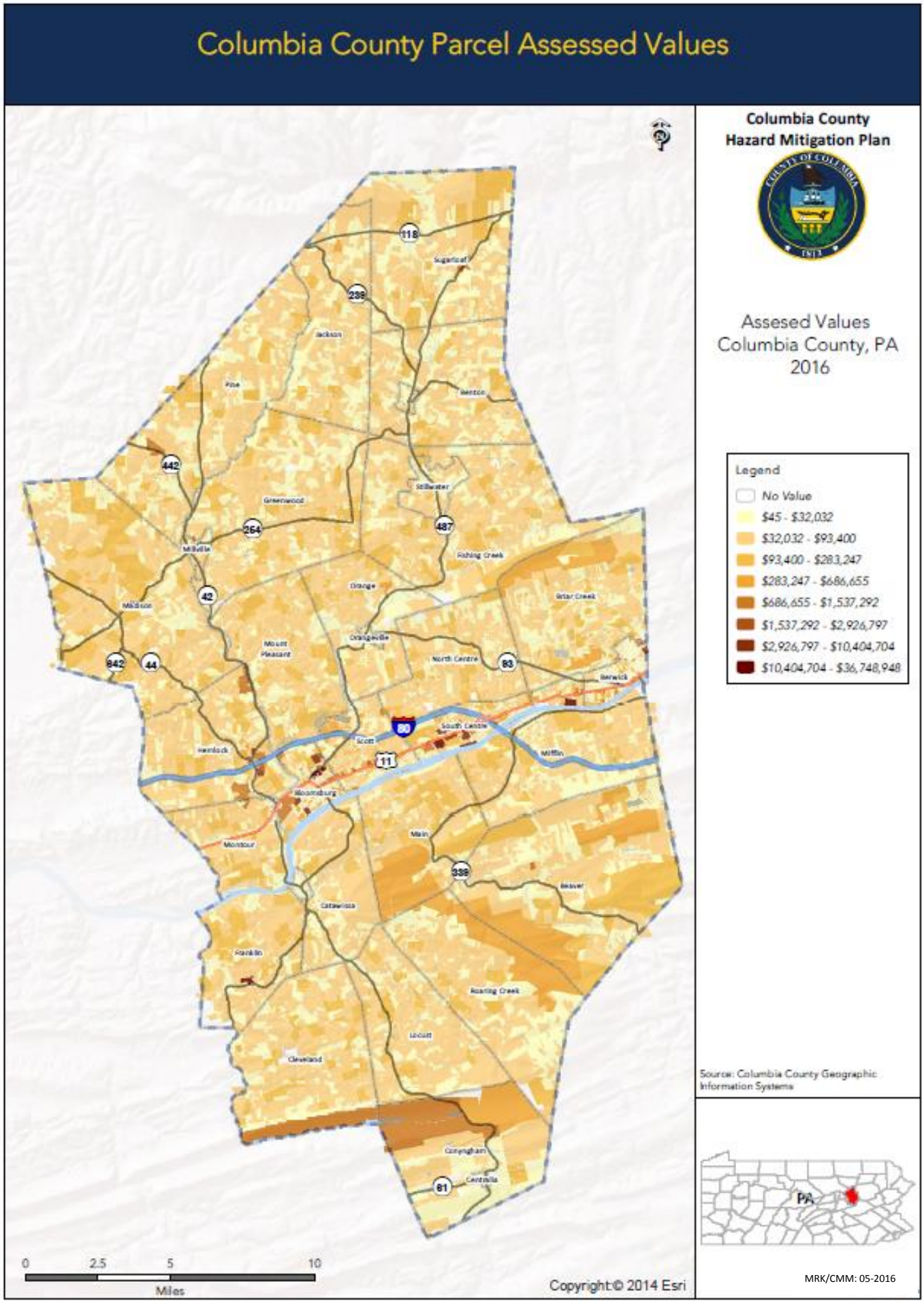


Figure 4.4-1: Columbia County parcel assessed values (Columbia County GIS Department, 2016).

The Department of Geographic Information Systems of the County of Columbia conducted an analysis of the structures impacted by the 1% annual chance flood hazard (100-year flood hazard). Utilizing the following geographic layers – 1% annual chance flood hazard areas (FEMA), parcels (Columbia), and building centroids (Columbia) – the Department identified those at risk structures impacted by the flood hazard. Using those at risk structures, were able to determine the associated structures' valuation data maintained by the county Assessment Office.

Using the following formula, (building market value * 0.5 * 3.69), the structures valuation was converted from 1992 market value to 2016 market value. To simulate the estimated loss for such an event, 25% was applied to each structures valuation.

The estimated loss for a 1% annual chance flood hazard was summarized by municipality and classified by structure land use.

Using this data, total building-related losses for the 1% annual-chance flood event were estimated to be $235.21 million. Just over 38% of these building-related losses were incurred by residential occupancies; a further 55% of building-related losses were incurred by commercial properties. Approximately 15% of the building-related losses were incurred by industrial occupancies. Figure 4.4-2 shows the spatial distribution of potential economic losses at the within the 1% annual chance of flood area. Some of the highest economic losses are expected in the Town of Bloomsburg and Scott Township. Total economic loss, including replacement value, content loss, functional loss, and displacement cost was estimated at $433.98 million for the entire County. The full hazard analysis report can be found in **Appendix F**.

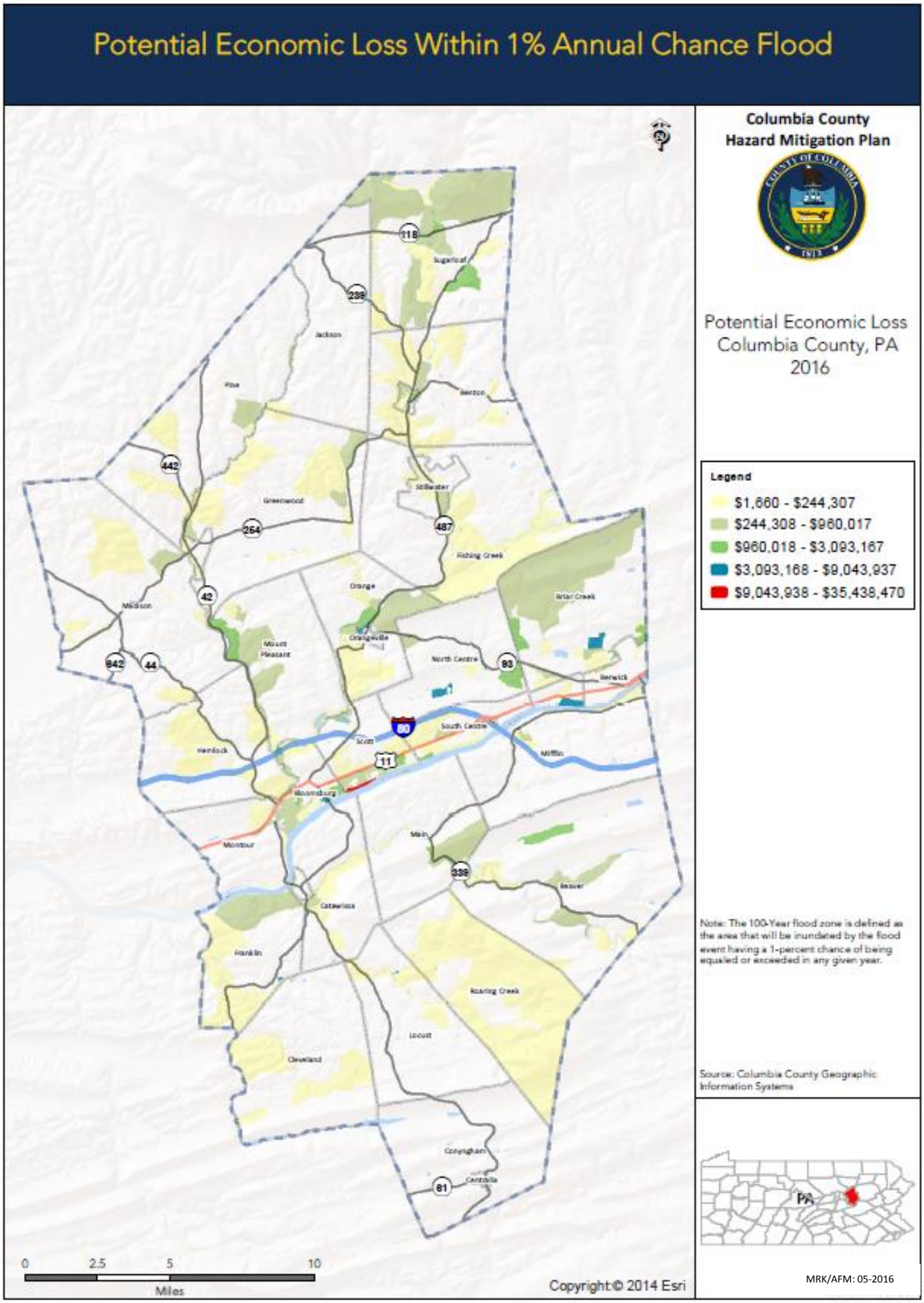


Figure 4.4-2: Potential Economic Loss within 1% Annual Chance of Flood (Columbia County GIS, 2016)

Another way of thinking about losses for floods is to look at the number of claims and the dollar amount of loss experienced by NFIP communities. In Columbia County, there are 999 NFIP policies in force; these policies have accumulated 2,105 claims since 1978. The historical value of these claims exceeds $59 million. Looking at these historical losses, Bloomsburg, Scott Township, Hemlock Township, and Orange Township have experienced the most losses with over $2 million in claims paid since 1978. Bloomsburg is the highest with over 31 million in losses paid since 1978.

Table 4.4-4: NFIP Claims and losses paid in Columbia County since 1978 (FEMA, 2016).

MUNICIPALITY	NO. POLICIES IN FORCE	TOTAL COVERAGE	TOTAL CLAIMS SINCE 1978	TOTAL PAID SINCE 1978
Beaver Township	5	$ 632,000	2	$ 29,186
Benton Borough	64	$ 7,929,000	72	$ 678,815
Benton Township	18	$ 1,982,000	56	$ 730,135
Berwick Borough	31	$ 2,907,000	27	$ 262,416
Bloomsburg, Town of	364	$ 53,189,000	928	$ 31,146,929
Briar Creek Borough	6	$ 663,000	20	$ 265,601
Briar Creek Township	36	$ 3,553,000	6	$ 56,658
Catawissa Borough	6	$ 1,798,000	60	$ 1,516,000
Catawissa Township	7	$ 794,000	18	$ 289,832
Centralia Borough	0	0	0	0
Cleveland Township	18	$ 2,324,000	34	$ 542,504
Conyngham Township	1	$70,000	0	0
Fishing Creek Township	42	$ 5,226,000	97	$ 3,290,179
Franklin Township	22	$ 1,545,000	65	$ 1,246,629
Greenwood Township	22	$ 1,585,000	35	$ 272,930
Hemlock Township	50	$ 8,024,400	156	$ 5,590,446
Jackson Township	0	0	0	0
Locust Township	12	$ 1,031,000	34	$ 386,448
Madison Township	2	$ 449,000	3	$ 17,250
Main Township	7	$ 1,028,000	17	$ 262,642
Mifflin Township	7	$ 2,150,000	17	$ 302,738
Millville Borough	7	$ 965,000	2	$ 4,472
Montour Township	14	$ 2,276,000	65	$ 1,301,942
Mt Pleasant Township	13	$ 2,345,000	22	$ 1,056,176
North Centre Township	6	$ 616,000	4	$ 14,347
Orange Township	24	$ 3,243,000	110	$ 2,667,716
Orangeville Borough	3	$ 161,000	26	$ 328,093
Pine Township	6	$ 1,075,000	2	$ 11,341

Roaring Creek Township	4	$ 283,000	1	$ 0
Scott Township	156	$ 33,636,000	180	$ 6,536,231
South Centre Township	15	$ 4,879,000	13	$ 422,761
Stillwater Borough	17	$ 2,019,000	27	$ 452,230
Sugarloaf Township	14	$ 1,653,000	6	$ 205,941
TOTAL	**999**	**$**	**2105**	**$ 59,888,588**

For the remaining hazards where loss estimates could be determined, loss estimates are generalized based on the historical impact of the hazard. For droughts, the losses are largely agricultural; as a result, losses are expected to be some portion of Columbia County's $45.9 million in agricultural production, depending on the magnitude of the event. For nuclear incidents, it is difficult to estimate losses within the 10-mile EPZ, but losses in the 50-mile EPZ are largely crop and livestock-based; as a result, they will also be some portion of the County's agricultural production. Losses associated with radon exposure are related to healthcare costs and lost wages, and the average mitigation cost for addressing this hazard is $1,200, according to the EPA.

Losses associated with particular natural hazard events are sometimes reported to the NCDC with the event. The reporting time frame is generally 1950-2010. While these historic losses give a glimpse of potential losses in hazard events, they are not reported for all events and should be considered a broad estimate. Flood losses reported to NCDC surpass $50.8 million and for any single event, range from $5,000 to $50 million. Tornado and windstorm events have had losses ranging from $1,000 to $500,000 depending on the magnitude of the events. These events have also led to three deaths and three injuries. For winter storm events, only one of the past events had losses reported with the event; it had monetary losses estimated at $150,000 and two injuries.

4.4.4. Future Development and Vulnerability

Risk and vulnerability to natural and human-made 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. Columbia County is expected to experience a variety of factors that will, in some areas, increase vulnerability to hazards while in other areas, vulnerability may stay static or even be reduced.

Population change is perhaps the most significant indicator of changes in vulnerability in the future. As discussed in Section 2.3, the total population of Columbia County has grown by 4.8 percent from 2000 to 2010, but population change has been highly variable between jurisdictions. The population change can be seen in Figure 4.4-3. Fourteen jurisdictions lost a portion of their population between 2000 and 2010 with the largest loss in population occurring in Benton and Centralia Boroughs. Two jurisdictions grew by 20% (Bloomsburg and Hemlock Township) while three other jurisdictions grew by more than 10%.

While Columbia County has grown slightly in the last ten years, there are still few places with high density, and the County expects to remain largely rural. Hazard vulnerability and loss potential will be higher in the places of higher density (namely the Town of Bloomsburg and the boroughs) throughout the County. However, population growth and associated development in previously less dense areas will likely create increases in loss potential, as more people may be living in areas prone to hazards, especially flooding, winter storms, and wildfires.

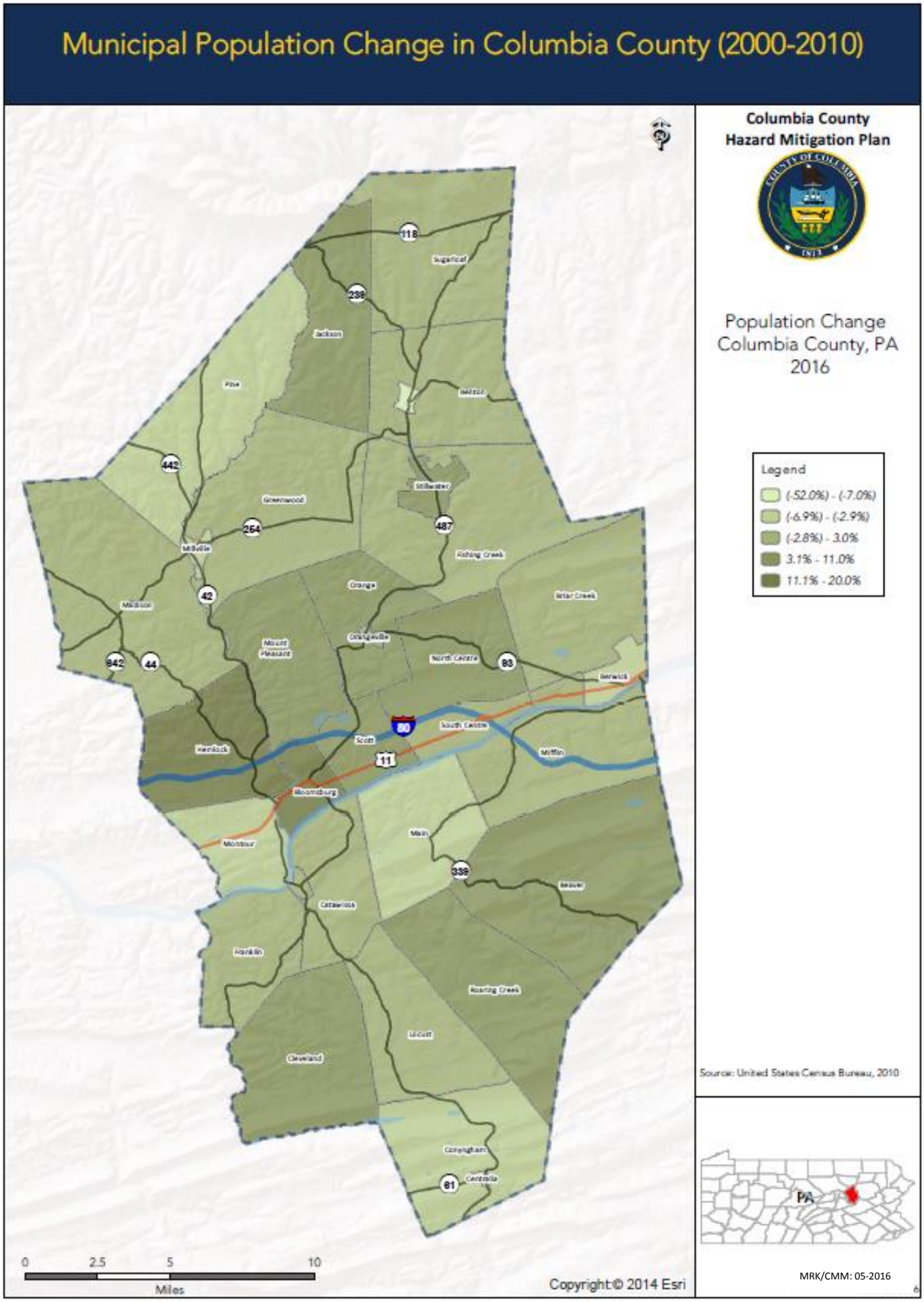


Figure 4.4-3: Municipal population change in Columbia County (Columbia County GIS, 2016)

Columbia County has also experienced an aging population in the last decades. Sixteen percent of the population is over the age of 65, and while the County has a fair number of young people, many of these are attendees at Bloomsburg University and do not always choose to stay in the County after college. Older residents pose unique challenges when it comes to evacuation and/or mobility during the rescue and recovery processes that typically occur in the case of a hazard event. As there becomes more of an elderly population in the county, officials may consider partnering with human services organizations to specifically plan for this vulnerable population.

The aging housing stock in Columbia County is another source of current and future vulnerability in many hazard events. A large percentage of the housing stock, approximately 37 percent, was built before 1940. Columbia County can experience significant gusts of wind during windstorms or tornadoes. The structure of these older houses may be more at risk of destruction under these strong wind conditions. These structures may 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.

In the past, Columbia County has expressed concern about open space preservation. The County participates in Pennsylvania's Agricultural Conservation Easement Program, and many jurisdictions have enacted farmland preservation procedures. Additionally, with assistance from DCNR, the County Conservation Fund has acquired over 9,000 acres across Columbia and Northumberland Counties. Preservation of farmland, open space, and natural areas, will address the County's concerns of threats to natural environments. Additionally, these natural areas can help maintain or reduce risk and vulnerability in the County.

5. Capability Assessment

5.1. Update Process Summary

Columbia County has a number of resources it can access to implement hazard mitigation initiatives including emergency response measures, local planning and regulatory tools, administrative assistance and technical expertise, fiscal capabilities, and participation in local, regional, state, and federal programs. The presence of these resources enables community resiliency through actions taken before, during, and after a hazard event.

The 2012 HMP identified the most commonly used resources available in Columbia County to support hazard mitigation with a focus on institutional, legal, fiscal, political, and technical capabilities. It indicated the presence of local plans, ordinances, and codes in each municipality. Finally, the 2012 Capability Assessment specified local, state, and non-profit resources available for mitigation efforts including the Susquehanna River Basin Commission, SEDACOG, DCED, DEP, DCNR, and PennVEST. Through responses to the *Capability Assessment Survey* distributed to municipalities and input from the HMSG and the HMPT, the 2017 HMPU provides an updated inventory of the most critical local planning tools available within each municipality and a summary of the fiscal and technical capabilities available through programs and organizations outside of the County. It also identifies emergency management capabilities and the processes used for implementation of the National Flood Insurance Program.

While the capability assessment serves as a good instrument for identifying local capabilities for, it also provides a means for recognizing gaps and weaknesses that can be resolved through future mitigation actions. The results of this assessment lend critical information for developing an effective mitigation strategy.

5.2. Capability Assessment Findings

5.2.1 Planning and Regulatory Capability

Some of the most important planning and regulatory capabilities that can be utilized for hazard mitigation include Comprehensive Plans, Building Codes, Floodplain Ordinances, Subdivision and Land Development Ordinances, and Zoning Regulations. These tools provide mechanisms for the implementation of adopted hazard mitigation strategies. Table 5.2-1 summarizes their presence within each municipality.

