MCM Consulting Group, Inc.

Sullivan County 2019 Hazard Mitigation Plan

Sullivan County Department of Emergency Services

Certification of Annual Review Meetings

YEAR	DATE OF MEETING	PUBLIC OUTREACH ADDRESSED? *	SIGNATURE
2020			
2021			
2022			
2023			
2024			

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

Record of Changes

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

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

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1. Introduction

1.1. Background

The Sullivan County Board of Commissioners, in response to the Disaster Mitigation Act of 2000 (DMA 2000), organized a countywide hazard mitigation planning effort to prepare, adopt and implement a multi-jurisdictional hazard mitigation plan (HMP) for Sullivan County and all of its thirteen municipalities. The Sullivan County Department of Emergency Services was charged by the Sullivan County Board of Commissioners to prepare the 2019 plan. The 2014 HMP has been utilized and maintained during the 5-year life cycle.

The Sullivan County Commissioners were successful in securing hazard mitigation grant funding to update the county hazard mitigation plan. The pre-disaster mitigation grant funding was administered by the Pennsylvania Emergency Management Agency and provided to Sullivan County as a sub-grantee. The Sullivan County Commissioners assigned the Sullivan County Department of Emergency Services with the primary responsibility to update the hazard mitigation plan. MCM Consulting Group, Inc. was selected to complete the update of the HMP. A local hazard mitigation planning team was developed comprised of government leaders and citizens from Sullivan County. This updated HMP will provide another solid foundation for the Sullivan County Hazard Mitigation Program.

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

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

1.2. Purpose

The purpose of this hazard mitigation plan (HMP) 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 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

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

A multi-jurisdictional planning approach was utilized for the Sullivan County HMP update, thereby eliminating the need for each municipality to develop its own approach to hazard mitigation and its own planning document. Further, this type of planning effort results in a common understanding of the hazard vulnerabilities throughout the county, a comprehensive list of mitigation projects, common mitigation goals and objectives and an evaluation of a broad capabilities assessment examining policies and regulations throughout the county and its municipalities.

1.4. Authority and Reference

Authority for this plan originates from the following federal sources:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended
- Code of Federal Regulations (CFR), Title 44, Parts 201 and 206
- Disaster Mitigation Act of 2000, Public Law 106-390, as amended
- National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 *et seq.*

Authority for this plan originates from the following Commonwealth of Pennsylvania sources:

- Pennsylvania Emergency Management Services Code. Title 35, Pa C.S. Section 101

- Pennsylvania Municipalities Planning Code of 1968, Act 247 as reenacted and amended by Act 170 of 1988
- Pennsylvania Storm Water Management Act of October 4, 1978. P.L. 864, No. 167

The following Federal Emergency Management Agency (FEMA) guides and reference documents were used to prepare this document:

- FEMA 386-1: *Getting Started*. September 2002
- FEMA 386-2: Understanding Your Risks: Identifying Hazards and Estimating Losses. August 2001
- FEMA 386-3: Developing the Mitigation Plan. April 2003
- FEMA 386-4: *Bringing the Plan to Life*. August 2003
- FEMA 386-5: Using Benefit-Cost Review in Mitigation Planning. May 2007
- FEMA 386-6: Integrating Historic Property and Cultural Resource Considerations into Hazard Mitigation Planning. May 2005
- FEMA 386-7: Integrating Manmade Hazards into Mitigation Planning. September 2003
- FEMA 386-8: Multijurisdictional Mitigation Planning. August 2006
- FEMA 386-9: Using the Hazard Mitigation Plan to Prepare Successful Mitigation Projects. August 2008
- FEMA Local Multi-Hazard Mitigation Planning Guidance. July 1, 2008
- FEMA National Fire Incident Reporting System 5.0: Complete Reference Guide. January 2008
- FEMA Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards. January 2013

The following Pennsylvania Emergency Management Agency (PEMA) guides and reference documents were used to prepare this document:

- PEMA: Hazard Mitigation Planning Made Easy!
- PEMA Mitigation Ideas: Potential Mitigation Measures by Hazard Type: A Mitigation Planning Tool for Communities. March 6, 2009
- PEMA: Standard Operating Guide. October 18, 2013

2. Community Profile

2.1. Geography and Environment

Sullivan County covers approximately 449.94 square miles and is situated in north central Pennsylvania as part of Pennsylvania's Endless Mountain Region. The county is bordered by Lycoming County in the west and by Bradford County to the north, Wyoming and Luzerne Counties to the east, and Columbia County to the south. Sullivan County is nestled in the Eastern Appalachian Plateau of northeastern Pennsylvania. The northern portion of the county is comprised of a lower glaciated plateau landform. The southern edge of the county is marked by the Allegheny Front where the high plateau makes a steep drop down to the Ridge and Valley Province. Sullivan County is comprised of a highly attractive landscape including narrow stream valleys, mountain lakes and bogs, extensive forests and rolling farmland. Sullivan County ranks fiftieth out of sixty-seven counties in Pennsylvania in terms of total land area.