Table 5.2.1-1: Summary of planning tools adopted by each municipality in Columbia County (Updated as of March 2016)

Community	Comprehensive plan	Building code	Floodplain ordinance – NFIP participant	Subdivision & land development ordinance	Zoning ordinance
Beaver Township	Yes	Yes	Yes	Yes, County	Yes
Benton Borough	Yes	Yes	Yes	Yes, County	Yes
Benton Township	Yes	Yes	Yes	Yes, County	Yes
Berwick Borough	Yes	Yes	Yes	Yes, Local	Yes

Bloomsburg, Town of	Yes	Yes	Yes	Yes, Local	Yes
Briar Creek Borough	Yes	Yes	Yes	Yes, Local	Yes
Briar Creek Township	No	Yes	Yes	Yes, Local	Yes
Catawissa Borough	Yes	Yes	Yes	Yes, County	Yes
Catawissa Township	Yes	Yes	Yes	Yes, County	Yes
Centralia Borough	No	No	Yes	Yes, County	No
Cleveland Township	Yes	Yes	Yes	Yes, County	Yes
Conyngham Township	No	Yes	Yes	Yes, County	no
Fishing Creek Township	Yes	Yes	Yes	Yes, County	No
Franklin Township	Yes	Yes	Yes	Yes, County	Yes
Greenwood Township	Yes	Yes	Yes	Yes, County	Yes
Hemlock Township	Yes	No	Yes	Yes, Local	Yes
Jackson Township	Yes	No	Yes	Yes, Local	Yes
Locust Township	Yes	Yes	Yes	Yes, Local	Yes
Madison Township	No	Yes	Yes	Yes, Local	No
Main Township	No	Yes	Yes	Yes, County	Yes
Mifflin Township	Yes	Yes	Yes	Yes, Local	Yes
Millville Borough	Yes	No	Yes	Yes, County	Yes
Montour Township	Yes	Yes	Yes	Yes, Local	Yes
Mount Pleasant Township	No	Yes	Yes	Yes County	Yes
North Centre Township	Yes	Yes	Yes	Yes, County	Yes
Orange Township	No	No	Yes	Yes, County	Yes
Orangeville Borough	No	Yes	Yes	Yes, County	No
Pine Township	Yes	Yes	Yes	Yes, County	Yes
Roaring Creek Township	Yes	Yes	Yes	Yes, County	Yes
Scott Township	Yes	Yes	Yes	Yes, Local	Yes
South Centre Township	Yes	Yes	Yes	Yes, Local	Yes
Stillwater Borough	Yes	Yes	Yes	Yes, County	Yes
Sugarloaf Township	Yes	No	Yes	Yes, County	Yes

Comprehensive Plans promote sound land use and regional cooperation among local governments to address planning issues. These plans serve as the official policy guide for influencing the location, type and extent of future development by establishing the basis for decision-making and review processes on zoning matters, subdivision and land development, land uses, public facilities and housing needs over time. The existing countywide Comprehensive Plan for Columbia County was developed in 1993; of the communities participating in this HMP, 23 have local comprehensive plans. Scott Township and South Centre Townships share a single comprehensive plan. County governments are required by law to adopt a comprehensive plan, while local municipalities may do so at their option. Future comprehensive plan updates and improvements will consider 2017 HMPU findings. Columbia County also has a Comprehensive Recreation, Parks, Greenways, and Open Space Plan, written in 2007. This plan is an advisory document that provides strategies for the enhancement of parks, recreational opportunities and services, greenways, trails, and open space countywide.

The plan also provides direction and initiatives for protecting open space and natural resources.

Building codes regulate construction standards for new construction and substantially renovated buildings. Standards can be adopted that require resistant or resilient building design practices to address hazard impacts common to a given community. In 2003, the Commonwealth of Pennsylvania implemented Act 45 of 1999, the Uniform Construction Code (UCC), a comprehensive building code that establishes minimum regulations for most new construction, including additions and renovations to existing structures. All municipalities in Columbia County are required to adhere to the UCC. On December 10, 2009 the Commonwealth adopted regulations of the 2009 International Code Council's codes. The effective date of the regulations is December 31, 2009. Since all municipalities in Columbia County are required to abide by the UCC they also are required to enforce the 2009 building code regulations for all building permits submitted after December 31, 2009. If a design or construction contract for proposed work was signed between December 31, 2006 and December 30, 2009 then the 2006 International Codes must be abided.

Through administration of floodplain ordinances, municipalities can ensure that all new construction or substantial improvements to existing structures located in the floodplain are flood-proofed, dry-proofed, or built above anticipated flood elevations. Floodplain ordinances may also prohibit development in certain areas altogether. The NFIP establishes minimum ordinance requirements which must be met in order for that community to participate in the program. However, a community is permitted and in fact, encouraged, to adopt standards which exceed NFIP requirements. Through participation in the NFIP, all municipalities within the County have floodplain regulations in place. In addition, while not an NFIP community, Bloomsburg University has floodplain regulations it adheres to when planning and siting new University buildings and infrastructure.

SALDOs are intended to regulate the development of housing, commercial, industrial or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Within these ordinances, guidelines on how land will be divided, the placement and size of roads and the location of infrastructure can reduce exposure of development to hazard events. All jurisdictions within Columbia County have adopted and enforce a subdivision and land development ordinance; Berwick Borough, Bloomsburg, Briar Creek Borough, Briar Creek Township, Cleveland Township, Hemlock Township, Jackson Township, Locust Township, Madison Township, Mifflin Township, Montour Township, Scott Township, and South Centre Township have their own municipal SALDO while the other twenty municipalities use the County's SALDO.

Zoning ordinances allow for local communities to regulate the use of land in order to protect the interests and safety of the general public. Zoning ordinances can be designed to address unique conditions or concerns within a given community. They may be used to create buffers between structures and high-risk areas, limit the type or density of development and/or require land development to consider specific hazard vulnerabilities. Twenty-eight municipalities in Columbia County have zoning regulations.

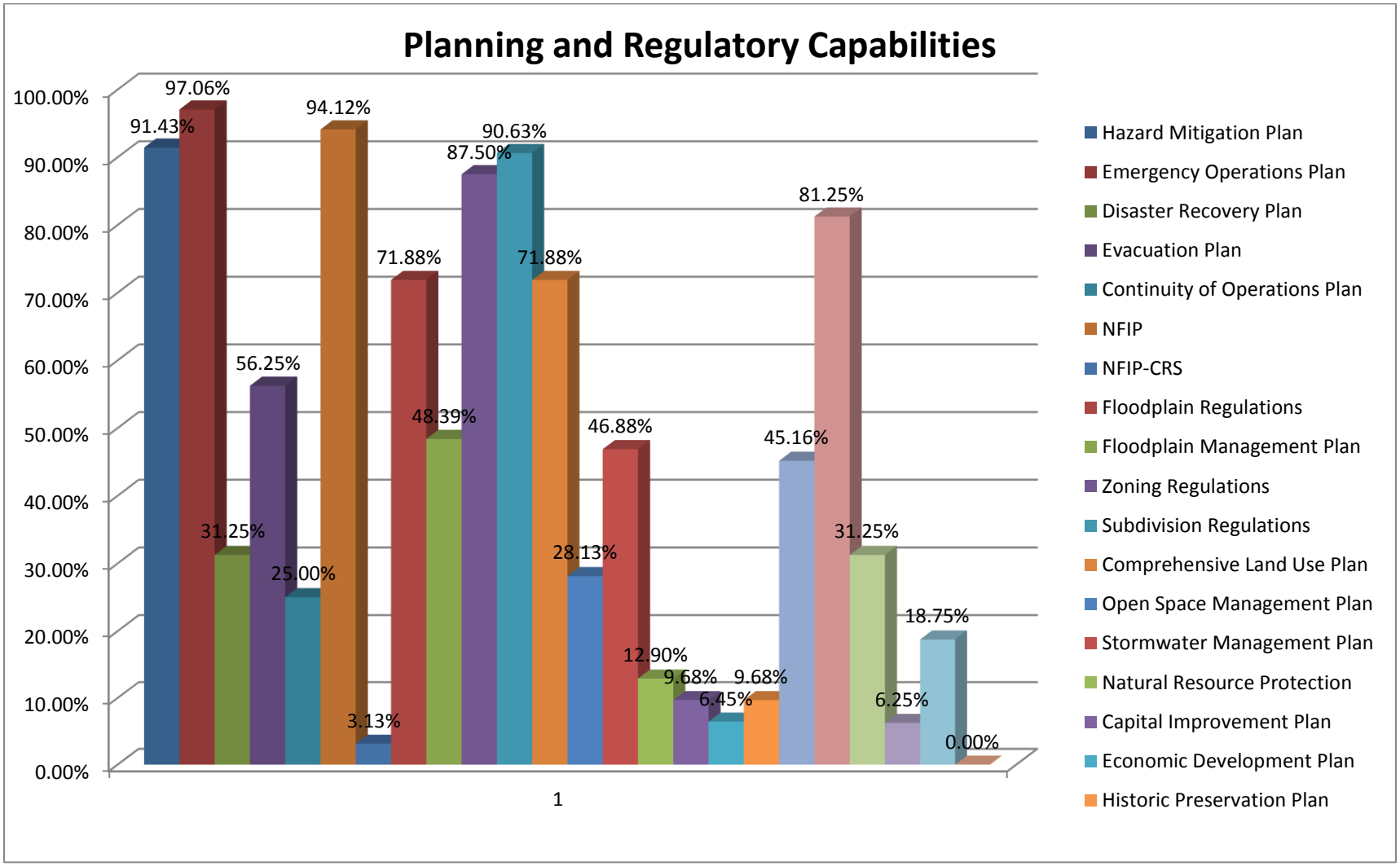
The Pennsylvania legislature enacted the Stormwater Management Act (Act 167 of 1978), commonly called Act 167. The Act enables the regulation of development and activities that cause accelerated runoff and encourages watershed-based planning and management of stormwater. The Department of Environmental Protection is the public agency charged with overseeing implementation of the Act 167 plans. Act 167 Stormwater Management Plans are

intended to improve stormwater management practices, mitigate potential negative impacts from future land uses, and to improve the condition of impaired waterways. Columbia County has one Stormwater Management Plan in Place, the Susquehanna Tributaries Act 167 Plan.

Bloomsburg University also maintains a number of planning and regulatory tools as an institution, including a comprehensive plan and stormwater management regulations.

Figure 5.2.3-1 shows the total percentage of the various categories of Planning & Regulatory Capabilities that are possessed by the municipalities.

Figure 5.2.1-1: Planning & Regulatory Capabilities



5.2.1.1 Participation in the National Flood Insurance Program (NFIP)

All communities in Columbia County participate in the NFIP (see table 5.2.3-1). The program is managed by local municipalities participating in the program through ordinance adoption and floodplain regulation. A table summarizing the NFIP participation and capabilities at the municipal level is located in **Appendix I** with the survey results.

Permitting processes needed for building construction and development in a Special Flood Hazard Area are implemented at the municipal level through local Ordinances (e.g. Zoning, Subdivision and Land Development, and Floodplain Ordinances). However, the County's Subdivision and Land Development Ordinance (SALDO), which is used by twenty municipalities, establishes the floodplain regulations for new developments in accordance with the Pennsylvania Floodplain Management Act also known as Act 166 (P.L. 851, No. 166 32 P.S. §679.101 et seq.).

FEMA Region III makes available to all communities, an Ordinance review checklist which lists the minimum requirements for Floodplain Management Ordinances. This checklist helps communities to develop an effective Floodplain Management Ordinance that meets Federal requirements for participation in the NFIP.

The Pennsylvania Department of Community and Economic Development (DCED), provides communities, based on their CFR, Title 44, Section 60.3 level of regulations, with a model ordinance document to assist them in meeting the minimum requirements established in the NFIP and Act 166. These model ordinances contain provisions that are more restrictive than State and Federal requirements. These provisions include, but are not limited to:

- Prohibiting manufactured homes in the floodway.
- Prohibiting manufactured homes within the area measured 50 feet landward from the top-of bank of any watercourse within a special flood hazard area.
- Special requirements for recreational vehicles within the special flood hazard area. Special requirement for accessory structures.
- Prohibiting new construction and development within the area measured 50 feet landward from the top-of bank of any watercourse within a special flood hazard area.
- Providing the County Conservation District an opportunity to review and comment on all applications and plans for any proposed construction or development in any identified floodplain area.

Columbia County's provisions were updated in 2008 when the County received DFIRMS. As stated in the County SALDO, flood-related subdivision provisions include the following:

- Prohibiting any new construction, development, use, or activity proposed to be within the floodway which is expected to cause an increase in flood heights;
- Requiring all new or substantially improved residential structures proposed in the flood fringe be elevated 18 inches or more above the base flood elevation;
- Requiring all new or substantially improved non-residential structures to be elevated 18 inches or more above the base flood elevation or be flood proofed in accordance with applicable standards;
- Prohibiting the finished elevation of proposed streets from being more than one foot below the base flood elevation;
- Requiring all new or replacement water and sanitary sewer facilities and systems to be located, designed, and constructed to minimize or eliminate flood damages and the

infiltration of flood waters and prevent the discharge of sewage into flood waters;
- Requiring utilities such as gas and electric lines and telephone systems to minimize the chance of impairment during a flood;
- Requiring storm drainage facilities to be designed to provide positive drainage away from buildings and not onto other properties; and
- Prohibiting the alteration or relocation of watercourses without the required permit from DEP and consultation with adjacent communities, DCED, and FEMA.

On a local level, according to DCED, all NFIP communities in Columbia County use ordinances that require 18" of freeboard, restrict the construction of jails, hospitals, and nursing homes in the floodplain, and restrict or prohibit chemical substances considered dangerous to human life.

Act 166 mandates municipal participation in and compliance with the NFIP if SFHA has been mapped. It also establishes higher regulatory standards for new or substantially improved structures which are used for the production or storage of dangerous materials as defined by the Act, by prohibiting them in the floodway. Additionally, the Act establishes the requirement that a Special Permit be obtained prior to any construction or expansion of any manufactured home park, hospital, nursing home, jail and prison if said structure is located within a special flood hazard area.

As new DFIRMS are published, the Pennsylvania State NFIP Coordinator housed at DCED, works with communities to ensure the timely and successful adoption of an updated Floodplain Management Ordinance by reviewing and providing feedback on existing and draft ordinances. In addition, DCED provides guidance and technical support through Community Assistance Contacts and Community Assistance Visits.

Columbia County municipalities are currently using 2008 DFIRMs. These digital maps greatly enhanced mitigation capabilities as they relate to identifying flood hazards and are a significant improvement to the previously effective paper Flood Insurance Rate Maps. Residents and municipal officials receive mapping assistance from the Columbia County Resiliency office, as well as the Columbia County GIS department upon request.

The Town of Bloomsburg is the only community in Columbia County currently participating in the NFIP's Community Rating System (FEMA CIS, 2011). CRS rewards those communities that establish floodplain management programs that go beyond NFIP minimum requirements by providing discounts on flood insurance premiums. Under the CRS, communities receive credit for activities falling into four categories: public information, mapping and regulations, flood damage reduction, and flood preparedness.

The CRS was implemented in 1990 to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. Section 541 of the 1994 Act amends Section 1315 of the 1968 Act to codify the CRS in the NFIP, and expands the CRS goals to specifically include incentives to reduce the risk of flood-related erosion and to encourage measures that protect natural and beneficial floodplain functions. These goals have been incorporated into the CRS, and communities now receive credit toward premium reductions for activities that contribute to them.

There are 10 CRS classes that provide varied reduction in insurance premiums. Class 1 requires the most credit points and gives the largest premium reduction; Class 10 receives no premium reduction. CRS premium discounts on flood insurance range from 5 percent for Class 9 communities up to 45 percent for Class 1 communities. Bloomsburg has been a CRS community since October of 1993; its CRS class is 8, making the community's policyholders eligible for a 10% discount on their NFIP flood insurance premiums.

5.2.2 Administrative and Technical Capability

Administrative capability is described by an adequacy of departmental and personnel resources for the implementation of mitigation-related activities. Technical capability relates to an adequacy of knowledge and technical expertise of local government employees or the ability to contract outside resources for this expertise in order to effectively execute mitigation activities. Common examples of skill sets and technical personnel needed for hazard mitigation include: planners with knowledge of land development/management practices, engineers or professionals trained in construction practices related to buildings and/or infrastructure (e.g. building inspectors), planners or engineers with an understanding of natural and/or human caused hazards, emergency managers, floodplain managers, land surveyors, scientists familiar with hazards in the community, staff with the education or expertise to assess community vulnerability to hazards, personnel skilled in geographic information systems, resource development staff or grant writers, and fiscal staff to handle complex grant application processes.

Based on assessment results, municipalities in Columbia County have low-to-moderate administrative and technical staff needed to conduct hazard mitigation activities. In general, the larger, more populated jurisdictions have the most technical capabilities. There seems to be sufficient emergency management and engineering staff across the County. Only eight of the municipalities have access to personnel for floodplain management, seven for grant writing and nine have access to personnel who might assist with land surveying, seven have GIS capabilities, and four with personnel who could assist with scientific work related to community hazards. See Figure 5.2.4-1 for a chart representing the total percentage of each Administrative & Technical capability that are found within the municipalities.

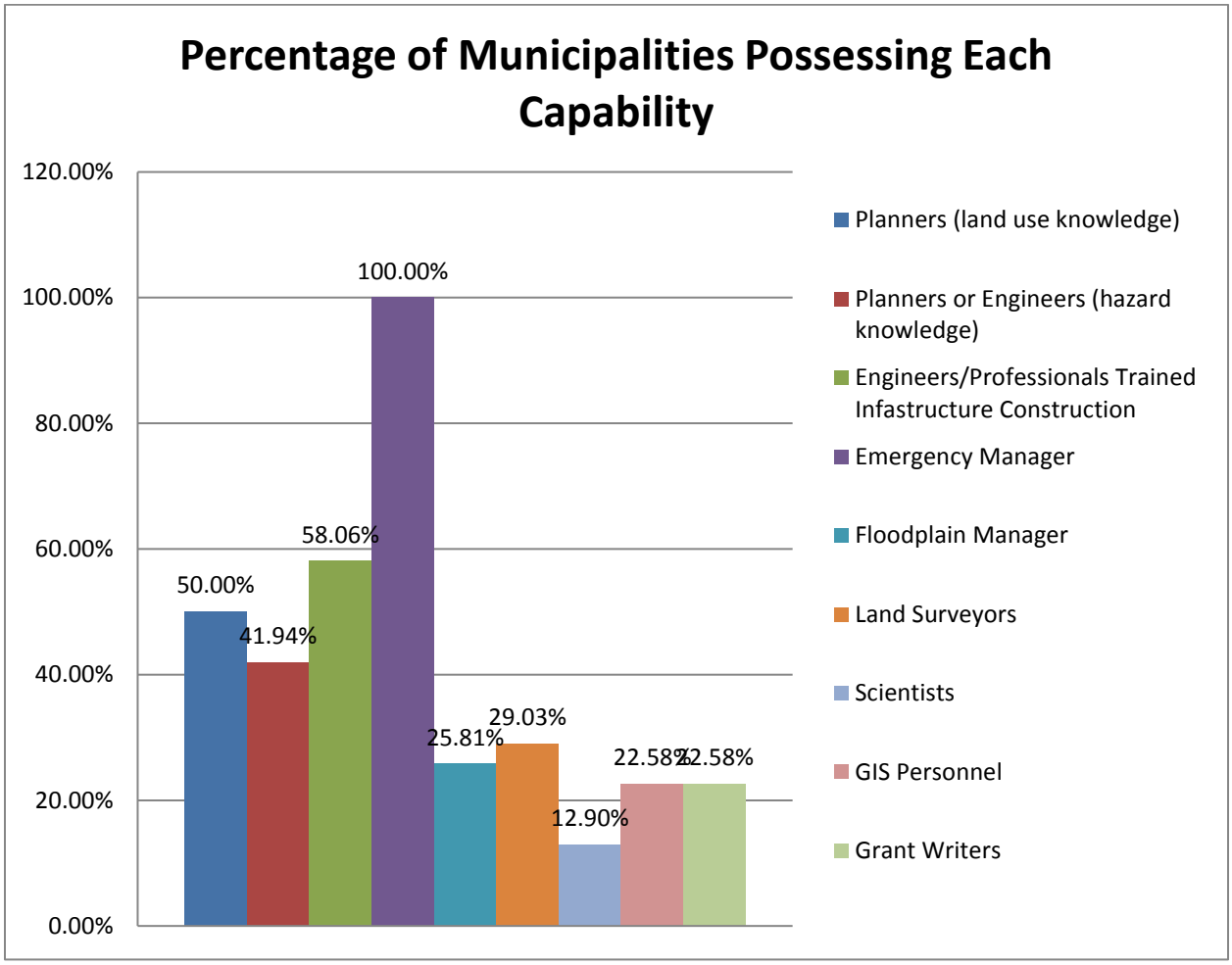
5.2.2.1 Emergency Management

The Columbia County Emergency Management Agency coordinates countywide emergency management efforts. Each municipality has a designated local emergency management coordinator (EMC) who possesses a unique knowledge of the impact hazard events have on their community, though in many instances in Columbia County, each EMC serves multiple communities in a zone. For example, the Roaring Creek Zone EMC covers Locust, Cleveland, Franklin, and Roaring Creek Townships. A significant amount of information used to develop this plan was obtained from these local emergency management coordinators. The Emergency Management Services Code (PA Title 35) requires that all municipalities in the Commonwealth have a Local Emergency Operations Plan (EOP) which is recommended to be updated every two years. According to the Capability Assessment Surveys completed by municipal leaders and information from emergency management personnel, all of the jurisdictions in the County have an EOP; the majority of EOPs date to 2011, but seven jurisdictions have plans dating from 2003. A countywide EOP also exists. Municipalities are not required to sign on to the County EOP, because County staff prefers to keep municipal emergency management coordinators actively engaged at a more local level. Communities in Columbia County also have additional emergency management capabilities. Nineteen jurisdictions have an evacuation plan in place or

under development either as a part of the EOP or as a separate plan. Finally, the Emergency Management Agency provides major training exercises and instructional workshops to emergency personnel in order to ensure that personnel are properly trained.