Sullivan County is nicknamed "The Gem of the Endless Mountains". Two state parks reside in Sullivan County; World's End and Rickett's Glen. Forest lands comprise 89.9% of the total land area in the County. Agriculture uses approximately 6% of the land area in the County and the remaining is consumed by mining or bodies of water. State and non-resident land ownership is extensive in the County at approximately 70% of the total land area. County residents occupy approximately 28% of the County's land area. The privately-owned acres have been developed at an ever-increasing rate with a profusion of seasonal recreation homes and hunting camps. The climate in Sullivan County is temperate, being characterized by moderately hot summers and moderately severe winters. Summer temperatures average between mid-70's and low 80's. Winter temperatures average in the low to mid 30's. Annual rainfall averages 35 inches and annual snowfall averages 70 inches.

Sullivan County presents a wide range of topographic features. The surface ranges from almost level on plateaus and in valleys, to rolling and hilly in other areas. Elevations in the county range from a high of 2,593 feet at North Mountain in Davidson Township to a low of 779 feet on Loyalsock Creek.

The county is served by Pennsylvania Route 87, Pennsylvania Route 487, and U.S. Route 220. The major rivers in the county are Loyalsock Creek, Little Loyalsock Creek, Muncy Creek, and Fishing Creek. The majority of the land in Sullivan County is forest, but there is some farmland, especially in the northern part of the county. There are numerous river valleys in the southern and western parts of Sullivan County.

Sullivan County is comprised of eight watersheds:

- Fishing Creek
- Huntington Creek

- Little Fishing Creek
- Loyalsock Creek
- Lycoming Creek
- Mehoopany Creek
- Muncy Creek
- Towanda Creek

2.2. Community Facts

Created on March 15, 1847 from part of Lycoming County and named for Senator Charles C. Sullivan, Butler District, who took an active part in procuring passage of the bill. Laporte, the county seat, was laid out in 1850 and incorporated as a borough in 1853. It was named for John La Porte, surveyor general of Pennsylvania from 1845 to 1851. The following boroughs and townships are located in Sullivan County:

- Boroughs: Dushore, Eagles Mere, Forksville, Laporte.
- Townships: Cherry, Colley, Davidson, Elkland, Forks, Fox, Hillsgrove, Laporte, Shrewsbury.

Sullivan County's leading industries are education, healthcare, social services, and manufacturing. The primary employment providers within Sullivan County are displayed below in *Table 1 - Top Employers.*

Table 1 - Top Employers

Company	Employees	Industry
Bayada Home Health Care Inc	None in the county	Healthcare
State Government	38	Government
The Highlands Care Center	120	Healthcare
Res-Care Inc	None in the county	Human Services
Sullivan County School District	104	Education
Darway Elder Care Rehabilitation	65	Healthcare
Sullivan County	66	Public Administration
Insinger Inc	32	Excavation Services
Hart Maintenance & Construction	20	Oil and Natural Gas Contractor
Fitzpatrick & Lambert Inc	6	Automotive Sales
Source: Pennsylvania Department of Labor & Industry		

Sullivan County ranks second in the state in timberland percentage; while Pennsylvania leads the nation in hardwood growing stock. The highest quality hardwood species indigenous to Sullivan County include: ash, soft maple, hard maple, red oak and most significantly black cherry. Sullivan County has over 2,500 people in the workforce. A significant percentage of the skilled workforce is employed in surrounding areas at large manufacturing operations such as DuPont, Craftmaster, Proctor & Gamble, Osram/Sylvania and the natural gas industry.

2.3. Population and Demographics

Sullivan County recorded a population of 6,428 during the 2010 U.S. Census, ranking the county in the 66th position among Pennsylvania's sixty-seven counties. The population in this county is declining slightly according to the U.S. Census Bureau whom estimated the population to be 6,328 in 2015, or -1.6% from the April 1, 2010 population census. The median income of households in Sullivan County is $44,926. This is approximately $8,700 less than the national median household income (U.S. Census, 2014).