Bloomsburg University's Office of Public Safety has a number of emergency management capabilities as well. The University completed a Hazard Mitigation Plan, EOP, and evacuation plan. The University also has a Continuity of Operations Plan.

Figure 5.2.2-1: Administrative & Technical Capabilities



The Columbia County Planning Commission and GIS Department provide leading technical assistance roles for municipalities. Other local organizations that could act as partners in mitigating natural and human-made hazards include the Penn State Cooperative Extension, Bloomsburg University staff and students, environmental advocacy groups, and watershed associations. Bloomsburg University has a high level of administrative and technical capability and is a great asset to our community. The University has access to land use planners, hazard planners, engineers, emergency management personnel, scientists, GIS professionals and students, and grant writers.

State 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, and
- Pennsylvania Department of Transportation.

Federal agencies which can provide technical assistance for mitigation activities include, but are not limited to:

- Army Corp of Engineers,
- Department of Housing and Urban Development,
- Department of Agriculture,
- Economic Development Administration,
- Emergency Management Institute,
- Environmental Protection Agency,
- FEMA, and
- Small Business Administration.

5.2.3 Financial Capability

The decision and capacity to implement mitigation-related activities is often strongly dependent on the presence of local financial resources. While some mitigation actions are less costly than others, it is important that money is available locally to implement policies and projects. Financial resources are particularly important if communities are trying to take advantage of state or federal mitigation grant funding opportunities that require local-match contributions. Based on survey results, most municipalities within the County perceive fiscal capability to be extremely limited. Two types of fiscal capabilities are more common in Columbia County. The first is Community Development Block Grant (CDBG) Funding; all jurisdictions in Columbia County have been designated as distressed communities and are thus eligible for CDGB funds. The second is not a funding source but rather partnering agreements between municipalities that enable resource sharing.

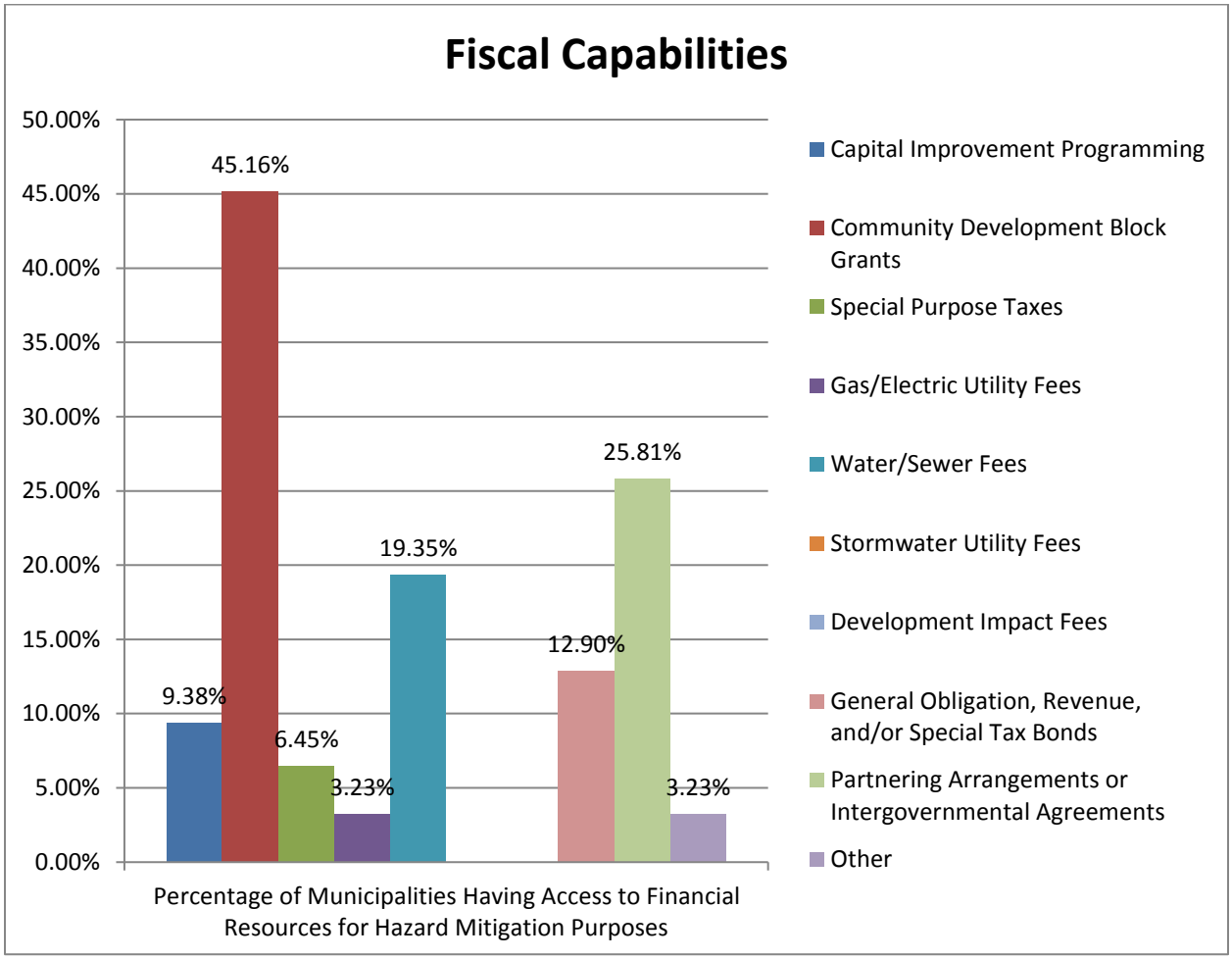
State programs which may provide financial support for mitigation activities include, but are not limited to:

- Community Conservation Partnerships Program,
- Community Revitalization Program,
- Floodplain Land Use Assistance Program,
- Growing Greener Program,
- Keystone Grant Program,
- Local Government Capital Projects Loan Program,
- Land Use Planning and Technical Assistance Program,
- Pennsylvania Heritage Areas Program,
- Pennsylvania Recreational Trails Program,
- Shared Municipal Services, and
- Technical Assistance Program.

Federal programs which may provide financial support for mitigation activities include, but are not limited to:

- Disaster Housing Program,
- Emergency Conservation Program,
- Emergency Management Performance Grants,
- Emergency Watershed Protection Program,
- Hazard Mitigation Grant Program (HMGP),
- Flood Mitigation Assistance Program,
- Non-insured Crop Disaster Assistance Program,
- Pre-Disaster Mitigation Program,
- Section 108 Loan Guarantee Programs,
- Severe Repetitive Loss Grant Program (SRL), and
- Weatherization Assistance Program.

Figure 5.2.3-1: Fiscal Capabilities of Municipalities relating to availability of funds specifically for Hazard Mitigation



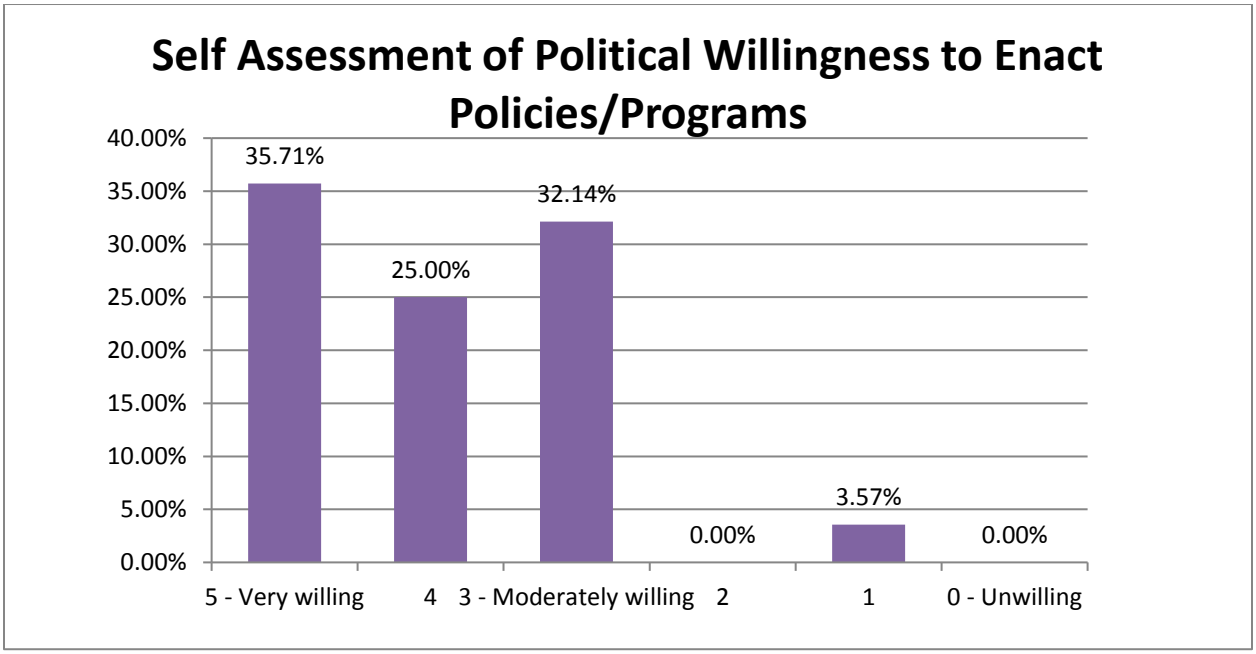
5.2.4 Political Capability

One of the most difficult capabilities to evaluate involves the political will of a jurisdiction to enact meaningful policies and projects designed to mitigate hazard events. The adoption of hazard mitigation measures may be seen as an impediment to growth and economic development. In many cases, mitigation may not generate interest among local officials when compared with competing priorities. Therefore, the local political climate must be considered when designing mitigation strategies, as it could be the most difficult hurdle to overcome in accomplishing the adoption or implementation of specific actions.

The *Capability Assessment Survey* was used to capture information on each jurisdiction's political capability. Survey respondents were asked to identify examples of political capability, such as guiding development away from hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements (i.e. building codes, floodplain management ordinances, etc…). These examples were used to guide respondents in scoring their community on a scale of "unwilling" (0) to "very willing" (5) to adopt policies and programs that

reduce hazard vulnerabilities. As this is a notably sensitive subject for local government employees, not every jurisdiction provided a political capability score. Of the 29 municipalities providing a political capability rating, scores ranged from 1 to 5 with an average score of 3.91. Bloomsburg University ranked its political capability to undertake hazard mitigation activities as a 4.

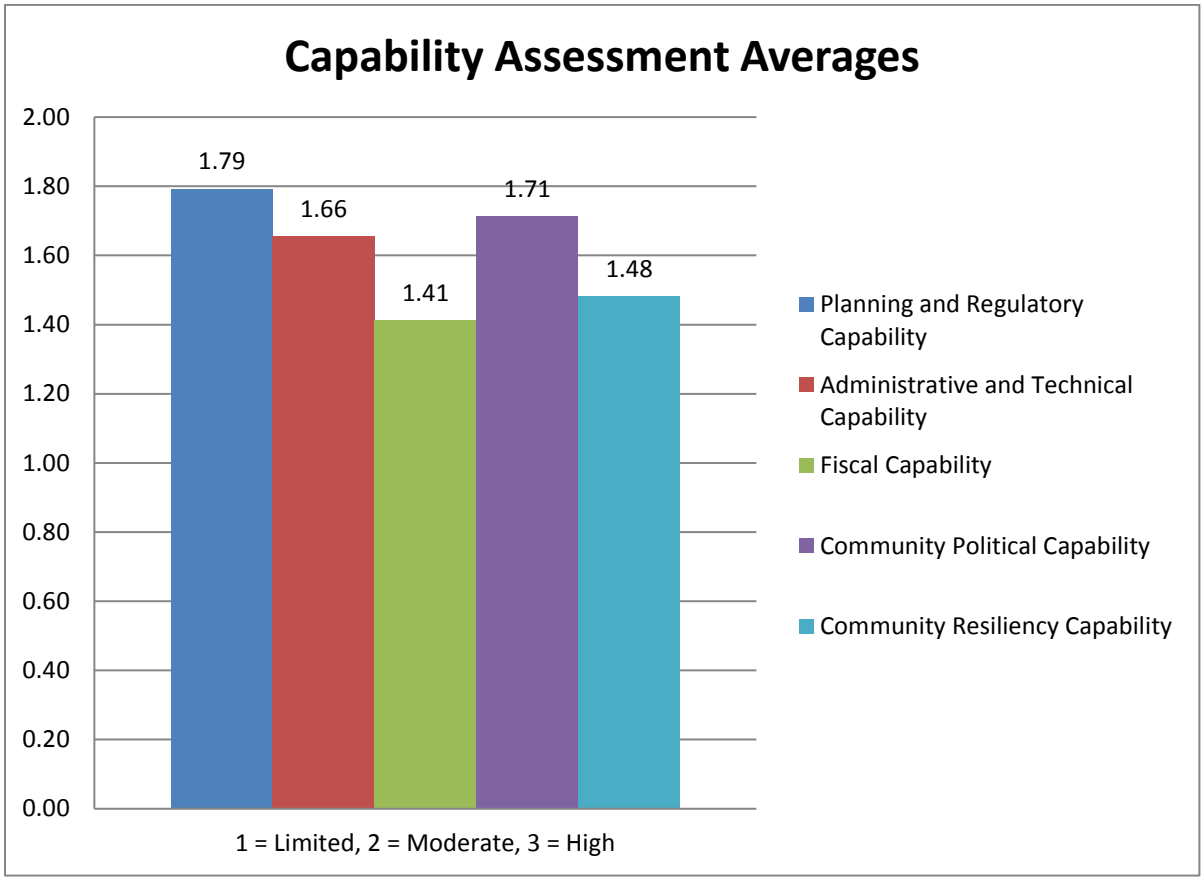
Figure 5.2.4-1: Summary of Self-Assessment Survey Completed by Municipal Officials



5.2.4.1 Self-Assessment

In addition to the inventory and analysis of specific local capabilities, the *Capability Assessment Survey* required each local jurisdiction to conduct its own self-assessment of its capability to effectively implement hazard mitigation activities. As part of this process, county and municipal officials were encouraged to consider the barriers to implementing proposed mitigation strategies in addition to the mechanisms that could enhance or further such strategies. In response to the survey questionnaire, local officials classified each of the capabilities as either “limited,” “moderate” or “high.” Again, because this may be sensitive for local government officials, not every jurisdiction completed the self-assessment. Table 5.2.7-1 summarizes the results of the self-assessment survey as a percentage of the twenty-nine responses received. For example, 62% of communities who responded indicated their community had low fiscal capabilities.

Figure 5.2.4.1-1: Averages of all Capability Assessment Surveys Submitted by Municipal Officials



5.2.5 Plan Integration

There are numerous existing regulatory and planning mechanisms in place at the state, county, and municipal level of government which support hazard mitigation planning efforts. These tools include the Commonwealth of Pennsylvania Standard All-Hazard Mitigation Plan, local floodplain management ordinances, the Columbia County Comprehensive Plan, Columbia County Emergency Operations Plan, Columbia County Hazard Vulnerability Analysis (HVA), Columbia County Comprehensive Recreation, Parks, Greenways, and Open Space Plan, local Emergency Operation Plans, local zoning ordinances, local subdivision and land development ordinances, local comprehensive plans, and the Susquehanna Tributaries Act 167 Plan. These mechanisms were discussed at community meetings and are described in Section 5.2.

Information from several of these documents has been incorporated into this plan and mitigation actions have been developed to further integrate these planning mechanisms into the hazard mitigation planning process. In particular, this plan uses information on identified land use patterns and land development priorities from the Columbia County Comprehensive Plan in order to establish vulnerability pertaining to future development. The Columbia County Comprehensive Recreation, Parks, Greenways, and Open Space Plan provided valuable information relating to the land use and development, particularly of the forested and recreations areas of the county.

The recently updated Columbia County Hazard Vulnerability Analysis provided extensive information on past occurrences, vulnerability, and risk in the last five years, including anecdotal information from the County EMA. Information from the County HVA on populations at risk to certain hazards was used to demonstrate vulnerability to various hazards. The Pennsylvania State Hazard Mitigation Plan was used extensively throughout the update to ensure uniformity with the state plan as well as concurrence with particular hazard information. Bloomsburg University also provided valuable input throughout the process both in the form of Surveys and through the use of their 2016 University Hazard Mitigation Plan.

In addition, data and technical information from the Columbia County GIS Department was incorporated into the plan in the form of a structures dataset, flood plain data, and other GIS datasets including *large and small streams, ponds, municipalities, roads, land use,* and *critical infrastructure* were provided by the Columbia County GIS Director. Floodplain management ordinance information was used to aid in the establishment of local capabilities in addition to the municipal participation in the NFIP.

Based on the comprehensive nature of this plan, the HMSG believes that this document will be highly useful when updating and developing other planning mechanisms in the County. Specific documents that the HMSG will actively incorporate information from the 2017 HMPU into include:

- Columbia County Comprehensive Plan: Section 4.4.4, Future Development and Vulnerability, will provide information for the development of the next County Comprehensive Plan by making available specific risk and vulnerability information for the entire county but more specifically potential areas of growth.
- Columbia County Comprehensive Recreation, Parks, Greenways, and Open Space Plan: The risk assessment in this HMPU will contribute to future selection of locations to preserve as open space.
- Columbia County Emergency Operations Plan: The 2017 HMPU will provide information on risk and vulnerability that will be extremely important to consider and incorporate into the next County EOP. Probability and vulnerability can direct emergency management efforts and response.
- Local Emergency Operations Plans: The 2017 HMPU will provide information on risk and vulnerability that will assist municipalities in developing their EOPs.
- Columbia County Hazard Vulnerability Analysis: The County EMA's HVA and the County HMPU are mutually beneficial plans that are used together to better understand risk and vulnerability. Just as the existing County HVA was used to supplement the development of this plan, the 2017 HMPU will be used to aid in goal and objective development, hazard identification, and risk assessment in the next County HVA. The County HVA was updated as of August 2016, information from both the 2012 Hazard Mitigation Plan and the 2017 Hazard Mitigation Plan were incorporated into the plan.
- Municipality Local Land Use Regulations: The Hazard Mitigation Plan provides an opportunity to contribute to local land use regulations to steer development away from hazard-prone areas.
- Act 167 Storm Water Management Plans: The Susquehanna River Tributaries Act 167 Plan will need to be updated before the next HMP update. The results of the 2017 HMPU vulnerability analysis, particularly for flooding, will be taken into consideration when updating the storm water management plan.

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6. Mitigation Strategy

6.1. Update Process Summary

Mitigation *goals* are general guidelines that explain what the County wants to achieve. Goals are usually expressed as broad policy statements representing desired long-term results. Mitigation *objectives* describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date.

There were 6 goals and 21 objectives identified in the 2012 HMP. On the whole, the 2017 plan goals and objectives were consistent with the existing objectives and goals expressed by the municipal representatives via a survey conducted at Risk Assessment Meeting. Minor changes in wording were incorporated in some objectives; however, they did not significantly alter the original intent of the objective from the 2012 plan.

A summary based on comments received from stakeholders who participated in the HMP update process is included in Table 6.1-1. These reviews are based on a survey on existing goals and objectives, completed by the HMSG. Municipal officials then provided feedback on the changes to the goals and objectives via the Goals and Objectives Evaluation Form distributed at the Risk Assessment Meeting. Copies of these evaluations are located in **Appendix C**.

Table 6.1-1: List of 2012 Mitigation Strategy Goals and Objectives. (2016)

Existing Goals and Objectives		Review
GOAL 1	Reduce vulnerability, including loss of life and damage to property, to natural and human-made hazards.	Review: This goal will remain as goal 1 in 2017 Mitigation Strategy
Objective 1A	Ensure that existing drainage systems (pipes, culverts, channels) are adequate and functioning properly to reduce impacts related to flash flooding and storm water problems.	This objective remains relevant and will be kept as objective 1A in the 2017 plan.
Objective 1B	Minimize future damage due to flooding of the Susquehanna River and its tributaries.	This objective remains relevant and will be kept as objective 1B in the 2017 plan.
Objective 1C	Reduce impacts related to winter storms, tornadoes, windstorms, drought, flash flooding and storm water problems.	This objective remains relevant and will be kept as objective 1C in the 2017 plan.
Objective 1D	Ensure that local building codes/ordinances are consistent with FEMA and PA DCED guidelines and are properly enforced.	This objective remains relevant and will be kept as objective 1D in the 2017 plan.
GOAL 2	Promote disaster-resistant future development.	Review: This goal will remain as goal 2 in the 2017 Mitigation Strategy
Objective 2A	Minimize future damage due to flooding of the Susquehanna River and its tributaries by promoting resistant construction, retrofitting techniques and in the rural areas by erosion/ sedimentation control practices.	This objective remains relevant and will be kept as objective 2A in the 2017 plan.
Objective 2B	Regulate construction/ development in the County to prevent increases in runoff and subsequent increases in flood flows.	This objective remains relevant and will be kept as objective 2B in the 2017 plan.

Objective 2C	Ensure that new construction is resistant to natural hazards.	This objective remains relevant and will be kept as objective 2C in the 2017 plan.
GOAL 3	Improve emergency warning and response capabilities and procedures to better protect the citizens of Columbia County.	Review: This goal will remain as goal 3 in the 2017 Mitigation Strategy
Objective 3A	Provide residents with adequate warning of potential floods and other meteorological events.	This objective remains relevant and will be kept as objective 3A in the 2017 plan.
Objective 3B	Ensure that emergency response services and critical facilities functions are not interrupted by hazards.	This objective remains relevant and will be kept as objective 3B in the 2017 plan.
Objective 3C	Provide adequate, safe, and efficient evacuation routes and shelters during hazard events.	This objective remains relevant and will be kept as objective 3C in the 2017 plan.
Objective 3D	Provide adequate communication systems for emergency management agencies and emergency response units	Objective 3D will be updated to reflect the commitment to ensure communication systems are adequate for emergency response units and emergency management agencies.
Objective 3E	Ensure that local officials are well trained regarding natural hazard and appropriate prevention and mitigation activities and improve communications between the public and emergency management services.	This objective remains relevant and will be kept as objective 3E in the 2017 plan.
GOAL 4	Protect existing natural resources and preserve environmentally sensitive areas where hazard potential is high.	Review: This goal will remain as goal 4 in the 2017 Mitigation Strategy
Objective 4A	Protect existing natural resources and open space, including parks and wetlands, within the floodplains.	This objective remains relevant and will be kept as objective 4A in the 2017 plan.
Objective 4B	Restore degraded natural resources and open space to improve their flood control function.	This objective remains relevant and will be kept as objective 4B in the 2017 plan.

Objective 4C	Preserve areas where natural hazard potential is high such as steeply sloping areas, sinkhole areas.	This objective remains relevant and will be kept as objective 4C in the 2017 plan.
GOAL 5	Increase Public Awareness regarding natural and human-made hazard risks, preparedness and mitigation.	Review: This goal will remain as goal 5 in the 2017 Mitigation Strategy
Objective 5A	Ensure that all residents and business owners are aware of the potential hazards associated with their environment and the ways they can protect themselves.	This objective remains relevant and will be kept as objective 5A in the 2017 plan.
Objective 5B	Improve the participation rate in federal flood insurance through education	This objective remains relevant and will be kept as objective 5B in the 2017 plan.
Objective 5C	Develop citizen information on natural, technological, and man-made disaster response.	This objective remains relevant and will be kept as objective 5C in the 2017 plan.
GOAL 6	Implement structural projects to reduce the impacts of hazards.	Review: This goal will remain as goal 6 in the 2017 Mitigation Strategy
Objective 6A	Use the Act 167 Storm water Management Plan as a guide to implementing structural solutions to reduce the impact of flooding.	This objective remains relevant and will be kept as objective 6A in the 2017 plan.
Objective 6B	Design and implement appropriate flood control projects.	This objective remains relevant and will be kept as objective 6B in the 2017 plan.
Objective 6C	Provide information to municipal officials regarding available funding for structural projects.	This objective remains relevant and will be kept as objective 6C in the 2017 plan.

Actions provide more detailed descriptions of specific work tasks to help the County and its municipalities achieve prescribed goals and objectives. There were 72 actions identified in the 2012 Mitigation Strategy. These actions were prioritized using the federal STAPLEE criteria to prioritize mitigation actions as recommended in the FEMA 386 Series and the Commonwealth of Pennsylvania All-Hazard Mitigation Planning Standard Operating Guide.

Of the 72 actions listed in the 2012 HMP, eleven of these actions have been removed, while several more are continual actions that reduce risk, vulnerability, and losses. The remaining actions have not had progress. A list of these actions as well as a review and summary of

their progress based on comments from the HMSG is included in Table 6.1-2. Actions were evaluated by the HMSG with the intent of carrying over any actions that have had no progress or were incomplete but still viable as well as continuous actions in the next five years.

Table 6.1-2: List and review summary of 2012 mitigation actions.(2017)

ACTION	REVIEW
ACTION 1: Coordinate with the U.S.G.S., local watershed organizations to increase the number of U.S.G.S. and Integrated Flood Observing and Warning System (IFLOWS) rain and stream gauges in the County as a potential enhancement to the existing Susquehanna River Basin Flood Forecast and Warning System.	**This action will remain as *Action 1* in the 2017 HMPU.**
ACTION 2: Increase the number of NOAA Weather Alert radios in public places across the County (i.e., municipal buildings, public libraries, police stations, fire stations, etc.) above and beyond that which required for the County's proposed participation in the NWS's Storm Ready Program.	**As technology evolves, this action has become somewhat antiquated. We have chosen not to include this action in the 2017 HMPU.**
ACTION 3: Conduct routine inspections, regular maintenance, and annual tests on all emergency communications equipment, public address systems, and alert sirens to ensure unhindered operation during an emergency event.	**This action is continuous and is included in the 2017 HMPU as *Action 2.***
ACTION 4: Ensure that a planned, coordinated, technologically advanced, and effective public warning dissemination program exists at the local level.	**This action is continuous and is included in the 2017 HMPU as *Action 3.***
ACTION 5: Maintain response actions to hazards that are consistent with the County-level EOP.	**This action is continuous and is included in the 2017 HMPU as *Action 4.***
ACTION 6: Conduct hazard response practice drills and emergency management training exercises on an annual basis.	**This action is continuous and is included in the 2017 HMPU as *Action 5.***

ACTION 7: Increase the protection of critical facilities, such as elevation of critical mechanisms within the facility (i.e.: pump and controls at wastewater treatment plants).	**This action remains relevant and will be included as *Action 6* in the 2017 HMPU.**
ACTION 8: Implement the recommendations of the Bloomsburg Municipal Sewer Authority's ongoing program of flood proofing and elevation and support its requests under the Wyoming Valley Levee Raising Project.	**This action was removed because the Wyoming Valley Levee Raising project has been discontinued.**
ACTION 9: Develop and distribute a public informational pamphlet related to the potential health and safety implications of various natural hazard events, including information on how to properly secure objects within the home or workplace in the event of an earthquake or other seismic event.	**This action remains relevant and was updated to include electronic information distribution. It is included in the 2017 HMPU as *Action 7.***
ACTION 10: Develop a technical proficiency at the municipal level for conducting post-disaster damage assessments and regulating reconstruction activities to ensure compliance with NFIP substantial damage/substantial improvement requirements and the UCC.	**This action is continuous and is included in the 2017 HMPU as *Action 8.***
ACTION 11: Develop a technical proficiency at the municipal level for assisting local residents and business owners in applying for hazard mitigation and assistance funds and identifying cost beneficial hazard mitigation measures to be incorporated into reconstruction activities.	**This action is continuous and is included in the 2017 HMPU as *Action 9.***
ACTION 12: Improve communications between the public and emergency management services through newsletters and online information.	**This action is continuous and is included in the 2017 HMPU as *Action 10.***
ACTION 13: Establish a partnering relationship with the NWS Mid-Atlantic River Forecast Center to enhance the existing Susquehanna River Basin Flood Forecast and Warning System via the Advanced Hydrologic Prediction Services Program.	**This action is continuous and is included in the 2017 HMPU as *Action 11.***

ACTION 14: Conduct a detailed inventory and prioritization of local environmental resources via the Comprehensive Planning or similar natural resources planning process to identify where resource conservation could help with hazard reduction.	**This action is continuous and is included in the 2017 HMPU as *Action 12.***
ACTION 15: Preserve the highest priority undeveloped floodplain and wetland areas via fee simple acquisition and/or permanent easement and retain as public open space for passive recreational uses in an effort to minimize/prevent potential flooding damages and enhance the regional environment. Less critical floodplain and wetland areas may be preserved/protected via local ordinance.	**This action is continuous and is included in the 2017 HMPU as *Action 13.***
ACTION 16: Develop and implement a wetland protection program consisting of public education materials that highlight the functions and values of wetlands and local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.	**This action is continuous and is included in the 2017 HMPU as *Action 14.***
ACTION 17: Update and implement a comprehensive water resources management plan that analyzes the County's existing water resources supply and evaluates the County's anticipated water use in an effort to identify suspected water supply shortages and potential new water supply sources.	**This action is continuous and is included in the 2017 HMPU as *Action 15.***
ACTION 18: Provide the public and municipal officials with easy accessibility for community DFIRM data and associated Flood Insurance Study, including providing the data and documents at the courthouse and/or conservation district offices along with resources on how to read a flood map, definitions of flood zones, facts about the NFIP, and information on how to purchase flood insurance.	**This action is continuous and is included in the 2017 HMPU as *Action 16.***

ACTION 19: Store in an easily accessible location (e.g., at public libraries) and make available for public inspection, this hazard mitigation plan, the FEMA guidance documents that were provided as part of the hazard mitigation planning program, any risk assessment publications, and links to agencies or references that are helpful in completing projects.	**This action is continuous and is included in the 2017 HMPU as *Action 17.***
ACTION 20: Develop and distribute a public summary of this hazard mitigation plan including relevant information on hazard specific "do's" and "don'ts", hazard-prone areas, and emergency contact information.	**This action remains relevant and is included in the 2017 HMPU as *Action 18.***
ACTION 21: Develop and implement a post-disaster recovery and mitigation training program for local officials.	**This action remains relevant and is included in the 2017 HMPU as *Action 19.***
ACTION 22: Create a website links/references section on the Columbia County and/or CCEMA website homepage to include links to FEMA - http://www.fema.gov/, PEMA - http://www.pema.state.pa.us/, PA DCED - http://www.newpa.com/, and NWS - http://www.nws.noaa.gov/. Additional links could also include those for watershed associations, the SRBC- http://www.srbc.net/	**This action remains relevant and is included in the 2017 HMPU as *Action 20.***
ACTION 23: Coordinate with FEMA, PEMA, PA DCED, NWS, the CCCD and any other appropriate entities on developing and implementing a natural hazard awareness curriculum in local schools.	**This action remains relevant and is included in the 2017 HMPU as *Action 21.***
ACTION 24: Develop a new or revise existing Zoning Ordinances to include appropriate development criteria for known hazard areas.	**This action remains relevant and is included in the 2017 HMPU as *Action 22.***
ACTION 25: Develop and make available for municipal use, digital hazard mapping files that will be developed based on the assessment of vulnerability identified in this mitigation plan.	**This action remains relevant and is included in the 2017 HMPU as *Action 23.***

ACTION 26: Develop new Subdivision and Land Development Ordinances or revise existing Subdivision and Land Development Ordinances to include municipality-specific, hazard mitigation-related development criteria and/or provisions for the mandatory use of conservation subdivision design principles in order to regulate the location and construction of buildings and other infrastructure in known hazard areas.	**This action remains relevant and is included in the 2017 HMPU as *Action 24.***
ACTION 27: Ensure municipal compliance with NFIP and PA Act 166 floodplain development regulations and/or encourage more restrictive requirements, as appropriate by conducting training and inspection workshops.	**This action remains relevant and is included in the 2017 HMPU as *Action 25.***
ACTION 28: Ensure municipal compliance with local watershed-specific Act 167 Stormwater Management Plan 2001 and Ordinances	**This action remains relevant and is included in the 2017 HMPU as *Action 26.***
ACTION 29: Implement a flood damage reduction/prevention public education program consisting of the development and distribution of an informative brochure and training for local officials on NWS "Storm Ready", FEMA NFIP Programs.	**This action is continuous and is included in the 2017 HMPU as *Action 27.* It has been updated to include website and social media information.**
ACTION 30: Enroll in the National Weather Service Storm Ready Program.	**This action was updated to read "continue participation" in place of "enroll in" and was included as *Action 28* in the 2017 HMPU.**
ACTION 31: Minimize future damage due to flooding of the Susquehanna River and its tributaries by working towards construction of a floodwall in the Bloomsburg/Hemlock Township area bordered by the Susquehanna River and Fishing Creek. Ensure the impacts of the floodwall on tributaries are fully understood.	**The construction of the flood wall in Bloomsburg/Hemlock township has been abandoned after numerous studies and attempts have found this not feasible. This action was updated to read "construction of a floodwall continuation in the area by the Bloomsburg School District High School" in order to leverage the advantage of the newly constructed floodwall around the Autoneum and Windsor facilities. It was included in the plan as *Action 29.***

ACTION 32: Evaluate Public Information and Education to ensure appropriate public response to natural hazards, their potential impacts and appropriate actions that should be taken by the public to reduce damages.	**This action remains relevant and is included in the 2017 HMPU as *Action 30.***
ACTION 33: Develop a completely new or amend the existing 1993 Comprehensive Plan to include an assessment and associated mapping of the municipality's vulnerability's vulnerability to location specific hazards and appropriate recommendations for the use of these hazard areas.	**This action remains relevant and is included in the 2017 HMPU as *Action 31.***
ACTION 34: Encourage local business and industry owners and residents to develop an emergency response plan as a potential alternative to implementing a physical property protection measure which may not be technically or fiscally appropriate. This should address real estate full disclosure requirements and training workshops/materials for these groups.	**This action remains relevant and is included in the 2017 HMPU as *Action 32.***
ACTION 35: Coordinate with PEMA, FEMA, and DCED to ensure that property owners and potential property owners are aware of the availability and benefits of obtaining federal flood insurance and encourage uninsured property owners to purchase insurance	**This action was update to include language about the Biggert-Watters legislation, and the FEMA sponsored updated flood mapping for the Susquehanna River Basin. It was included as *Action 33.***
ACTION 36: When funding becomes available, perform acquisitions, foundation stabilizations, demolitions, retrofitting, relocations, elevations, and dry and wet flood proofing on hazard-prone homes and commercial structures as appropriate.	**This action remains relevant and is included in the 2017 HMPU as *Action 34.***
ACTION 37: Coordinate with the local municipality and/or PennDOT on the potential feasibility of replacing, removing, or enlarging those bridge and culvert stream crossings that were identified during the Act 167 Storm water Management Planning process as being unable to pass the 10-year frequency flood flow.	**This action remains relevant and is included in the 2017 HMPU as *Action 35.***

ACTION 38: Conduct drainage system maintenance throughout the township to prevent roadway flooding.	**This action remains relevant and is included in the 2017 HMPU as *Action 36.* It has been updated to include ditch lines along with drainage systems.**
ACTION 39: Remove diversion pipeline obstruction on Snyder Run.	**This action was removed because it has been completed.**
ACTION 40: Install storm water plug to stop the flow of flood water and effectively pump water from 11th Street to12th Street and prevent flooding.	**This action has been updated because the storm water plug was already installed. It now reads the action is to install a pump station in conjunction with the already installed plug. It will now be *Action 37.***
ACTION 41: Dig out diversion overflow pathway of Kinney Run to provide a better pathway for water to flow.	**This action remains relevant and is included in the 2017 HMPU as *Action 38.***
ACTION 42: Continue to send out information to all residents of the Town regarding flood potential via the CRS Education newsletter.	**This action remains relevant and is included in the 2017 HMPU as *Action 39.***
ACTION 43: Create and implement an emergency call-down list for critical facilities in the Borough, including schools, municipal buildings, fire, and police stations.	**This action was removed based upon input received from the municipality.**
ACTION 44: Explore landscaping, site management, and erosion and sediment control plans in order to prevent destruction of township roadways due to heavy rain and runoff from steep slopes.	**This action was updated to read "conduct sediment and erosion control and stream restoration throughout the township". It is included in the plan as *Action 43.***
ACTION 45: Acquire repeatedly flooded property on Harrison Road.	**This action was removed based upon feedback received.**
ACTION 46: Conduct routine stream maintenance to keep Fishing Creek free of obstructions to flow to prevent flooding problems.	**This action remains relevant and is included in the 2017 HMPU as *Action 45.***
ACTION 47: Conduct a 5-year engineering plan to reduce roadway damage due to flooding, landslides, run-off, and weather.	**This action remains relevant and is included in the 2017 HMPU as *Action 47.***
ACTION 48: Remove sandbar to alleviate flooding at Robbins Road Bridge.	**This action remains relevant and is included in the 2017 HMPU as *Action 48.***

ACTION 49: Update zoning ordinance to enhance floodplain management section with stricter regulations such as higher freeboard, expanding the restriction on development of certain kinds of structures in the floodplain, and/or requiring elevation certificates for structures in the SFHA.	**This action was removed because it was very similar to another action already in the plan.**
ACTION 50: Conduct outreach to township residents regarding flood hazard mitigation via the Township website.	**This action remains relevant and is included in the 2017 HMPU as *Action 49.***
ACTION 51: Research and develop stormwater management and floodplain ordinances to better protect lives and property from floods based on best practices from Pennsylvania and Nationally.	**This action remains relevant and is included in the 2017 HMPU as *Action 50.***
ACTION 52: Upgrade Radiological Emergency Preparedness activities for the Susquehanna Steam Electric Station to ensure they comply with FEMA's 2011 Radiological Emergency Preparedness Program guidance.	**This action remains relevant and is included in the 2017 HMPU as *Action 51. It was updated to read FEMA's 2016 REP.***
ACTION 53: Provide residents with information on issues and current regulations associated with Marcellus Shale Drilling via municipal websites, pamphlets, and town hall-style meetings.	**This action was removed due to the decline in Marcellus Shale Drilling in the area.**
ACTION 54: Provide better data from tropical spring, summer, and fall rainstorms, landslides, and winter storms, especially local dollar amounts of damage.	**This action remains relevant and is included in the 2017 HMPU as *Action 52.***
ACTION 55: Remove sandbar in Fishing Creek south of the village of Fernville.	**This action was removed from the plan. The possibility has been explored and was determine to be unfeasible.**
ACTION 56: Install surge and lightning protection devices on the University's communications infrastructure.	**This action was completed and was removed.**
ACTION 57: Install public address system in all campus buildings to provide directions to campus population in case of severe weather, hazardous material release, or other hazards.	**This action was completed and was removed.**

ACTION 58: Install new piping and/or road work where needed to increase the capabilities of water drainage from various roadways.	**This action remains relevant and is included in the 2017 HMPU as *Action 55.***
ACTION 59: Include information on disaster or emergency education to residents in the yearly newsletter to residents of the township.	**This action remains relevant and is included in the 2017 HMPU as *Action 56.***
ACTION 60: Promote awareness of designated shelters during radiological emergencies at Susquehanna Steam Electric Station and during severe weather events in semi-annual newsletter.	**This action remains relevant and is included in the 2017 HMPU as *Action 57.***
ACTION 61: Update Borough's 1992 zoning ordinance to discourage development in the areas with identified current hazard risk.	**This action remains relevant and is included in the 2017 HMPU as *Action 58.***
ACTION 62: Elevate creek bed and fill and secure creek bank along Mountain Road and elevate roadway four feet to prevent flood-related issues.	**This action remains relevant and is included in the 2017 HMPU as *Action 60.***
ACTION 63: Conduct outreach to residents of mobile home parks or trailers on how and why to anchor trailers to protect against severe windstorms and flood events.	**This action remains relevant and is included in the 2017 HMPU as *Action 61.***
ACTION 64: Conduct outreach on the benefits of being a CRS community, using Bloomsburg as a success story.	**This action remains relevant and is included in the 2017 HMPU as *Action 62.***
ACTION 65: Install South of Market Street Stormwater Project (a stormwater management program intended to reduce flooding).	**This action was removed due to feedback received from the municipality.**
ACTION 66: Install Kline Road Stormwater Project (a stormwater management program intended to reduce flooding).	**This action was removed due to feedback received from the municipality.**
ACTION 67: Clean up and maintain streams continuously throughout township, if funding is available.	**This action remains relevant and is included in the 2017 HMPU as *Action 64.***
ACTION 68: Develop additional mitigation actions that are specific to each hazard identified in this risk assessment.	**This action remains relevant and is included in the 2017 HMPU as *Action 65.***

ACTION 69: Work to compile a comprehensive list of levees within the County that includes the name and location of the levee, who built the structure, who maintains and operates the levee, and whether it protects against the 1% annual chance flood.	**This action remains relevant and is included in the 2017 HMPU as *Action 66.***
ACTION 70: Foster increased cooperation and communication between Columbia County EMA and the owners of privately held dams that might impact downstream communities through outreach, education, and dam failure scenarios or exercises, as appropriate.	**This action remains relevant and is included in the 2017 HMPU as *Action 67.***
ACTION 71: Create and distribute information on radon exposure and radon mitigation systems to homeowners throughout the County, especially those in zip codes with elevated radon test levels.	**This action remains relevant and is included in the 2017 HMPU as *Action 68.* It was updated to include electronic information.**
ACTION 72: Include information on how to properly secure objects within the home or workplace in the event of an earthquake or other seismic event	**This action remains relevant and is included in the 2017 HMPU as *Action 69.***

6.2. Mitigation Goals and Objectives

Based on results of the goals and objectives evaluation exercise and input from the HMSG, a list of six goals and twenty corresponding objectives was developed. These goals and objectives remain largely the same as the goals and objectives created for the 2012 HMU with only minor changes noted. Table 6.2-1 details the mitigation goals and objectives established for the 2017 HMPU.