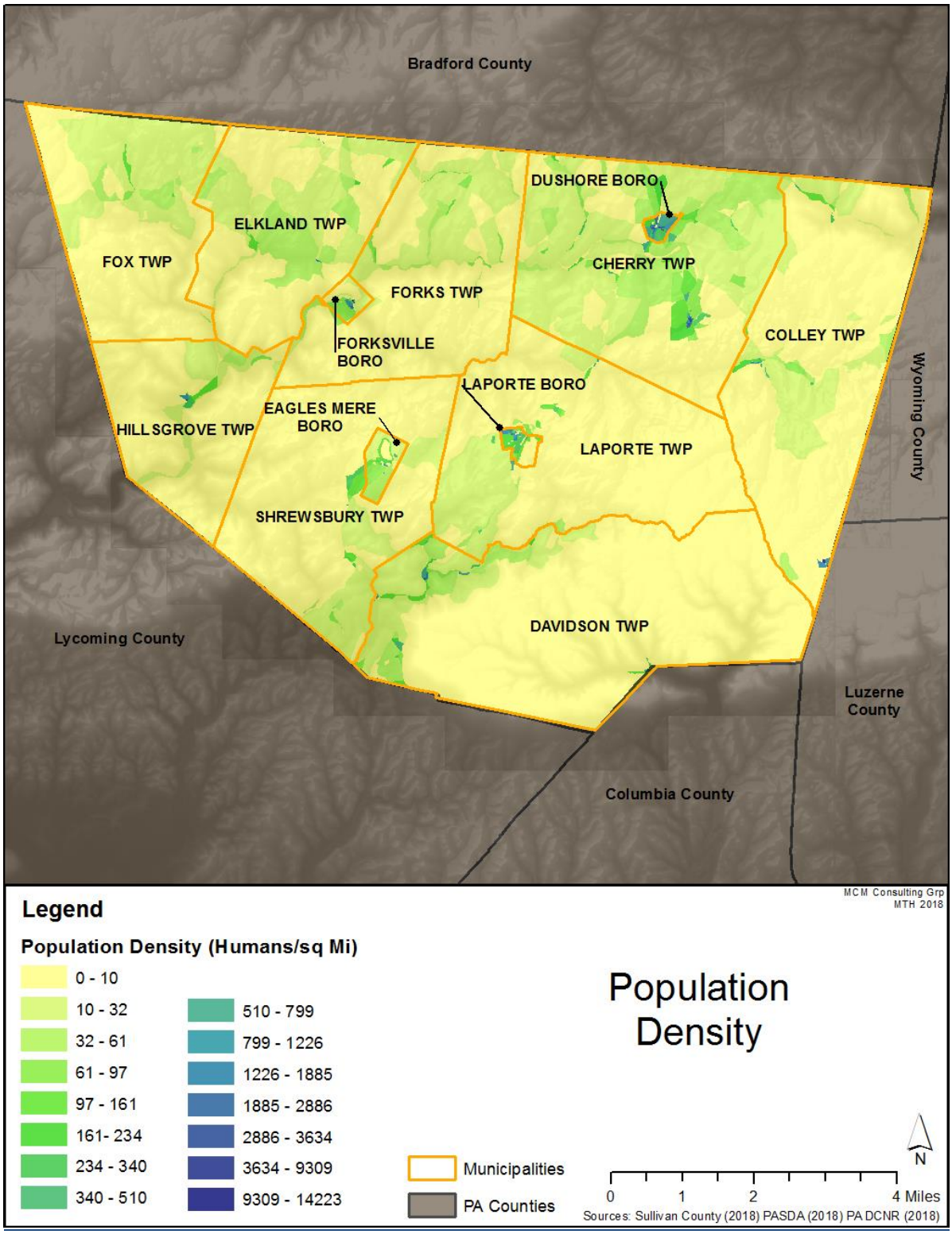
The populations per municipality are identified in *Table 2 - Municipal Population* below.

Table 2 - Municipal Population

Sullivan County Municipality Populations			
Municipality	**Population**	**Municipality**	**Population**
Cherry Township	1,705	Forksville Borough	145
Colley Township	694	Fox Township	358
Davidson Township	573	Hillsgrove Township	287
Dushore Borough	608	Laporte Borough	316
Eagles Mere Borough	120	Laporte Township	349
Elkland Township	577	Shrewsbury Township	319
Forks Township	377		
Source: US Decennial Census			

The median age in Sullivan County is 52.4 years old (according to the 2010 United States Census Bureau). Approximately 61% of the county's total population is between the age of 18 to 64, according to the 2010 census data. A total of 6,375 (82.6%) owner-occupied housing units were identified during the 2010 census.

Figure 1 - Population Density Map



2.4. Land Use and Development

Sullivan County is composed of thirteen municipalities, which includes:

- Nine townships
- Four boroughs

Sullivan County is one of the most forested counties in the State of Pennsylvania. The Commonwealth of Pennsylvania owns 38% of the land; to include Ricketts Glen and Worlds End State Parks, state forests, fish and boat commission acreage and game lands. There are more than 60,000 acres of state game lands and nearly 42,000 acres of state forest in the County. Agriculture covers approximately 6% of the acreage in the county. Agriculture is found predominantly in the northern 1/3 of the county, although significant blocks of agricultural activity are found elsewhere, primarily in the Loyalsock and Muncy Creek stream valleys.

2.5. Data Sources

- Sullivan County Comprehensive Plan
- Sullivan County Planning & Development
- United States Census Bureau (2010, 2014)
- United States Department of Agriculture
- Natural Resources Conservation Service
- Pennsylvania State Data Center
- Sullivan County Conservation District
- Pennsylvania Department of Environmental Protection
- Sullivan County Geographic Information Systems (GIS)
- Pennsylvania Spatial Data Access (PASDA)
- National Oceanic and Atmospheric Administration
- Pennsylvania Department of Conservation and Natural Resources
- Pennsylvania Department of Labor and Industry