Table 6.2-1: List of Mitigation Strategy Goals and Objectives. (2017)

GOAL 1	***Reduce vulnerability, including loss of life and damage to property, to natural and human-made hazards.***
Objective 1A	***Ensure that existing drainage systems (pipes, culverts, channels) are adequate and functioning properly to reduce impacts related to flash flooding and storm water problems.***
Objective 1B	***Minimize future damage due to flooding of the Susquehanna River and its tributaries.***

Objective 1C	***Reduce impacts related to winter storms, tornadoes, windstorms, drought, flash flooding and storm water problems.***
Objective 1D	***Ensure that local building codes/ordinances are consistent with FEMA and PA DCED guidelines and are properly enforced.***
GOAL 2	***Promote disaster-resistant future development.***
Objective 2A	***Minimize future damage due to flooding of the Susquehanna River and its tributaries by promoting resistant construction, retrofitting techniques and in the rural areas by erosion/ sedimentation control practices.***
Objective 2B	***Regulate construction/ development in the County to prevent increases in runoff and subsequent increases in flood flows.***
Objective 2C	***Ensure that new construction is resistant to natural hazards.***
GOAL 3	***Improve emergency warning and response capabilities and procedures to better protect the citizens of Columbia County.***
Objective 3A	***Provide residents with adequate warning of potential floods and other meteorological events.***
Objective 3B	***Ensure that emergency response services and critical facilities functions are not interrupted by hazards.***
Objective 3C	***Provide adequate, safe, and efficient evacuation routes and shelters during hazard events.***
Objective 3D	***Ensure adequate communication systems exist for emergency management agencies and emergency response units.***
Objective 3E	***Ensure that local officials are well trained regarding natural hazard and appropriate prevention and mitigation activities and improve communications between the public and emergency management services.***
GOAL 4	***Protect existing natural resources and preserve environmentally sensitive areas where hazard potential is high.***
Objective 4A	***Protect existing natural resources and open space, including parks and wetlands, within the floodplains.***
Objective 4B	***Restore degraded natural resources and open space to improve their flood control function.***
Objective 4C	***Preserve areas where natural hazard potential is high such as steeply sloping areas, sinkhole areas.***
GOAL 5	***Increase Public Awareness regarding natural and human-made hazard risks, preparedness and mitigation.***
Objective 5A	***Ensure that all residents and business owners are aware of the potential hazards associated with their environment and the ways they can protect themselves.***
Objective 5B	***Improve the participation rate in federal flood insurance through education***

Objective 5C	***Develop citizen information on natural, technological, and man-made disaster response.***
GOAL 6	***Implement structural projects to reduce the impacts of hazards.***
Objective 6A	***Use the Act 167 Storm water Management Plan as a guide to implementing structural solutions to reduce the impact of flooding.***
Objective 6B	***Design and implement appropriate flood control projects.***
Objective 6C	***Provide information to municipal officials regarding available funding for structural projects.***

6.3. Identification and Analysis of Mitigation Techniques

Appendix 7 of the SOG developed by PEMA provides a comprehensive list of hazard mitigation ideas. Columbia County used this guide to identify mitigation techniques and develop mitigation actions. There are six categories of mitigation actions which Columbia County considered in developing its Mitigation Action Plan. Those categories include:

Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning, zoning, building codes, subdivision regulations, hazard specific regulations (such as floodplain regulations), capital improvement programs, and open-space preservation and stormwater regulations.

Property Protection: Actions that involve modifying or removing existing buildings or infrastructure to protect them from a hazard. Examples include the acquisition, elevation and relocation of structures, structural retrofits, flood-proofing, storm shutters, and shatter-resistant glass. Most of these property protection techniques are considered to involve “sticks and bricks;” however, this category also includes insurance.

Public Education and Awareness: Actions to inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include hazard mapping, outreach projects, library materials dissemination, real estate disclosures, the creation of hazard information centers, and school age / adult education programs.

Natural Resource Protection: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, forest and vegetation management, wetlands restoration or preservation, slope stabilization, and historic property and archeological site preservation.

Structural Project Implementation: Mitigation projects intended to lessen the impact of a hazard by using structures to modify the environment. Structures include storm water controls (culverts); dams, dikes, and levees; and safe rooms.

Emergency Services: Actions that typically are not considered mitigation techniques but reduce the impacts of a hazard event on people and property. These actions are often taken

prior to, during, or in response to an emergency or disaster. Examples include warning systems, evacuation planning and management, emergency response training and exercises, and emergency flood protection procedures.

Table 6.3-1 provides a matrix identifying the mitigation techniques used for the moderate and high risk hazards in the County. The specific actions associated with these techniques are included in Table 6.4-1.

Table 6.3-1: Mitigation techniques used for moderate and high risk hazards in Columbia County.(2017)

HAZARD	MITIGATION TECHNIQUE					
	PREVENTION	PROPERTY PROTECTION	PUBLIC EDUCATION AND AWARENESS	NATURAL RESOURCE PROTECTION	STRUCTURAL PROJECT IMPLEMEN-TATION	EMERGENCY SERVICES
Flood, Flash Flood, Ice Jam	X	X	X	X	X	X
Environmental Hazard	X		X	X	X	X
Winter Storm	X		X	X	X	X
Tornado, Windstorm	X	X	X	X	X	X
Nuclear Incidents	X		X		X	X
Dam Failure	X	X	X		X	X
Drought	X		X	X		X
Utility Interruption	X	X	X			X

6.4. Mitigation Action Plan

Following the Risk Assessment stage of the HMP update process, the Risk Assessment Meeting was held on April 5, 2016 to develop a framework for the Mitigation Action Plan (see meeting minutes in Appendix C). Following the goals and objectives review and evaluation during the Mitigation Workshop, the group went over Mitigation Techniques using PEMA's

Mitigation Ideas document. Municipalities were informed that they needed to have at least one hazard-related mitigation action for each municipality. Municipal representatives were given Mitigation Action Forms and were encouraged to complete one for each action they wished to pursue in the 2017 HMPU. Jurisdictions that had hazard mitigation project opportunities in the 2012 plan had the opportunity to evaluate and, if applicable, select to carry over their project into the 2017 Mitigation Strategy.

The Mitigation Action Form was not the only avenue available to municipalities to identify mitigation priorities. In total, all municipalities selected actions by using one of the following methods: submission of a Mitigation Action Form; comment provided on other worksheets completed throughout the process (i.e., the Goal and Objective Evaluation, the Evaluation of Identified Hazards and Risk Form, or Plan Comment Form); or actions located in the 2012 Mitigation Action Plan that the HMSC evaluated and determined to be in progress or incomplete but still viable.

The final list of 78 mitigation actions is made up of actions developed by the HMSG from the 2006 Mitigation Action Plan, actions stemming from the 2006 HMP objectives, actions stemming from comments on the 2012 Mitigation Goals and Objectives and draft plan, and the new actions developed at the Mitigation Action Workshop.

Table 6.4-1 lists all the mitigation actions for the 2017 HMPU. At least one mitigation action was established for each moderate and high-risk hazard in Columbia County, but more than one action is identified for several hazards. Each participating jurisdiction is signed up for at least one action. Each mitigation action is intended to address one or more of the goals and objectives identified in Section 6.2. Actions 25, 33, and 39 will contribute to continued compliance with and participation in the NFIP. Additionally, Actions 22, 24, and 25 will reduce the effects of hazards on new buildings and infrastructure while Actions 6, 29, 34, 47, and 50 will reduce the effects of hazards on existing buildings and infrastructure.

Each of the actions in Table 6.4-1 list the community or communities participating in the action, the action number and description, mitigation technique(s), hazard(s) addressed the lead agency or department, implementation schedule, and potential funding sources. Additional details about each mitigation action can be found on the mitigation action forms in **Appendix C**. Notably, these action forms include estimated project costs (when available), who will administer/implement the action, and the local priority of each action. Please note that emergency services actions have been highlighted green and marked with an asterisk to indicate that while they are important measures designed to reduce losses and suffering, they are not true mitigation actions.

Table 6.4-1: List of 2017 Mitigation Actions

2017 mitigation actions with information including the community or communities affected action category, hazard addressed, action description, lead agency/department, and general implementation schedule. Emergency Services actions have been highlighted in green and marked with an asterisk to distinguish them.

COMMUNITY: Columbia County	**ACTION:** Coordinate with the U.S.G.S., local watershed organizations to increase the number of U.S.G.S. and Integrated Flood Observing and Warning System (IFLOWS) rain and stream gauges in the County, specifically along Fishing Creek, as a potential enhancement to the existing Susquehanna River Basin Flood Forecast and Warning System.
ACTION NO: 1*	
Category:	Prevention; Emergency Services
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County Resiliency
Implementation Schedule:	Within 5 years
Funding Source:	FEMA/HMGP; NWS, Flood Control Protected property fees.

COMMUNITY: Columbia County EMA; Beaver Twp; Benton Borough; Benton Township; Berwick Borough; Bloomsburg; Briar Creek Borough; Briar Creek Township; Catawissa Borough; Catawissa Township; Cleveland Township; Fishing Creek Township; Franklin Township; Hemlock Township; Greenwood Township; Jackson Township; Locust Township; Madison Township; Main Township; Mifflin Township; Millville Borough; Montour Township; Mount Pleasant Township; North Centre Township; Orange Township; Orangeville Borough; Pine Township; Roaring Creek Township; Scott Township; South Centre Township; Sugarloaf Township	**ACTION:** Conduct routine inspections, regular maintenance, and annual tests on all emergency communications equipment, public address systems, and alert sirens to ensure unhindered operation during an emergency event.
ACTION NO: 2*	
Category:	Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous

Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 3***	**ACTION:** Ensure that a planned, coordinated, technologically advanced, and effective public warning dissemination program exists at the local level.
Category:	Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	PEMA
COMMUNITY: Columbia County **ACTION NO: 4***	**ACTION:** Maintain response actions to hazards that are consistent with the County-level EOP.
Category:	Emergency Services
Hazard(s) Addressed:	Drought; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Pandemic; Landslide; Nuclear Incident; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 5***	**ACTION:** Conduct hazard response practice drills and emergency management training exercises on an annual basis.
Category:	Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire

Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Annually
Funding Source:	Staff Time
COMMUNITY: Orangeville Borough, Orange Township, Scott Township, Town of Bloomsburg, Catawissa Borough, BAJSA, Benton Borough	**ACTION:** Increase the protection of critical facilities, such as elevation of critical mechanisms within the facility (i.e.: pump and controls at wastewater treatment plants) or elevation/relocation of the facility as appropriate.
ACTION NO: 6	
Category:	Property Protection
Hazard(s) Addressed:	Utility Interruption
Lead Agency/Department:	Local Municipalities/EMC/Authorities
Implementation Schedule:	As funding becomes available
Funding Source:	FEMA/PDM; FEMA/HMGP; HUD Disaster Recovery Initiative
COMMUNITY: Columbia County	**ACTION:** Create and distribute public informational pamphlets and electronic information related to the potential health and safety implications of various natural hazard events, including information on how to properly secure objects within the home or workplace in the event of an earthquake or other seismic event.
ACTION NO: 7	
Category:	Public Education and Awareness
Hazard(s) Addressed:	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Pandemic; Landslide; Radon Exposure; Tornado, Windstorm; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	USACE, FEMA

COMMUNITY: Columbia County; Beaver Twp; Benton Borough; Benton Township; Berwick Borough; Bloomsburg; Briar Creek Borough; Briar Creek Township; Catawissa Borough; Catawissa Township; Cleveland Township; Fishing Creek Township; Franklin Township; Hemlock Township; Greenwood Township; Jackson Township; Locust Township; Madison Township; Main Township; Mifflin Township; Millville Borough; Montour Township; Mount Pleasant Township; North Centre Township; Orange Township; Orangeville Borough; Pine Township; Roaring Creek Township; Scott Township; South Centre Township; Sugarloaf Township	**ACTION:** Develop a technical proficiency at the municipal level for conducting post-disaster damage assessments and regulating reconstruction activities to ensure compliance with NFIP substantial damage/substantial improvement requirements and the UCC.
ACTION NO: 8*	
Category:	Emergency Services
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Local EMCs
Implementation Schedule:	Within 5 years
Funding Source:	PEMA; DCED

COMMUNITY: Columbia County; Beaver Twp; Benton Borough; Benton Township; Berwick Borough; Bloomsburg; Briar Creek Borough; Briar Creek Township; Catawissa Borough; Catawissa Township; Cleveland Township; Fishing Creek Township; Franklin Township; Hemlock Township; Greenwood Township; Jackson Township; Locust Township; Madison Township; Main Township; Mifflin Township; Millville Borough; Montour Township; Mount Pleasant Township; North Centre Township; Orange Township; Orangeville Borough; Pine Township; Roaring Creek Township; Scott Township; South Centre Township; Sugarloaf Township	**ACTION:** Develop a technical proficiency at the municipal level for assisting local residents and business owners in applying for hazard mitigation and assistance funds and identifying cost beneficial hazard mitigation measures to be incorporated into reconstruction activities.
ACTION NO: 9*	
Category:	Public Education and Awareness; Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Local EMCs with technical assistance provided by Columbia County Resiliency
Implementation Schedule:	Within 5 years
Funding Source:	PEMA; DCED

COMMUNITY: Columbia County **ACTION NO: 10***	**ACTION:** Improve communications between the public and emergency management services through online information.
Category:	Public Education and Awareness; Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 11***	**ACTION:** Maintain a partnering relationship with the NWS Mid-Atlantic River Forecast Center to enhance the existing Susquehanna River Basin Flood Forecast and Warning System via the Advanced Hydrologic Prediction Services Program.
Category:	Emergency Services
Hazard(s) Addressed:	Drought; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 12**	**ACTION:** Conduct a detailed inventory and prioritization of local environmental resources via the Comprehensive Planning or similar natural resources planning process to identify where resource conservation could help with hazard reduction.
Category:	Natural Resource Protection
Hazard(s) Addressed:	Drought; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Tornado, Windstorm; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County Planning Commission, Columbia County Conservation District

Implementation Schedule:	Continuous
Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 13**	**ACTION:** Identify undeveloped floodplain and wetland areas through the enforcement of county or municipal SALDO's, and when available, seek grants to acquire public open space for passive recreational uses in an effort to minimize/prevent potential flooding damages and enhance the regional environment.
Category:	Natural Resource Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County Planning Commission, Columbia County Conservation District
Implementation Schedule:	Continuous
Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 14**	**ACTION:** Develop and implement a wetland protection program, with the aid of PA DEP & DCNR, consisting of public education materials that highlight the functions and values of wetlands and local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.
Category:	Natural Resource Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County Planning Commission, Columbia County Conservation District
Implementation Schedule:	Within 5 years
Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 15**	**ACTION:** Update and implement a comprehensive water resources management plan that analyzes the County's existing water resources supply and evaluates the County's anticipated water use in an effort to identify suspected water supply shortages and potential new water supply sources.

Category:	Natural Resource Protection
Hazard(s) Addressed:	Drought
Lead Agency/Department:	Columbia County Planning Commission, Columbia County Conservation District
Implementation Schedule:	Within 5 years
Funding Source:	Staff Time; USACE Water Resources Development Act Program
COMMUNITY: Columbia County **ACTION NO: 16**	**ACTION:** Provide the public and municipal officials with easy accessibility for community DFIRM data and associated Flood Insurance Study, including providing the data and documents at the courthouse, on the county website, and/or conservation district offices along with resources on how to read a flood map, definitions of flood zones, facts about the NFIP, and information on how to purchase flood insurance.
Category:	Prevention, Property Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County Resiliency Office, Columbia County Planning Commission, Columbia County GIS
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 17**	**ACTION:** Store in an easily accessible location (e.g., at public libraries/website) and make available for public inspection, this hazard mitigation plan, the FEMA guidance documents that were provided as part of the hazard mitigation planning program, any risk assessment publications, and links to agencies or references that are helpful in completing projects.
Category:	Prevention, Public Education and Awareness
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA/Columbia County Planning Commission/Columbia County Resiliency Office
Implementation Schedule:	Within 6 months of formal HMP adoption

Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 18**	**ACTION:** Develop and distribute a public summary of this hazard mitigation plan including relevant information on hazard specific "do's" and "don'ts", hazard-prone areas, and emergency contact information.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Within 1 year of formal HMP adoption
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 19***	**ACTION:** Develop and implement a post-disaster recovery and mitigation training program for local officials.
Category:	Public Education and Awareness, Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 20**	**ACTION:** Maintain a website links/references section on the Columbia County and/or CCEMA website homepage to include links to FEMA - http://www.fema.gov, PEMA - http://www.pema.pa.gov, PA DCED - http://www.newpa.com, and NWS - http://www.weather.gov/. Additional links could also include those for watershed associations, the SRBC- http://www.srbc.net/
Category:	Public Education and Awareness

Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 21**	**ACTION:** Coordinate with FEMA, PEMA, PA DCED, NWS, the CCCD and any other appropriate entities on developing and implementing a natural hazard awareness curriculum in local schools.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time

COMMUNITY: Columbia County; Beaver Twp; Benton Borough; Benton Township; Berwick Borough; Bloomsburg; Briar Creek Borough; Briar Creek Township; Catawissa Borough; Catawissa Township; Cleveland Township; Fishing Creek Township; Franklin Township; Hemlock Township; Greenwood Township; Jackson Township; Locust Township; Madison Township; Main Township; Mifflin Township; Millville Borough; Montour Township; Mount Pleasant Township; North Centre Township; Orange Township; Orangeville Borough; Pine Township; Roaring Creek Township; Scott Township; South Centre Township; Sugarloaf Township	**ACTION:** Develop new or revise existing Zoning Ordinances & Floodplain Regulations to include appropriate development criteria for known hazard areas.
ACTION NO: 22	
Category:	Prevention
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Municipal Government Officials/Zoning Offices
Implementation Schedule:	Within 3 years
Funding Source:	Staff Time; DCED, Potential state or federal grant funding

COMMUNITY: Columbia County **ACTION NO: 23**	**ACTION:** Maintain and make available for municipal use, digital hazard mapping files that will be based on the assessment of vulnerability identified in this mitigation plan.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County GIS Department
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 24**	**ACTION:** Develop new Subdivision and Land Development Ordinances or revise existing Subdivision and Land Development Ordinances to include municipality-specific, hazard mitigation-related development criteria and/or provisions for the mandatory use of conservation subdivision design principles in order to regulate the location and construction of buildings and other infrastructure in known hazard areas.
Category:	Prevention
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County Planning Commission
Implementation Schedule:	Within 5 years
Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 25**	**ACTION:** Encourage municipal compliance with NFIP and PA Act 166 floodplain development regulations and/or encourage more restrictive requirements, as appropriate by conducting training and inspection workshops.
Category:	Prevention
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter

Lead Agency/Department:	Columbia County Resiliency Office; Columbia County Conservation District
Implementation Schedule:	Within 5 years
Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 26**	**ACTION:** Ensure municipal compliance with local watershed-specific Act 167 Storm Water Management Plan 2001 and Ordinances
Category:	Prevention
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County Planning Commission; Columbia County Conservation District
Implementation Schedule:	Continuous
Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 27**	**ACTION:** Maintain a flood damage reduction/prevention public education program utilizing the EMA Website and Social Media/Resiliency website including but not limited to the development of informative training for local officials on NWS "Storm Ready", FEMA, and NFIP Programs.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County EMA and Columbia County Resiliency
Implementation Schedule:	Continuous
Funding Source:	Staff Time; NWS
COMMUNITY: Columbia County **ACTION NO: 28**	**ACTION:** Continue participation in the National Weather Service Storm Ready Program.
Category:	Public Education and Awareness

Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Tornado, Windstorm; Winter Storm
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Bloomsburg **ACTION NO: 29**	**ACTION:** Minimize future damage to community structures due to flooding of the Susquehanna River and its tributaries by working towards design and construction of a floodwall continuation in the area by the Bloomsburg School District High School, which is located near the Susquehanna River in the SFHA.
Category:	Structural Project
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	SEDA-COG
Implementation Schedule:	Within Five Years
Funding Source:	DCED
COMMUNITY: Columbia County **ACTION NO: 30**	**ACTION:** Evaluate Public Information and Education to ensure appropriate public response to natural hazards, their potential impacts and appropriate actions that should be taken by the public to reduce damages.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Drought; Earthquake; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Pandemic; Landslide; Radon Exposure; Tornado, Windstorm; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time

COMMUNITY: Columbia County **ACTION NO: 31**	**ACTION:** Develop a completely new or amend the existing 1995 Comprehensive Plan to include an assessment and associated mapping of the municipality's vulnerability to location specific hazards and appropriate recommendations for the use of these hazard areas.
Category:	Prevention
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County Planning Commission
Implementation Schedule:	Within 5 years
Funding Source:	Staff Time; DCED
COMMUNITY: Columbia County **ACTION NO: 32***	**ACTION:** Encourage local business and industry owners and residents to develop an emergency response plan as a potential alternative to implementing a physical property protection measure which may not be technically or fiscally appropriate. This should address real estate full disclosure requirements and training workshops/materials for these groups.
Category:	Prevention; Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time

COMMUNITY: Columbia County; Beaver Twp; Benton Borough; Benton Township; Berwick Borough; Bloomsburg; Briar Creek Borough; Briar Creek Township; Catawissa Borough; Catawissa Township; Cleveland Township; Fishing Creek Township; Franklin Township; Hemlock Township; Greenwood Township; Jackson Township; Locust Township; Madison Township; Main Township; Mifflin Township; Millville Borough; Montour Township; Mount Pleasant Township; North Centre Township; Orange Township; Orangeville Borough; Pine Township; Roaring Creek Township; Scott Township; South Centre Township; Sugarloaf Township	**ACTION:** Coordinate with PEMA, FEMA, and DCED to ensure that affected community members are aware of the of the Biggert-Waters legislation, the FEMA sponsored updated flood mapping for the Susquehanna River Basin, and the availability and benefits of obtaining federally backed flood insurance. Encourage uninsured affected community members to purchase flood insurance, and to inform community members outside of the SFHA that they are also eligible to purchase flood insurance through the NFIP.
ACTION NO: 33	
Category:	Prevention; Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County Resiliency Office; Township/Borough Leaders
Implementation Schedule:	Continuous
Funding Source:	PEMA; DCED

COMMUNITY: Beaver Twp; Benton Borough; Benton Township; Berwick Borough; Bloomsburg; Briar Creek Borough; Briar Creek Township; Catawissa Borough; Catawissa Township; Cleveland Township; Fishing Creek Township; Franklin Township; Hemlock Township; Greenwood Township; Jackson Township; Locust Township; Madison Township; Main Township; Mifflin Township; Millville Borough; Montour Township; Mount Pleasant Township; North Centre Township; Orange Township; Orangeville Borough; Pine Township; Roaring Creek Township; Scott Township; South Centre Township; Sugarloaf Township	**ACTION:** When funding becomes available, perform acquisitions, foundation stabilizations, demolitions or demolition and rebuilding in accordance with the current adopted community floodplain ordinances, building codes, or minimum NFIP standards, whichever is greater, retrofitting, relocations, elevations, and dry and wet flood proofing on hazard-prone homes and commercial structures as appropriate.
ACTION NO: 34	
Category:	Structural Projects; Property Protection
Hazard(s) Addressed:	Earthquake; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Municipalities
Implementation Schedule:	As funding becomes available
Funding Source:	FEMA/HMGP, PDM, RFC, SRL as appropriate

COMMUNITY: Beaver Twp; Benton Borough; Benton Township; Berwick Borough; Bloomsburg; Briar Creek Borough; Briar Creek Township; Catawissa Borough; Catawissa Township; Cleveland Township; Fishing Creek Township; Franklin Township; Hemlock Township; Greenwood Township; Jackson Township; Locust Township; Madison Township; Main Township; Mifflin Township; Millville Borough; Montour Township; Mount Pleasant Township; North Centre Township; Orange Township; Orangeville Borough; Pine Township; Roaring Creek Township; Scott Township; South Centre Township; Sugarloaf Township	**ACTION:** Coordinate with the local municipality and/or PennDOT on the potential feasibility of replacing, removing, or enlarging those bridge and culvert stream crossings that were identified during the Act 167 Storm water Management Planning process as being unable to pass the 10-year frequency flood flow.
ACTION NO: 35	
Category:	Property Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Columbia County Planning Commission; PennDOT
Implementation Schedule:	As funding becomes available
Funding Source:	PennDOT

COMMUNITY: Beaver Twp, Catawissa Township, Cleveland Township, Fishing Creek Township; Franklin Township, Locust Township, Montour Township, Roaring Creek Township	**ACTION:** Conduct drainage system and ditch line maintenance & upgrades throughout the township to prevent roadway flooding. Ensure existing drainage systems are adequate and functioning properly in order to reduce impacts related to flash flooding and storm water/runoff.
ACTION NO: 36	
Category:	Prevention, Property Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Supervisors, PennDOT
Implementation Schedule:	As funding becomes available
Funding Source:	PA Liquid Fuels Funds
COMMUNITY: Bloomsburg	**ACTION:** Decrease the likelihood of flooding from storm water by installing a pump station, in conjunction with a recently installed storm water plug, to effectively move water from 11th Street to 12th Street during flood events to minimize the chance of flooding in these areas.
ACTION NO: 37	
Category:	Structural Project
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Town Public Works Department
Implementation Schedule:	As funding becomes available
Funding Source:	DEP; FEMA/HMGP
COMMUNITY: Bloomsburg	**ACTION:** Dig out diversion overflow pathway of Kinney Run to provide a better pathway for water to flow.
ACTION NO: 38	
Category:	Natural Resource Protection

Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Town Public Works Department
Implementation Schedule:	As funding becomes available
Funding Source:	DEP
COMMUNITY: Bloomsburg **ACTION NO: 39**	**ACTION:** Continue to send out information to all residents of the Town regarding flood potential via the CRS Education newsletter and social media.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	CRS Coordinator
Implementation Schedule:	Annually
Funding Source:	Staff Time
COMMUNITY: Catawissa Borough **ACTION NO: 40**	**ACTION:** Heighten public awareness of flooding from the Catawissa Creek and Susquehanna River by publishing and distribution of newsletters and notices in the newspaper.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Catawissa Borough Municipal Staff
Implementation Schedule:	Annually
Funding Source:	Staff Time
COMMUNITY: Catawissa Borough **ACTION NO: 41**	**ACTION:** Minimize effects of utility interruptions by completing tree trimming projects, replacement of damaged utility poles, and installation of underground utility lines.
Category:	Prevention

Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Tornado, Windstorm; Utility Interruption; Winter Storm
Lead Agency/Department:	Catawissa Borough Light Department, PPL
Implementation Schedule:	As funding becomes available
Funding Source:	PEMA
COMMUNITY: Benton Borough, Cleveland Township, Franklin Township, Locust Township, Roaring Creek Township	**ACTION:** Improve emergency management warning and response capabilities and procedures to better protect the public through implementation of an early warning or alert program that utilizes cloud based or other technology based communications to distribute texts, phone calls, email alerts, or social media messages. Development, implementation, and maintenance of emergency evacuation plans and emergency responder training and exercises.
ACTION NO: 42*	
Category:	Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Franklin Township board of Supervisors, Roaring Creek Zone EMA, with assistance from Columbia County EMA
Implementation Schedule:	As funding becomes available
Funding Source:	Municipal Funds, PEMA & FEMA grants
COMMUNITY: Cleveland Township, Franklin Township, Locust Township, Roaring Creek Township	**ACTION:** Conduct sediment, erosion control, and stream restoration throughout the township
ACTION NO: 43	
Category:	Prevention, Property Protection

Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Supervisors
Implementation Schedule:	As funding becomes available
Funding Source:	Municipal funding, Agricultural Department, Department of Forestry
COMMUNITY: Fishing Creek Township **ACTION NO: 44***	**ACTION:** Acquire database (hard copy) of all properties within township flood zone. Present and make available information for public.
Category:	Public Education & Awareness, Emergency Services
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Fishing Creek Township Supervisors, Township Secretary
Implementation Schedule:	Completion within one year
Funding Source:	Township General Fund
COMMUNITY: Millville Borough **ACTION NO: 45**	**ACTION:** Conduct routine stream maintenance to keep Fishing Creek free of obstructions to flow to prevent flooding problems.
Category:	Property Protection, Natural Resource Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Millville Borough Council
Implementation Schedule:	As funds become available
Funding Source:	DCNR; DEP

COMMUNITY: Millville Borough, Pine Township, Greenwood Township, Madison Township **ACTION NO: 46***	**ACTION:** Improve emergency communications during events by building the communications network, specifically purchasing one digital base radio and two digital portable radios
Category:	Emergency Services
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Municipal Officials, Millville Area Zone Emergency Management Agency (MAZEMA)
Implementation Schedule:	As funds become available
Funding Source:	State & Federal Grants
COMMUNITY: Montour Township **ACTION NO: 47**	**ACTION:** Conduct a 5-year engineering plan to reduce roadway damage due to flooding, landslides, run-off, and weather.
Category:	Prevention
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Winter Storms
Lead Agency/Department:	Township Engineer
Implementation Schedule:	5 years
Funding Source:	FEMA/HMGP
COMMUNITY: Mount Pleasant Township **ACTION NO: 48**	**ACTION:** Remove sandbar to alleviate flooding at Robbins Road Bridge.
Category:	Property Protection

Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Supervisors
Implementation Schedule:	As funds become available
Funding Source:	DCNR; DEP
COMMUNITY: Scott Township **ACTION NO: 49**	**ACTION:** Conduct outreach to township residents regarding flood hazard mitigation via the Township website.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Administrative Office
Implementation Schedule:	Continuous
Funding Source:	Staff Time; Township General Fund
COMMUNITY: Scott Township **ACTION NO: 50**	**ACTION:** Research and develop storm water management methods and floodplain ordinances to better protect lives and property from floods based on best practices from Pennsylvania and Nationally.
Category:	Prevention
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Administrative Office
Implementation Schedule:	5 years
Funding Source:	Township General Fund (project funding already set aside)

COMMUNITY: Beaver Township; Berwick Borough; Briar Creek Borough; Briar Creek Township; North Centre Township; South Centre Township; Fishing Creek Township	**ACTION:** Upgrade Radiological Emergency Preparedness activities for the Susquehanna Steam Electric Station to ensure they comply with FEMA's 2016 Radiological Emergency Preparedness Program guidance.
ACTION NO: 51*	
Category:	Prevention; Emergency Services
Hazard(s) Addressed:	Nuclear Incidents
Lead Agency/Department:	Local EMCs
Implementation Schedule:	Continuous (3 times every 2 years)
Funding Source:	Township/Borough General Fund; PEMA
COMMUNITY: Columbia County	**ACTION:** Provide better data from tropical spring, summer, and fall rainstorms, landslides, and winter storms, especially local dollar amounts of damage.
ACTION NO: 52	
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Landslide, Tropical Storm, Nor'easter, Winter Storm
Lead Agency/Department:	Columbia County EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Hemlock Township, Scott Township	**ACTION:** Publish and distribute newsletters and website information to township residents on flood resources. Conduct workshops on managing storm water through use of raingardens and other appropriate means.
ACTION NO: 53	
Category:	Public Education and Awareness

Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Hemlock Township Zoning
Implementation Schedule:	Newsletter – within one year of adoption of HMP Workshops – within two years of adoption of HMP
Funding Source:	Township Staff Time, County Resource Assistance
COMMUNITY: Orangeville Borough **ACTION NO: 54**	**ACTION: I**mplement a comprehensive water resources management plan that analyzes the Borough's existing water resources supply and evaluates the Borough's anticipated water use in an effort to identify suspected water supply shortages and potential new water supply sources, including but not limited to drilling of a secondary well to feed the water supply.
Category:	Natural Resource Protection
Hazard(s) Addressed:	Drought
Lead Agency/Department:	Municipal Sewer/Water Coordinator or Borough Secretary
Implementation Schedule:	Within 5 years
Funding Source:	When funding becomes available
COMMUNITY: Jackson Township **ACTION NO: 55**	**ACTION:** Install new piping and/or road work where needed to increase the capabilities of water drainage from various roadways.
Category:	Property Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Supervisors
Implementation Schedule:	As funding becomes available
Funding Source:	Columbia County Conservation District
COMMUNITY: Jackson Township **ACTION NO: 56**	**ACTION:** Include information on disaster or emergency education to residents in the yearly newsletter to residents of the township.

Category:	Public Education and Awareness
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Township Administrative Office
Implementation Schedule:	1 year
Funding Source:	Township General Fund; Staff Time
COMMUNITY: North Centre Township **ACTION NO: 57***	**ACTION:** Promote awareness of designated shelters during radiological emergencies at Susquehanna Steam Electric Station and during severe weather events in semi-annual newsletter.
Category:	Public Education and Awareness, Emergency Services
Hazard(s) Addressed:	Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Nuclear Incident; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Township EMC
Implementation Schedule:	Twice a year each year
Funding Source:	Township General Fund
COMMUNITY: Briar Creek Borough **ACTION NO: 58**	**ACTION:** Update Borough's 1992 zoning ordinance to discourage development in the areas with identified current hazard risk.
Category:	Prevention
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Briar Creek Solicitor and Code Enforcement Officer
Implementation Schedule:	By 2015

Funding Source:	DCED
COMMUNITY: Catawissa Township **ACTION NO: 59**	**ACTION:** Acquisition of Levan residence on Old Numidia Road which was damaged during the Lee flooding and has yet to be restored
Category:	Property Protection, Structural
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Supervisors
Implementation Schedule:	As funds become available
Funding Source:	State & Federal Grants
COMMUNITY: Catawissa Township **ACTION NO: 60**	**ACTION:** Continue to investigate the possibility of mitigation measures along Mountain Road to prevent further damages to roadway, including elevation of the road surface
Category:	Property Protection, Structural
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Supervisors, Road Crew
Implementation Schedule:	As funds become available
Funding Source:	FEMA/HMGP; DCNR; DEP
COMMUNITY: Berwick Borough, Briar Creek Borough, Orange Township **ACTION NO: 61**	**ACTION:** Conduct outreach to residents of mobile home parks or trailers on how and why to anchor trailers to protect against severe windstorms and flood events.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Tornado, Windstorm
Lead Agency/Department:	Township Supervisors

Implementation Schedule:	Within 5 years
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 62**	**ACTION:** Conduct outreach on the benefits of being a CRS community.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam
Lead Agency/Department:	Columbia County Resiliency
Implementation Schedule:	Within 5 years
Funding Source:	Staff Time
COMMUNITY: Mifflin Township **ACTION NO: 63**	**ACTION:** Perform acquisitions, dry flood proofing, wet flood proofing, purchasing of development rights, zoning, and storm water management to address the flooding along River Road and Tributary 13.
Category:	Structural Projects, Property Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Mifflin Township Supervisors
Implementation Schedule:	As funds become available
Funding Source:	Township Funds, State & Federal Grants
COMMUNITY: Main Township **ACTION NO: 64**	**ACTION:** Clean up and maintain streams continuously throughout township, if funding is available.
Category:	Natural Resource Protection
Hazard(s) Addressed:	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Supervisors

Implementation Schedule:	As funds become available
Funding Source:	DCNR; DEP
COMMUNITY: Columbia County **ACTION NO: 65**	**ACTION:** Develop additional mitigation actions that are specific to each hazard identified in this risk assessment.
Category:	Prevention
Hazard(s) Addressed:	Dam Failure; Drought; Earthquake; Environmental Hazards; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Landslide; Levee Failure; Nuclear Incident; Pandemic; Radon Exposure; Tornado, Windstorm; Utility Interruption; Winter Storm; Wildfire
Lead Agency/Department:	Columbia County Planning Commission; Columbia County EMA
Implementation Schedule:	Within 5 years
Funding Source:	FEMA/HMGP; FEMA/PDM
COMMUNITY: Columbia County **ACTION NO: 66**	**ACTION:** Work to compile a comprehensive list of levees within the County that includes the name and location of the levee, who built the structure, who maintains and operates the levee, and whether it protects against the 1% annual chance flood.
Category:	Prevention; Public Education and Awareness
Hazard(s) Addressed:	Levee Failure
Lead Agency/Department:	Columbia County EMA; Local EMCs
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 67**	**ACTION:** Foster increased cooperation and communication between Columbia County EMA and the owners of privately held dams that might impact downstream communities through outreach, education, and dam failure scenarios or exercises, as appropriate.
Category:	Prevention; Public Education and Awareness
Hazard(s) Addressed:	Dam Failure

Lead Agency/Department:	Columbia County EMA; Local EMCs
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Columbia County **ACTION NO: 68**	**ACTION:** Create and distribute electronic and print information on radon exposure and radon mitigation systems to homeowners throughout the County, especiallythose in zip codes with elevated radon test levels.
Category:	Public Education and Awareness
Hazard(s) Addressed:	Radon Exposure
Lead Agency/Department:	Columbia County EMA; Local EMCs
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Bloomsburg University **ACTION NO: 69**	**ACTION:** Improve Emergency Communications by converting radio system from analog to digital for interoperability.
Category:	Structure and Infrastructure
Hazard(s) Addressed:	Flooding; Civil Disturbance; Environmental Hazards; Hurricane; Tropical Storm; Pandemic; Tornado, Windstorms; Terrorism; Nuclear Incidents; Winter Storm
Lead Agency/Department:	Bloomsburg University Facilities Management Department
Implementation Schedule:	Within 3 years
Funding Source:	University funding; grants
COMMUNITY: Beaver Township **ACTION NO: 70**	**ACTION:** Foster increased cooperation and communication between Beaver Township and the owners of privately held dams thatmight impact downstream communities through outreach, education, and dam failure scenarios or exercises, as appropriate. Encourage dam owners to create an emergency action plan that addresses the hazard.