Figure 2 - Sullivan County Base Map

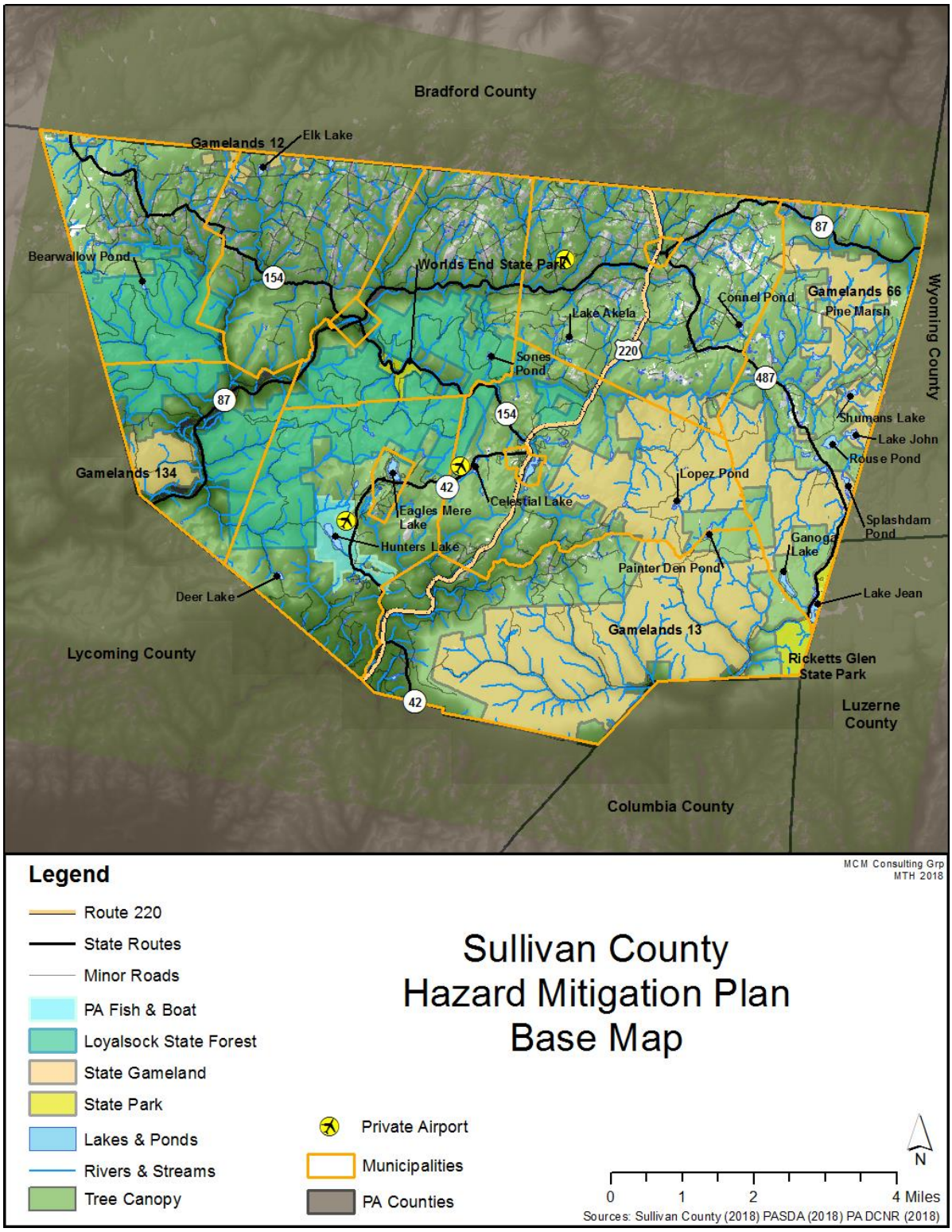


Figure 3 - Land Use/Land Cover Map

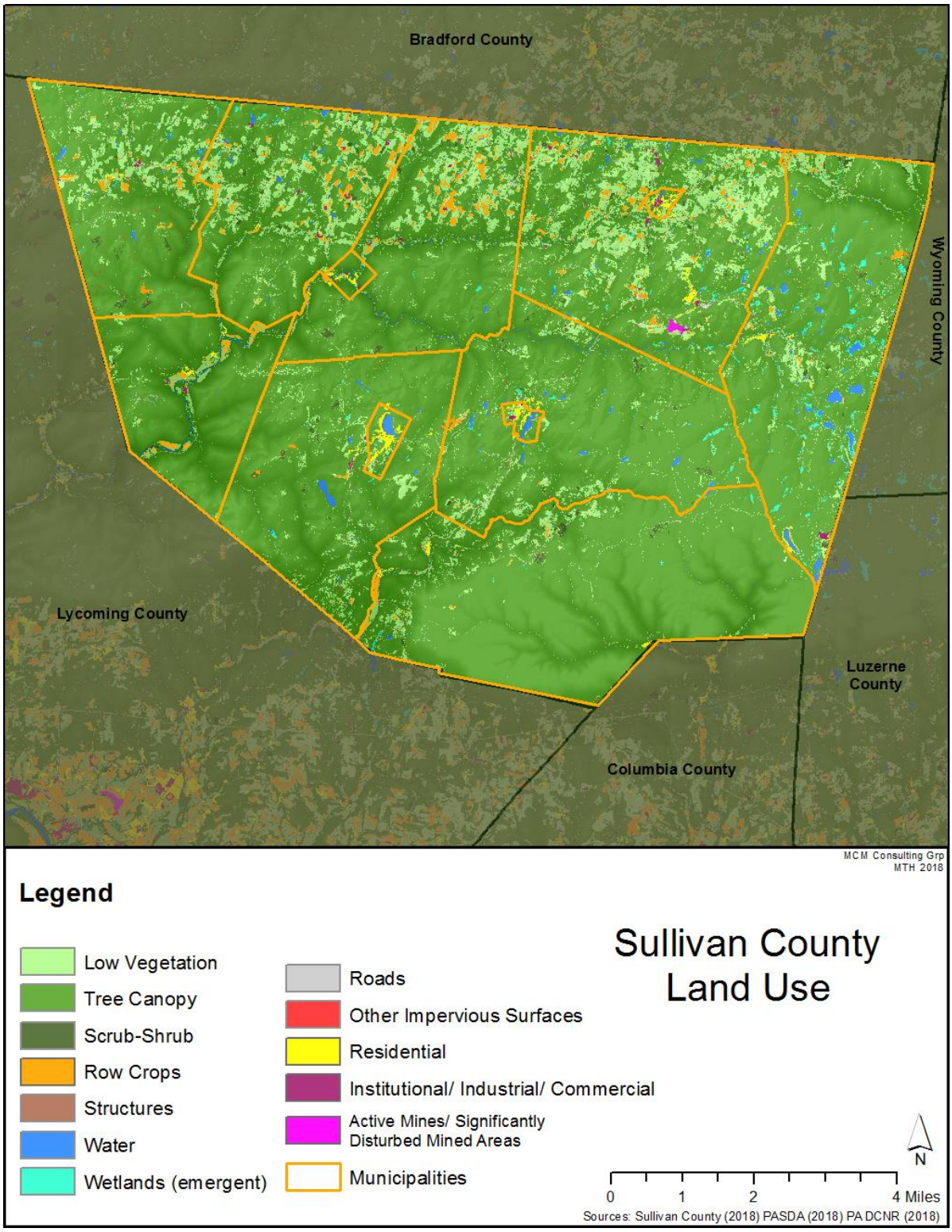


Figure 4 - Recreation Features