Category:	Prevention; Public Education and Awareness
Hazard(s) Addressed:	Dam Failure
Lead Agency/Department:	Columbia County EMA; Local EMCs
Implementation Schedule:	Continuous
Funding Source:	Staff Time
COMMUNITY: Orange Township **ACTION NO: 7 1**	**ACTION:** Maintain and improve the levee located along Fishing Creek in Orange Township in order to realize more effective flood protection for surrounding properties
Category:	Structural
Hazard(s) Addressed:	Flooding, Flash Flooding, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Orange Township Maintenance Department
Implementation Schedule:	Ongoing as funding becomes available
Funding Source:	Township General Funds, DCED Grant Funding, PEMA/FEMA Grant Funding
COMMUNITY: Orange Township **ACTION NO: 72**	**ACTION:** Address natural gas compressor station and pipeline construction within the township through education and outreach to residents relating to the impact of natural gas structures on the local community
Category:	Public Education and Awareness
Hazard(s) Addressed:	Environmental Hazards
Lead Agency/Department:	Orange Township Officials and EMA
Implementation Schedule:	Continuous
Funding Source:	Staff Time, Local General Fund
COMMUNITY: Orange Township	**ACTION:** Make improvements and upgrades to the aged infrastructure at the Wood's Edge Sewer treatment plant which was mandated by

ACTION NO: 7 3	the court to be taken over by the township from a private developer and brought into compliance by remediating existing violation issues.
Category:	Natural Resource Protection
Hazard(s) Addressed:	Environmental Hazards; Flooding, Flash Flooding, Ice Jam: Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Orange Township
Implementation Schedule:	Summer of 2017
Funding Source:	PENNVEST, Local General Funds, Sewer bill assessments, DCED grant funding
COMMUNITY: Orange Township **ACTION NO: 7 4**	**ACTION:** Construction of a new pump station to replace the current Mount Pleasant sewer plant in order to facilitate the regionalization of Orange Township and Orangeville Borough Sewer systems. The current Mount Pleasant plant is aged and in need of major repairs and also was impacted by flooding in prior storm events.
Category:	Structural
Hazard(s) Addressed:	Flooding, Flash Flooding, Ice Jam: Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Orange Township
Implementation Schedule:	As funding becomes available
Funding Source:	PENNVEST Local General Fund Monies, Sewer Billing assessments, DCED Grant funding.
COMMUNITY: Benton Borough **ACTION NO: 7 5**	**ACTION:** Implementation of structural projects to reduce the impacts of flooding including the repair of the retaining wall behind the Benton Dam, the refortification of the stream bank and retaining wall with rip rap to prevent further erosion and mitigate hazards to adjacent structures including but not limited to the bridge on SR487 spanning fishing creek, the southern portion of park street, and structures south and west of the retaining wall, elevation of high risk residential structures above flood plain, and repair of concrete pad used by emergency services to access water supply.
Category:	Structural
Hazard(s) Addressed:	Flooding, Flash Flooding, Ice Jam: Hurricane, Tropical Storm, Nor'easter

Lead Agency/Department:	Benton Borough
Implementation Schedule:	Currently underway, to be completed within 3 years of plan adoption
Funding Source:	PENNVEST Local General Fund Monies, Sewer Billing assessments, DCED Grant funding.
COMMUNITY: Roaring Creek Township	**ACTION:** Replace or repair the culverts at the entry way to the Roaring Creek Forest Preserve (95 properties affected) and the High Mountain Acres development (25 properties affected). The culvert at Roaring Creek Forest Preserve is inadequate and flooding events restrict ingress/egress to the properties and residences on site. There is currently no culvert at the High Mountain Acres development. Residents access their properties by driving through stream bed. Flooding events cause ingress/egress issues with this location as well.
ACTION NO: 7 6	
Category:	Structural
Hazard(s) Addressed:	Flooding, Flash Flooding, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Lead Agency/Department:	Township Officials
Implementation Schedule:	As funding becomes available
Funding Source:	State and Federal Grant Funding, Homeowner Association, Soil Conservation Grants
COMMUNITY: Sugarloaf Township	**ACTION:** Create and distribute a newsletter that addresses hazards such as Hazardous Materials releases and Radon and educates the public on evacuation routes and shelter locations and distribute the newsletter to homeowners throughout the township
ACTION NO: 77	
Category:	Public Education and Awareness
Hazard(s) Addressed:	Radon Exposure, Environmental
Lead Agency/Department:	Township Officials
Implementation Schedule:	Continuous
Funding Source:	Staff Time

COMMUNITY: Columbia County	**ACTION:** Investigate potential methods to protect the historical covered bridges through processes such as elevations, relocations, or potential means to restrict or remove debris which may flow down the waterways and cause damage to the bridges.
ACTION NO: 78	
Category:	Prevention, Structural Projects, Property Protection
Hazard(s) Addressed:	Dam Failure; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Levee Failure; Tornado, Windstorm
Lead Agency/Department:	Columbia County Commissioners, Columbia County EMA, Columbia County Resiliency, Columbia County Planning
Implementation Schedule:	5 years
Funding Source:	Staff Time, State & Federal grant funding

Table 6.4-1 lists 78 mitigation actions, many of which will require substantial time commitments from staff at the County and local municipalities. Those that participated in the development of the 2017 HMPU believe that these actions are attainable and can be implemented over the next five-year cycle. While all activities will be pursued over the next five years, the reality of limited time and resources requires the identification of high-priority mitigation actions. Prioritization allows the individuals and organizations involved to focus their energies and ensure progress on mitigation activities.

Mitigation actions were evaluated using the ten criteria suggested in the *FEMA Local Mitigation Planning Handbook*. These feasibility criteria include:

- Life Safety – How effective will the action be at protecting lives and preventing injuries?
- Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?
- Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
- Political – Is there overall public support for the mitigation action? Is there the political will to support it?
- Legal – Does the community have the authority to implement the action?
- Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?
- Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
- Administrative – Does the community have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?

- Local Champion – Is there a strong advocate for the action or project among local departments and agencies that will support the action's implementation?
- Other Community Objectives – Does the action advance other community objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of the comprehensive plan?

This method uses life safety, property protection, technical, political, legal, environmental, social, administrative, local champion, and other community objectives to evaluate which of the identified actions should be considered most critical. Economic considerations are particularly important in weighing the costs versus benefits of implementing one action prior to another. FEMA mitigation planning requirements indicate that any prioritization system used shall include a special emphasis on the extent to which benefits are maximized according to a cost-benefit review of the proposed projects. To do this in an efficient manner that is consistent with FEMA's guidance on using cost-benefit review in mitigation planning, a concept from the PASTEEL method was used to include a higher weighting for two elements of the economic feasibility factor – Benefits of Action and Costs of Action. This method incorporates concepts similar to those described in Method C of FEMA 386-5: Using Benefit Cost Review in Mitigation Planning (FEMA, 2007).

Those participating in the 2017 HMPU process provided comments which allowed for the prioritization of the mitigation actions listed in Table 6.4-1 using the seven PASTEEL criteria. In order to evaluate and prioritize the mitigation actions, favorable and less favorable factors were identified for each action. Table 6.4-2 summarizes the evaluation methodology and provides the results of this evaluation for all mitigation actions. The first results column includes a summary of the feasibility factors, placing equal weight on all factors. The second results column reflects feasibility scores with benefits and costs weighted more heavily; and therefore, given greater priority. A weighting factor of three was used for each benefit and cost element. Therefore, a "+" benefit factor rating equals three pluses and a "-" benefit factor rating equals three minuses in the total prioritization score.

Table 6.4-2: Summary of mitigation action prioritization (2017)

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
1) Coordinate with the U.S.G.S., local watershed organizations to increase the number of U.S.G.S. and Integrated Flood Observing and Warning System (IFLOWS) rain and stream gauges in the County, specifically along Fishing Creek, as a potential enhancement to the existing Susquehanna River Basin Flood Forecast and Warning System.	+	+	+	+	+	+	+	+	+	+	+	-	11+ 1-	13+ 1-
2) Conduct routine inspections, regular maintenance, and annual tests on all emergency communications equipment, public address systems, and alert sirens to ensure unhindered operation during an emergency event.	+	+	+	+	+	N	+	+	+	N	+	+	10+ 0- 2 N	14+ 0- 2 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
3) Ensure that a planned, coordinated, technologically advanced, and effective public warning dissemination program exists.	+	+	+	+	+	N	+	+	+	N	+	+	10+ 0- 2 N	14+ 0- 2 N
4) Maintain response actions to hazards that are consistent with the County-level EOP.	+	+	+	+	+	N	-	+	+	+	+	+	10+ 1- 1 N	14+ 1- 1N
5) Conduct hazard response practice drills and emergency management training exercises on an annual basis	+	+	+	+	+	N	+	+	+	+	+	+	11+ 0- 1 N	15+ 0- 1 N
6) Increase the protection of critical facilities, such as elevation of critical mechanisms within the facility (i.e.: pump and controls at wastewater treatment plants) or elevation/relocation of the facility as appropriate.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral													
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic		FEASIBILITY SCORE	
NAME											**Benefit of Action (x3)**	**Cost of Action (x3)**	**Non-Weighted**	**Weighted Score**
7) Create and distribute public informational pamphlets and electronic information related to the potential health and safety implications of various natural hazard events, including information on how to properly secure objects within the home or workplace in the event of an earthquake or other seismic event.	+	+	+	+	+	N	+	+	N	N	+	+	9+ 0- 3 N	13+ 0- 3N
8) Develop a technical proficiency at the municipal level for conducting post-disaster damage assessments and regulating reconstruction activities to ensure compliance with NFIP substantial damage/substantial improvement requirements and the UCC.	+	+	N	N	+	+	-	-	-	N	+	+	6+ 3- 3 N	10+ 3- 3 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
9) Develop a technical proficiency at the municipal level for assisting local residents and business owners in applying for hazard mitigation and assistance funds and identifying cost beneficial hazard mitigation measures to be incorporated into reconstruction activities.	+	+	N	+	+	+	-	-	+	+	+	+	9+ 2- 1 N	13+ 2- 1 N
10) Improve communications between the public and emergency management services through online information.	+	+	+	+	+	N	+	+	+	+	+	+	11+ 0- 1 N	15+ 0- 1 N
11) Maintain a partnering relationship with the NWS Mid-Atlantic River Forecast Center to enhance the existing Susquehanna River Basin Flood Forecast and Warning System via the Advanced Hydrologic Prediction Services Program.	+	+	+	+	+	+	N	+	+	+	+	+	11+ 0- 1 N	15+ 0- 1 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
12) Conduct a detailed inventory and prioritization of local environmental resources via the Comprehensive Planning or similar natural resources planning process to identify where resource conservation could help with hazard reduction.	+	+	+	+	+	+	N	+	N	N	+	+	9+ 0- 3 N	13+ 0- 3 N
13) Preserve the highest priority undeveloped floodplain and wetland areas through the enforcement of the SALDO and occasionally grants for acquisition and retain as public open space for passive recreational uses in an effort to minimize/prevent potential flooding damages and enhance the regional environment. Less critical floodplain and wetland areas may be preserved/ protected via local ordinance.	+	+	+	+	N	+	-	+	+	+	+	+	10+ 1- 1 N	14+ 1- 1 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
14) Develop and implement a wetland protection program, with the aid of PA DEP & DCNR, consisting of public education materials that highlight the functions and values of wetlands and local ordinance provisions that require the identification of wetlands in accordance with federal and state standards and minimize/eliminate their disturbance in accordance with federal and state laws.	+	+	+	N	N	+	N	+	+	+	+	N	8+ 0- 4 N	10+ 0- 4 N
15) Update and implement a comprehensive water resources management plan that analyzes the County's existing water resources supply and evaluates the County's anticipated water use in an effort to identify suspected water supply shortages and potential new water supply sources.	+	+	N	N	N	+	N	+	+	+	+	N	7+ 0- 5 N	9+ 0- 5 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
16) Provide the public and municipal officials with easy accessibility for community DFIRM data and associated Flood Insurance Study, including providing the data and documents at the courthouse, on the county website, and/or conservation district offices along with resources on how to read a flood map, definitions of flood zones, facts about the NFIP, and information on how to purchase flood insurance.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N
17) Store in an easily accessible location (e.g., at public libraries/website) and make available for public inspection, this hazard mitigation plan, the FEMA guidance documents that were provided as part of the hazard mitigation planning program, any risk assessment publications, and links to agencies or references that are helpful in completing projects.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral												FEASIBILITY SCORE	
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic			
											Benefit of Action (x3)	Cost of Action (x3)	Non-Weighted	Weighted Score
18) Develop and distribute a public summary of this hazard mitigation plan including relevant information on hazard specific "do's" and "don'ts", hazard-prone areas, and emergency contact information.	+	+	+	+	+	+	+	+	+	+	+	+	**12+ 0- 0 N**	**16+ 0- 0 N**
19) Develop and implement a post-disaster recovery and mitigation training program for local officials.	+	+	+	+	+	+	+	+	+	+	+	+	**12+ 0- 0 N**	**16+ 0- 0 N**
20) Maintain a website links/references section on the Columbia County and/or CCEMA website homepage to include links to FEMA - http://www.fema.gov, PEMA - http://www.pema.pa.gov, PA DCED - http://www.newpa.com, and NWS - http://www.weather.gov/. Additional links could also include those for watershed associations, the SRBC- http://www.srbc.net/	+	+	+	+	+	+	+	+	+	+	+	+	**12+ 0- 0 N**	**16+ 0- 0 N**

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
21) Coordinate with FEMA, PEMA, PA DCED, NWS, the CCCD and any other appropriate entities on developing and implementing a natural hazard awareness curriculum in local schools.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N
22) Develop new or revise existing Zoning Ordinances & Floodplain Regulations to include appropriate development criteria for known hazard areas.	+	+	+	+	N	+	-	-	-	+	+	N	7+ 3- 2 N	9+ 3- 2 N
23) Maintain and make available for municipal use, digital hazard mapping files that will be based on the assessment of vulnerability identified in this mitigation plan.	+	+	+	+	+	N	+	+	+	+	+	N	10+ 0- 2 N	12+ 0- 2 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
24) Develop new Subdivision and Land Development Ordinances or revise existing Subdivision and Land Development Ordinances to include municipality-specific, hazard mitigation-related development criteria and/or provisions for the mandatory use of conservation subdivision design principles in order to regulate the location and construction of buildings and other infrastructure in known hazard areas.	+	+	+	N	+	+	N	+	+	+	-	-	8+ 2- 2 N	8+ 6- 2 N
25) Encourage municipal compliance with NFIP and PA Act 166 floodplain development regulations and/or encourage more restrictive requirements, as appropriate by conducting training and inspection workshops.	+	+	+	N	+	+	-	N	N	+	+	+	8+ 1- 3 N	12+ 1- 3 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
26) Ensure municipal compliance with local watershed-specific Act 167 Storm Water Management Plan finalized in 2001 and Ordinances.	+	+	+	N	+	+	N	+	N	+	+	+	9+ 0- 3 N	13+ 0- 3 N
27) Maintain a flood damage reduction/prevention public education program utilizing the EMA Website and Social Media/Resiliency website including but not limited to the development of informative training for local officials on NWS "Storm Ready", FEMA, and NFIP Programs.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N
28) Continue participation in the National Weather Service Storm Ready Program.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
29)Minimize future damage to community structures due to flooding of the Susquehanna River and its tributaries by working towards design and construction of a floodwall continuation in the area by the Bloomsburg School District High School, which is located near the Susquehanna River in the SFHA	+	+	+	+	+	+	-	+	+	+	+	+	**11+ 1- 0 N**	**15+ 1- 0 N**
30) Evaluate Public Information and Education to encourage appropriate public response to natural hazards, their potential impacts and appropriate actions that should be taken by the public to reduce damages.	+	+	+	+	+	+	+	+	+	+	+	+	**12+ 0- 0 N**	**16+ 0- 0 N**

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral										Economic		FEASIBILITY SCORE	
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Benefit of Action (x3)	Cost of Action (x3)	Non-Weighted	Weighted Score
31) Develop a completely new or amend the existing 1995 Comprehensive Plan to include an assessment and associated mapping of the municipality's vulnerability to location specific hazards and appropriate recommendations for the use of these hazard areas.	+	+	+	N	+	+	N	+	N	+	+	+	9+ 0- 3 N	13+ 0- 3 N
32) Encourage local business and industry owners and residents to develop an emergency response plan as a potential alternative to implementing a physical property protection measure which may not be technically or fiscally appropriate. This should address real estate full disclosure requirements and training workshops/materials for these groups.	+	+	+	+	+	+	+	N	N	+	+	+	10+ 0- 2 N	14+ 0- 2 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral													
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic		FEASIBILITY SCORE	
NAME											**Benefit of Action (x3)**	**Cost of Action (x3)**	**Non-Weighted**	**Weighted Score**
33) Coordinate with PEMA, FEMA, and DCED to ensure that affected community members are aware of the of the Biggert-Watters legislation, the FEMA sponsored updated flood mapping for the Susquehanna River Basin, and the availability and benefits of obtaining federally backed flood insurance. Encourage uninsured affected community members to purchase flood insurance, and to inform community members outside of the SFHA that they are also eligible to purchase flood insurance through the NFIP.	+	+	+	+	+	+	N	+	+	+	+	+	11+ 0- 1 N	15+ 0- 1 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
34) When funding becomes available, perform acquisitions, foundation stabilizations, demolitions, retrofitting, relocations, elevations, and dry and wet flood proofing on hazard-prone homes and commercial structures as appropriate.	+	+	+	+	+	+	N	N	N	+	+	+	9+ 0- 3 N	13+ 0- 3 N
35) Coordinate with the local municipality and/or PennDOT on the potential feasibility of replacing, removing, or enlarging those bridge and culvert stream crossings that were identified during the Act 167 Storm water Management Planning process as being unable to pass the 10-year frequency flood flow.	+	+	+	+	+	+	N	+	+	+	+	+	11+ 0- 1 N	15+ 0- 1 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral												
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic		FEASIBILITY SCORE
NAME											**Benefit of Action (x3)**	**Cost of Action (x3)**	**Non-Weighted** / **Weighted Score**
36) Conduct drainage system and ditch line maintenance & upgrades throughout the township to prevent roadway flooding. Ensure existing drainage systems are adequate and functioning properly in order to reduce impacts related to flash flooding and storm water/runoff.	+	+	+	+	+	+	+	N	N	N	+	-	8+ 1- 3 N / 10+ 3- 3N
37)Decrease the likelihood of flooding from storm water by installing a pump station, in conjunction with a recently installed storm water plug, to effectively move water from 11th Street to 12th Street during flood events to minimize the chance of flooding in these areas	+	+	+	+	+	+	N	+	+	+	+	+	11+ 0- 1 N / 15+ 0- 1 N
38) Dig out diversion overflow pathway of Kinney Run to provide a better pathway for water to flow.	+	+	+	+	+	N	N	+	+	+	+	+	10+ 0- 2 N / 14+ 0- 2 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral										Economic		FEASIBILITY SCORE	
NAME	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Benefit of Action (x3)	Cost of Action (x3)	Non-Weighted	Weighted Score
39) Continue to send out information to all residents of the Town regarding flood potential via the CRS Education newsletter and social media.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N
40) Heighten public awareness of flooding from the Catawissa Creek and Susquehanna River by publishing and distribution of newsletters and notices in the newspaper.	+	+	+	+	+	+	+	N	+	+	+	+	11+ 0- 1 N	11+ 0- 1 N
41) Minimize effects of utility interruptions by completing tree trimming projects, replacement of damaged utility poles, and installation of underground utility lines.	+	+	N	+	+	+	+	N	+	+	+	N	9+ 0- 3 N	11+ 0- 3 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
42) Improve emergency management warning and response capabilities and procedures to better protect the public through implementation of an early warning or alert program that utilizes cloud based or other technology based communications to distribute texts, phone calls, email alerts, or social media messages. Development, implementation, and maintenance of emergency evacuation plans and emergency responder training and exercises.	+	+	N	+	+	+	+	N	+	+	+	-	9+ 1- 2 N	11+ 3- 2 N
43) Conduct sediment, erosion control, and stream restoration throughout the township	+	+	+	+	N	-	+	N	+	+	+	-	8+ 2- 2 N	10+ 4- 2 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
44) Acquire database (hard copy) of all properties within township flood zone. Present and make available information for public.	+	+	+	+	+	N	+	+	+	+	+	+	11+ 0- 1 N	15+ 0- 1 N
45) Conduct routine stream maintenance to keep Fishing Creekfree of obstructions to flow to prevent flooding problems.	+	+	+	+	N	-	+	N	+	+	+	-	8+ 2- 2 N	10+ 4- 2 N
46) Improve emergency communications during events by building the communications network, specifically purchasing one digital base radio and two digital portable radios	+	+	+	+	+	N	+	+	+	+	+	-	10+ 1- 1 N	12+ 3- 1N
47) Conduct a 5-year engineering plan to reduce roadway damage due to flooding, landslides, run-off, and weather.	N	+	+	+	+	+	+	+	+	N	+	-	9+ 1- 2 N	11+ 3- 2 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral										Economic		FEASIBILITY SCORE	
NAME	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Benefit of Action (x3)	Cost of Action (x3)	Non-Weighted	Weighted Score
48) Remove sandbar to alleviate flooding at Robbins Road Bridge	+	+	-	+	N	-	N	N	+	N	N	-	4+ 3- 5 N	4+ 5- 5 N
49) Conduct outreach to township residents regarding flood hazard mitigation via the Township website.	+	+	+	+	+	+	N	N	N	+	+	+	9+ 0- 3 N	13+ 0- 3 N
50) Research and develop storm water management methods and floodplain ordinances to better protect lives and property from floods based on best practices from Pennsylvania and Nationally.	+	+	+	N	+	+	+	N	N	+	N	N	7+ 0- 5 N	7+ 0- 5 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
51) Upgrade Radiological Emergency Preparedness activities for the Susquehanna Steam Electric Station to ensure they comply with FEMA's 2016 Radiological Emergency Preparedness Program guidance.	+	N	+	+	+	N	N	+	+	+	+	N	8+ 0- 4 N	10+ 0- 4 N
52) Provide better data from tropical spring, summer, and fall rainstorms, landslides, and winter storms, especially local dollar amounts of damage.	+	+	+	+	+	+	+	+	+	+	+	-	11+ 1- 0 N	13+ 3- 0 N
53) Publish and distribute newsletters and website information to township residents on flood resources. Conduct workshops on managing storm water through use of raingardens and other appropriate means.	+	+	+	+	+	+	+	+	+	+	+	N	11+ 0- 1 N	13+ 0- 1N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
54) Implement a comprehensive water resources management plan that analyzes the Borough's existing water resources supply and evaluates the Borough's anticipated water use in an effort to identify suspected water supply shortages and potential new water supply sources, including but not limited to drilling of a secondary well to feed the water supply.	+	+	+	+	+	N	+	+	+	+	N	N	9+ 0- 3 N	11+ 0- 3 N
55) Install new piping and/or road work where needed to increase the capabilities of water drainage from various roadways.	+	+	+	+	+	N	N	+	+	+	N	-	8+ 1- 3 N	8+ 3- 3N
56) Include information on disaster or emergency education to residents in the yearly newsletter to residents of the township.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	12+ 0- 0 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral													
NAME	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic: Benefit of Action (x3)	Economic: Cost of Action (x3)	FEASIBILITY SCORE: Non-Weighted	FEASIBILITY SCORE: Weighted Score
57) Promote awareness of designated shelters during radiological emergencies at Susquehanna Steam Electric Station and during severe weather events in semi-annual newsletter.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	12+ 0- 0 N
58) Update Borough's 1992 zoning ordinance to discourage development in the areas with identified current hazard risk.	+	+	+	+	+	+	+	+	+	+	N	-	10+ 1- 1 N	10+ 3- 1 N
59) Acquisition of Levan residence on Old Numidia Road which was damaged during the Lee flooding and has yet to be restored	+	+	+	+	+	+	-	N	+	+	N	-	8+ 2- 2 N	8+ 4- 2 N
60) Continue to investigate the possibility of mitigation measures along Mountain Road to prevent further damages to roadway, including elevation of the road surface	N	+	+	+	+	N	N	+	+	N	N	-	6+ 1- 5 N	6+ 3- 5 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral												
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic		FEASIBILITY SCORE
NAME											**Benefit of Action (x3)**	**Cost of Action (x3)**	**Non-Weighted** / **Weighted Score**
61) Conduct outreach to residents of mobile home parks or trailers on how and why to anchor trailers to protect against severe windstorms and flood events.	+	+	+	+	+	+	+	+	+	+	+	+	**12+ 0- 0 N** / **12+ 0- 0 N**
62) Conduct outreach on the benefits of being a CRS community.	+	+	+	N	+	+	N	+	+	+	+	N	**9+ 0- 3 N** / 11+ 0- 3 N
63) Perform acquisitions, dry flood proofing, wet flood proofing, purchasing of development rights, zoning, and storm water management to address the flooding along River Road and Tributary 13.	+	+	+	+	+	+	N	N	+	+	+	N	**9+ 0- 3 N** / 11+ 0- 3 N
64) Clean up and maintain streams continuously throughout township, if funding is available.	+	+	+	+	N	N	N	N	+	+	+	-	**7+ 1- 4 N** / 9+ 3- 4 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
65) Develop additional mitigation actions that are specific to each hazard identified in this risk assessment.	+	+	+	+	+	N	N	+	+	+	+	+	10+ 0- 2 N	14+ 0- 2 N
66) Work to compile a comprehensive list of levees within the County that includes the name and location of the levee, who built the structure, who maintains and operates the levee, and whether it protects against the 1% annual chance flood.	+	+	+	N	+	+	N	+	N	+	+	N	8+ 0- 4 N	10+ 0- 4 N
67) Foster increased cooperation and communication between Columbia County EMA and the owners of privately held dams that might impact downstream communities through outreach, education, and dam failure scenarios or exercises, as appropriate.	+	+	+	N	+	+	N	N	N	+	+	N	7+ 0- 5 N	9+ 0- 5 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
68) Create and distribute electronic and print information on radon exposure and radon mitigation systems to homeowners throughout the County, especially those in zip codes with elevated radon test levels.	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	12+ 0- 0 N
69) Improve Emergency Communications by converting radio system from analog to digital for interoperability.	+	+	+	+	+	N	N	+	+	+	+	-	9+ 1- 2 N	11+ 3- 2 N
70) Foster increased cooperation and communication between Beaver Township and the owners of privately held dams that might impact downstream communities through outreach, education, and dam failure scenarios or exercises, as appropriate. Encourage dam owners to create an emergency action plan that addresses the hazard.	+	+	+	N	+	+	N	N	N	+	+	N	7+ 0- 5 N	9+ 0- 5 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral										Economic		FEASIBILITY SCORE	
NAME	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Benefit of Action (x3)	Cost of Action (x3)	Non-Weighted	Weighted Score
71) Maintain and improve the levee located along Fishing Creek in Orange Township in order to realize more effective flood protection for surrounding properties	+	+	+	+	N	+	N	+	+	N	+	-	8+ 1- 3 N	10+ 3- 3 N
72) Address natural gas compressor station and pipeline construction within the township through education and outreach to residents relating to the impact of natural gas structures on the local community	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N
73) Make improvements and upgrades to the aged infrastructure at the Wood's Edge Sewer treatment plant which was mandated by the court to be taken over by the township from a private developer and brought into compliance by remediating existing violation issues.	+	+	+	+	+	+	+	N	+	+	+	-	8+ 1- 3 N	10+ 3- 3 N