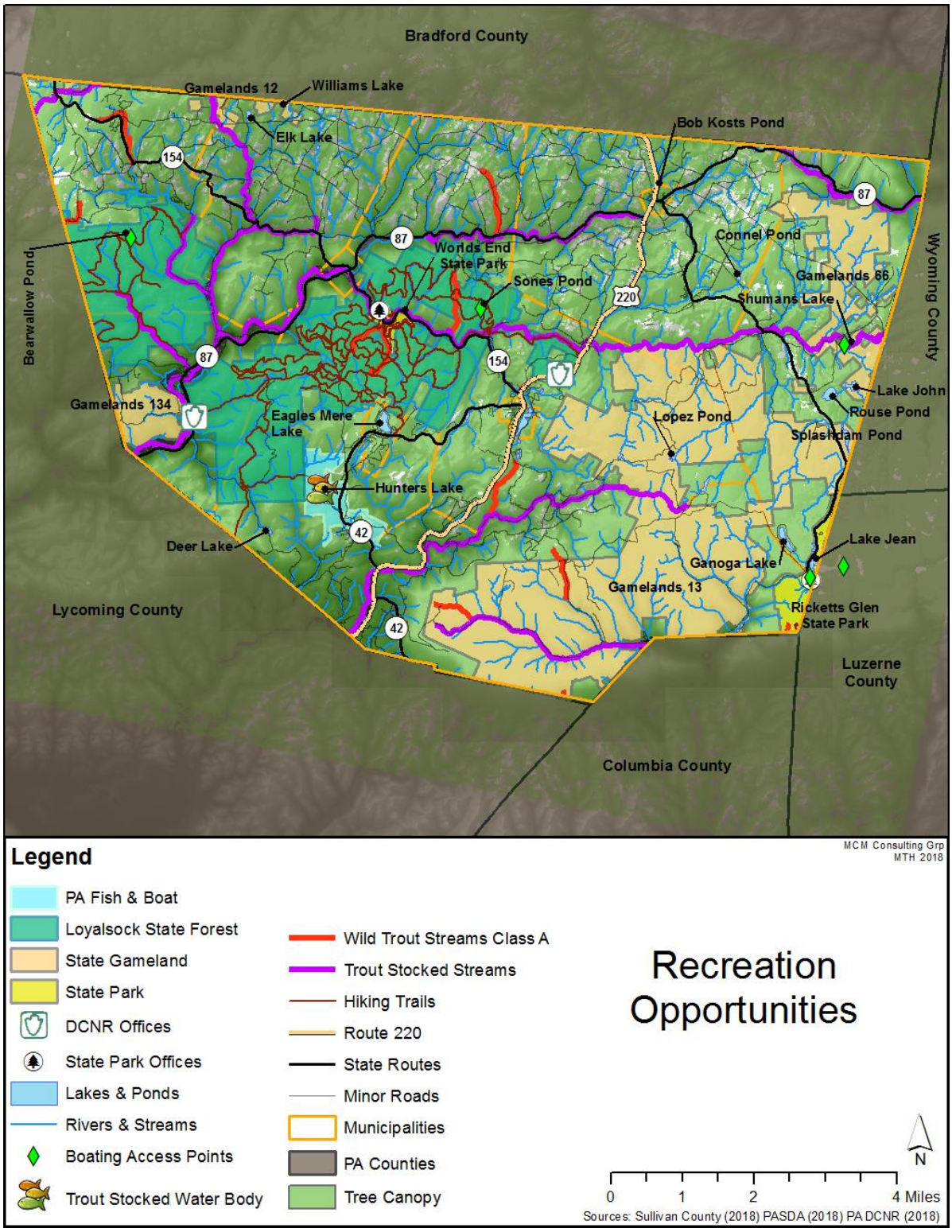
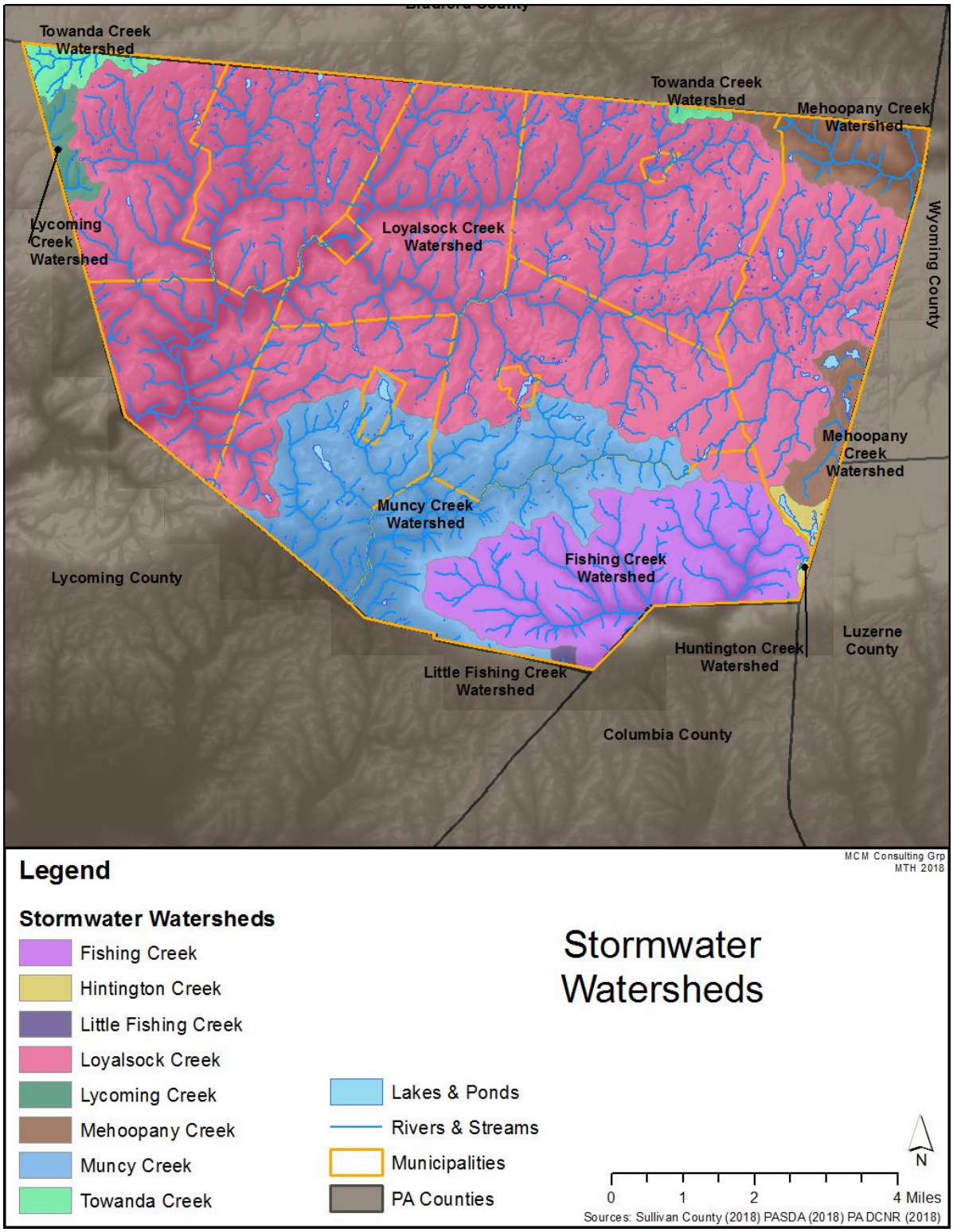