MITIGATION ACTIONS NAME	(+) Favorable (-) Less favorable (N) Not applicable/Neutral Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic Benefit of Action (x3)	Cost of Action (x3)	FEASIBILITY SCORE Non-Weighted	Weighted Score
74) Construction of a new pump station to replace the current Mount Pleasant sewer plant in order to facilitate the regionalization of Orange Township and Orangeville Borough Sewer systems. The current Mount Pleasant plant is aged and in need of major repairs and also was impacted by flooding in prior storm events.	+	+	+	+	+	+	+	N	+	+	+	-	8+ 1- 3 N	10+ 3- 3 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral													
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic		FEASIBILITY SCORE	
NAME											**Benefit of Action (x3)**	**Cost of Action (x3)**	**Non-Weighted**	**Weighted Score**
75) Implementation of structural projects to reduce the impacts of flooding including the repair of the retaining wall behind the Benton Dam, the refortification of the stream bank and retaining wall with rip rap to prevent further erosion and mitigate hazards to adjacent structures including but not limited to the bridge on SR487 spanning Fishing Creek, the southern portion of Park Street, and structures south and west of the retaining wall, elevation of high risk residential structures above flood plain, and repair of concrete pad used by emergency services to access water supply.	+	+	+	+	+	N	+	N	+	+	+	-	9+ 1- 2 N	11+ 3- 2 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral													
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic		FEASIBILITY SCORE	
NAME											**Benefit of Action (x3)**	**Cost of Action (x3)**	**Non-Weighted**	**Weighted Score**
76) Replace or repair the culverts at the entry way to the Roaring Creek Forest Preserve (95 properties affected) and the High Mountain Acres development (25 properties affected). The culvert at Roaring Creek Forest Preserve is inadequate and flooding events restrict ingress/egress to the properties and residences on site. There is currently no culvert at the High Mountain Acres development. Residents access their properties by driving through stream bed. Flooding events cause ingress/egress issues with this location as well.	+	+	+	+	+	N	+	N	+	+	+	N	9+ 0- 3 N	11+ 0- 5 N

MITIGATION ACTIONS	(+) Favorable (-) Less favorable (N) Not applicable/Neutral													
	Life Safety	Property Protection	Technical	Political	Legal	Environmental	Social	Administrative	Local Champion	Other Community Objectives	Economic		FEASIBILITY SCORE	
NAME											**Benefit of Action (x3)**	**Cost of Action (x3)**	**Non-Weighted**	**Weighted Score**
77) Create and distribute a newsletter that addresses hazards such as Hazardous Materials releases and Radon and educates the public on evacuation routes and shelter locations and distribute the newsletter to homeowners throughout the township	+	+	+	+	+	+	+	+	+	+	+	+	12+ 0- 0 N	16+ 0- 0 N
78) Investigate potential methods to protect the historical covered bridges through processes such as elevations, relocations, or potential means to restrict or remove debris which may flow down the waterways and cause damage to the bridges.	N	+	N	+	+	+	+	+	+	+	+	N	9+ 0- 3 N	11+ 0- 5 N

Using cost-benefit weighted prioritization, no actions received more unfavorable ratings than favorable ratings.

7. Plan Maintenance

7.1. Update Process Summary

Monitoring, evaluating and updating this plan, is critical to maintaining its value and success in Columbia County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continued basis.

Past procedure established an annual memorandum summarizing the state of the plan coupled with a Mitigation Committee meeting and a plan update every three years. The EMA was designated as the responsible agency. This procedure also did not require municipalities to provide information to the County on changes in hazard risk or in mitigation projects and priorities.

Instead, the CCEMA was responsible for seeking out this information. This plan maintenance procedure and schedule was not particularly successful, as to the best knowledge of the HMSG, very little plan maintenance was conducted from 2006-2016, including the incorporation of the 2012 HMP into other planning mechanisms in the County. In contrast, the 2017 plan maintenance procedures indicate that the Columbia County Emergency Management Agency is the primary responsible County entity, though work will be conducted in cooperation with the Columbia County Resiliency Office. The 2017 plan maintenance procedures call for an annual review of the plan and a review of the plan within 30 days of disaster to help identify mitigation opportunities.

Additionally, the 2017 HMPU more fully defines the municipalities' role in updating and evaluating the plan. Finally, the 2017 HMPU elaborates upon continued public involvement and how this plan may be integrated into other planning mechanisms in the County.

The HMSG recognizes the importance of monitoring, evaluating, and updating the plan and decided to incorporate both evaluations and evaluations within 30 days of a disaster event, coordinating with each municipality as needed. The proposed maintenance schedule and procedure will be presented at the public meeting to receive concurrence. The 2017 HMPU builds on the spirit of the 2012 plan maintenance procedures and improves maintenance and reporting on hazards, risk, and mitigation progress with the new schedule of reviews and meetings.

7.2. Monitoring, Evaluating and Updating the Plan

The HMSG established for the 2017 HMPU is designated to administer the plan maintenance processes of monitoring, evaluation and updating with support and representation from all participating municipalities. The Columbia County Emergency Management Agency, in coordination and cooperation with the Columbia County Resiliency

Officer, will lead the HMSG in all associated plan maintenance requirements, including annual reviews. The HMSG will coordinate maintenance efforts, but the input needed for effective periodic evaluations will come from community representatives, local emergency management coordinators and planners, the general public and other important stakeholders. The HMSG will oversee the progress made on the implementation of action items identified in the 2017 HMPU and modify actions, as needed, to reflect changing conditions. The HMSG will meet annually on or around the anniversary of plan adoption to discuss specific coordination efforts that may be needed with other stakeholders. Should a significant disaster occur within the County, the HMSG will reconvene within 30 days of the disaster to review and update the HMPU.

Each municipality will designate a community representative to monitor mitigation activities and hazard events within their respective communities. The local emergency management coordinator would be suitable for this role. Each year when the HMSG reconvenes, municipal leaders will be asked to provide a brief write-up that includes any disaster or hazard events that have occurred in their communities, any significant changes in municipal capability, and changes in municipal risk to all hazards in the plan within the previous twelve months, incorporating any appropriate data and information as available. These municipal leaders will also be asked to work with the HMSG to provide updates on applicable mitigation actions and feedback on changing hazard vulnerabilities within their community.

Upon each HMPU evaluation, the HMSG will consider whether applications should be submitted for existing mitigation grant programs. A decision to apply for funding will be based on appropriate eligibility and financial need requirements. The HMSG will also support local and county officials in applying for post-disaster mitigation funds when they are available. All state and federal mitigation funding provided to the County or local municipalities will be reported in subsequent plan updates. In addition, new plans and programs being developed within the County will be evaluated as to the ability and necessity to incorporate the 2017 HMPU into them.

The 2017 HMPU will be updated every five years, as required by the Disaster Mitigation Act of 2000, or following a disaster event. Data collection for the plan update should begin immediately. However, in order to ensure ample time to reconvene the planning team, assess risks, analyze capabilities, and evaluate and make changes to the Mitigation Strategy, the County will begin the update process eighteen months before the plan expires, as recommended in the SOG. This plan update schedule includes the following milestones:

- Sixteen to eighteen months prior to plan expiration: County will reconvene planning team and conducts Kickoff Meeting.
- Fifteen months prior to plan expiration: County will hold Capability Assessment Meeting to assess and evaluate new or changed municipal and county capabilities.
- Nine to thirteen months prior to plan expiration: County will conduct risk assessment meeting to review the 2017 risk and vulnerability and assess changes in risk, hazards, and vulnerability, adding documentation of hazard events and incorporating

appropriate changes into hazard profiles.

- Seven to nine months prior to plan expiration: County will hold mitigation strategy workshop and solicit new or updated mitigation projects and priorities.
- Four months prior to plan expiration: County will present the draft plan to citizens, leaders, and other stakeholders, collecting comments and feedback for incorporation into the draft plan. County will also hold a 30-day comment period during which the plan can be reviewed by the public.
- Three months prior to plan expiration: County will submit draft plan to PEMA and FEMA for review. Following review and revisions, plan will be granted Approval-Pending- Adoption status followed by final approval after municipal adoption.

Future plan updates will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. During the five-year review process, the following criteria will be used to assess the effectiveness the Columbia County HMPU.

- The ability of the identified hazard mitigation planning goals to address current and anticipated future conditions.
- Any known or perceived changes in the County's vulnerability to identified hazards. The current capabilities of the County and its constituent municipalities.
- The successes, failures, and/or lessons learned from implementing the identified hazard mitigation recommendations and actions.
- The need to address additional hazards in the plan and/or the need for other risk-based changes to the plan.
- The ability of current local resources to address identified hazards.

Issues that arise during monitoring and evaluation which require changes to the risk assessment, mitigation strategy and other components of the plan will be incorporated during future updates.

7.3. Continued Public Involvement

As was done during the development of the 2017 HMPU, the HMSG will involve the public during the evaluation and update of the HMPU through various workshops and meetings. The public will have access to an electronic copy of the current HMPU through their local municipal office, Columbia County Emergency Management Agency or the Columbia County Resiliency Office. The Emergency Management Agency and Resiliency Office will also keep a paper copy of the plan should a citizen not have ready electronic access. Information on upcoming events related to the HMPU or solicitation for comments will be announced via newsletters, newspapers, mailings, and on the Columbia County EMA website (ema.columbiapa.org). The HMSG will incorporate all relevant comments during the next update of the HMPU.

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8. Plan Adoption

The Plan will be submitted to the Pennsylvania State Hazard Mitigation Officer on *<Month Day, Year>*.It will be forwarded to FEMA for final review and approval-pending-adoption on *<Month Day, Year>*., or when PEMA approval is given. FEMA granted approval-pending-adoption on *<Month Day, Year>*.. Full approval from FEMA was received on *<Month Day, Year>*.

This section of the plan includes copies of the local adoption resolutions passed by Columbia County and its municipal governments; a completed Local Mitigation Plan Review Crosswalk can be found in **Appendix B**. Adoption resolution templates are provided to assist the County and municipal governments with recommended language for future adoption of the HMP.

Columbia County 2017 Hazard Mitigation Plan

County Adoption Resolution

Resolution No. _____
Columbia County, Pennsylvania

WHEREAS, the municipalities of Columbia 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, Columbia County acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and

WHEREAS, the Columbia County 2017 Hazard Mitigation Plan has been developed by the Columbia County Emergency Management Agency and the Columbia County Resiliency in cooperation with other county departments, local municipal officials, and the citizens of Columbia County, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Columbia County 2017 Hazard Mitigation Plan, and

WHEREAS, the Columbia County 2017 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 Columbia that:

- The Columbia County 2017 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 Columbia County 2017 Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this_____day of_____, 2017

ATTEST:

_____

COLUMBIA COUNTY COMMISSIONERS

By _____

By _____

By _____

Columbia County 2017 Hazard Mitigation Plan

Municipal Adoption Resolution

Resolution No. _____
<*Borough/Township of Municipality Name*>, Columbia County, Pennsylvania

WHEREAS, the <*Borough/Township of Municipality Name*>, Columbia 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 <*Borough/Township of Municipality Name*> acknowledges the requirements of Section 322 of DMA 2000 to have an approved Hazard Mitigation Plan as a prerequisite to receiving post-disaster Hazard Mitigation Grant Program funds, and

WHEREAS, the Columbia County 2017 Hazard Mitigation Plan has been developed by the Columbia County Emergency Management Agency and the Columbia County Resiliency Office in cooperation with other county departments, and officials and citizens of <*Borough/Township of Municipality Name*>, and

WHEREAS, a public involvement process consistent with the requirements of DMA 2000 was conducted to develop the Columbia County 2017 Hazard Mitigation Plan, and

WHEREAS, the Columbia County 2017 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 <*Borough/Township of Municipality Name*>:

- The Columbia County 2017 Hazard Mitigation Plan is hereby adopted as the official Hazard Mitigation Plan of the <*Borough/Township*>, and
- The respective officials and agencies identified in the implementation strategy of the Columbia County 2017 Hazard Mitigation Plan are hereby directed to implement the recommended activities assigned to them.

ADOPTED, this_____day of_____, 2017

ATTEST:

_____

<BOROUGH/TOWNSHIP OF MUNICIPALITY NAME>

By _____

By _____

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9. Appendices

Appendix A - Resources

The following are resources used in the 2017 update:

1) Bold, Thomas. Personal Communication. September 2016.

2) Center for Disease Control and Prevention: Highly Pathogenic Asian Avian Influenza A (H5N1) in People. Retrieved from http://www.cdc.gov/flu/avianflu/h5n1-people.htm

3) Columbia County Comprehensive Recreation, Parks, Greenways and Open Space Plan (2007).

4) FLU.gov: H1N1 – originally referred to as Swin3 Flu. Retrieved from http://www.flu.gov/about_the_flu/h1n1/

5) National Oceanic and Atmospheric Administration: Storm events database. Retrieved from https://www.ncdc.noaa.gov/stormevents/listevents.jsp?eventType=%28C%29+Tornado&beginDate_mm=03&beginDate_dd=01&beginDate_yyyy=1950&endDate_mm=03&endDate_dd=31&endDate_yyyy=2016&county=COLUMBIA%3A37&hailfilter=0.00&tornfilter=0&windfilter=000&sort=DT&submitbutton=Search&statefips=42%2CPENNSYLVANIA

6) Pennsylvania Department of Health: 2015/16 Influenza Season Data. Retrieved from http://www.health.pa.gov/My%20Health/Diseases%20and%20Conditions/I-L/Pages/20152016-Influenza-Season.aspx#.V2vqhfkrLIU

7) Pennsylvania Department of Health: Zika Virus Home Page. Retrieved from http://www.health.pa.gov/My%20Health/Diseases%20and%20Conditions/U-Z/Zikavirus/Pages/ZikaVirusHomePage.aspx#.V2rjU27D99M

8) Rossi, C. E. (2015, May 22). Information Notice No. 90-25: Loss of Vital AC Power with Subsequent Reactor Coolant System Heat-Up. Retrieved from http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1990/in90025.html

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10) United States Department of Agriculture Census of Agriculture: 2012 Census Publications
http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/Pennsylvania/index.asp
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11) United States Department of Health and Human Services: Pandemic Flu History. Retrieved from http://www.flu.gov/pandemic/history/

12) United States Nuclear Regulatory Commission: Emergency Action Level Development. (2015, May 26). Retrieved from http://www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/emerg-action-level-dev.html

13) United States Nuclear Regulatory Commission: Emergency Classification. (2014, September 8). Retrieved from http://www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/emerg-classification.html

14) United States Nuclear Regulatory Commission: Probabilistic Risk Assessment (PRA). (2013, July 17). Retrieved from http://www.nrc.gov/about-nrc/regulatory/risk-informed/pra.html

15) World Health Organization: Zika Virus. Retrieved from http://www.who.int/mediacentre/factsheets/zika/en/

The following resources were used in the previous drafts of the Columbia County Hazard Mitigation Plan:

1) American Meteorological Society. 2009. *Glossary of Meteorology: Waterspout*. Retrieved at: http://amsglossary.allenpress.com/glossary/search?id=waterspout1.

2) Battle, J.H. cn. 1887. *History of Columbia and Montour counties, Pennsylvania.* A. Warner & Co., Chicago, Illinois. Retrieved at: http://www.archive.org/stream/historyofcolumbi01batt#page/n9/mode/2up

3) The Bloomsburg Daily. 2011. "Columbia County Homes Destroyed Down from Over 1,000 to 141." Retrieved at: http://www.thebloomsburgdaily.com/2011/10/03/columbia-county-homes-destroyed-down-from-over-1000-to-141/.

4) Bradford County, PA. 2011. *Natural Gas Information.* Retrieved at: http://www.bradfordcountypa.org/Natural-Gas.asp

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17) Federal Emergency Management Agency (FEMA). 1997. *Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy.* Washington, D.C.

18) Federal Emergency Management Agency Community Information System. (FEMA CIS). February 17, 2011. *Community Rating System Overview Report*.

19) Federal Emergency Management Agency. Region III Levee Inventory. Retrieved at http:// http://www.r3levees.org/.

16) Federal Highway Administration. 2009. "Congestion: A National Issue." Retrieved at: http://www.ops.fhwa.dot.gov/aboutus/opstory.htm.

20) Freeze, John G. (John Gosse). 1883. *A History of Columbia County, Pennsylvania.* Elwell & Bittenbender, Bloomsburg, Pennsylvania. Retrieved at: http://www.archive.org/stream/historyofcolumbi01free#page/n5/mode/2up

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24) Hirst, E. and B. Kirby. 1996. *Ancillary Services*. Oak Ridge, TN: Oak Ridge National Laboratory.

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27) Krajick, Kevin. May 2005. "Fire in the Hole." Smithsonian Magazine.

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