Figure 5 - Hydrologic Features



3. Planning Process

3.1. Update Process and Participation Summary

The Sullivan County Hazard Mitigation Plan update began February 14, 2018. The Sullivan County Commissioners were able to secure a hazard mitigation grant to start the process. The Sullivan County Department of Emergency Services was identified as the lead agency for the Sullivan County Hazard Mitigation Plan update. The planning process involved a variety of key decision makers and stakeholders within Sullivan County. Sullivan County immediately determined that the utilization of a contracted consulting agency would be necessary to assist with the plan update process. MCM Consulting Group, Inc. was selected as the contracted consulting agency to complete the update of the hazard mitigation plan. The core hazard mitigation team, which was referred to as the steering committee, included officials from the Sullivan County Department of Emergency Services, elected officials and MCM Consulting Group, Inc. (MCM).

The process was developed around the requirements laid out in the Federal Emergency Management Agency (FEMA) Local Hazard Mitigation Crosswalk, referenced throughout this plan, as well as numerous other guidance documents including, but not limited to, Pennsylvania's All-Hazard Mitigation Standard Operating Guide, FEMA's State and Local Mitigation Planning How-to Guide series of documents (FEMA 386-series).

MCM Consulting Group, Inc. assisted the Sullivan County Emergency Services Department in coordinating and leading public involvement meetings, local planning team meetings, analysis and the writing of the HMP. The Sullivan County Local Planning Team worked closely with MCM in the writing and review of the HMP. MCM conducted project meetings and local planning team meetings throughout the process. Meeting agendas, meeting minutes and sign in sheets were developed and maintained for each meeting conducted by MCM. These documents are detailed in Appendix C of this plan.

Public meetings with local elected officials were held, as well as work sessions and in-progress review meetings with the Sullivan County Local Planning Team and staff. At each of the public meetings, respecting the importance of local knowledge, municipal officials were strongly encouraged to submit hazard mitigation project opportunity forms, complete their respective portions of the capabilities assessment and review and eventually adopt the county hazard mitigation plan. Sullivan County will continue to work with all local municipalities to collect local hazard mitigation project opportunities.

The HMP planning process consisted of:

- Applying for and receiving a hazard mitigation planning grant to fund the planning project.
- Announcing the initiative via press releases and postings on the county website.
- Involving elected and appointed county and municipal officials in a series of meetings, training sessions and workshops.

- Identifying capabilities and reviewed the information with the municipalities.
- Identifying hazards.
- Assessment of risk and analyzing vulnerabilities.
- Identifying mitigation strategies, goals and objectives.
- Developing an mitigation action plan.
- Announcing completion via press releases and postings on the county website.
- Plan adoption at a public meeting of the Sullivan County Board of Commissioners.
- Plan submission to FEMA and PEMA.

The draft version of the 2019 Sullivan County HMP was completed on February 7, 2019. The 2019 plan follows an outline developed by PEMA which provides a standardized format for all local HMPs in the Commonwealth of Pennsylvania. The 2019 HMP format is consistent with the PEMA recommended format. The 2019 Sullivan County HMP has additional hazard profiles that were added to the HMP and these additional profiles increased the subsections in section 4.3 of the HMP.

3.2. The Planning Team

The 2019 Sullivan County Hazard Mitigation Plan update was led by the Sullivan County Steering committee. The Sullivan County Steering Committee provided guidance and leadership for the overall project. The steering committee assisted MCM Consulting Group, Inc. with dissemination of information and administrative tasks. *Table 3 – Steering Committee* outlines the individuals that comprised this team.

Table 3 – Steering Committee

Sullivan County Hazard Mitigation Plan Update Steering Committee		
Name	**Organization**	**Position**
Joe Carpenter	Sullivan County DES	Director
Jason Dickson	Sullivan County DES	911 Coordinator, Deputy Director
Deb DiBono	Sullivan County DES	Operations & Planning Manager
Brian Hoffman	Sullivan County Commissioner	Elected or Appointed Official
Robert Anderson	MCM Consulting Group, Inc.	Senior Consultant
Corbin Snyder	MCM Consulting Group, Inc.	Project Coordinator
Michael Rearick	MCM Consulting Group, Inc.	Project Manager

In order to represent the county, the Sullivan County Steering Committee developed a diversified list of potential Local Planning Team (LPT) members. Members that participated in the 2014 hazard mitigation plan were highly encouraged to join the 2019 team. The steering committee then provided invitations to the prospective members and provided a description of duties to serve on the LPT. The following agencies, departments and organizations were invited to participate in the LPT: Sullivan County Commissioners, Sullivan County Planning Commission, Pennsylvania Department of Conservation and Natural Resources (DCNR) Bureau of Parks, DCNR Bureau of Forestry, Sullivan County

Historical Society, PennDOT, Pennsylvania State Police, Sullivan County Conservation District, Sullivan County School District, Sullivan County Fire Chiefs, Sullivan County Ambulance, Sullivan County Sheriff and all thirteen municipalities. The invitations for membership of the LPT were disseminated by the Sullivan County Emergency Management Agency utilizing letters, email and telephone calls. The LPT worked throughout the process to plan and hold meetings, collect information and conduct public outreach. Although the contiguous counties to Sullivan County were not directly invited to participate on the LPT, outreach was conducted during the planning period to these counties.

The stakeholders listed in *Table 4 - Local Planning Team* served on the 2019 Sullivan County Hazard Mitigation Local Planning Team, actively participated in the planning process by attending meetings, completing assessments, surveys and worksheets and/or submitting comments.

Table 4 - Local Planning Team

Sullivan County Hazard Mitigation Plan Update Local Planning Team		
Name	**Organization**	**Position**
Frank Frederick	Laporte Borough	Elected or Appointed Official
Brenda Urner	Laporte Borough	Elected or Appointed Official
Kelly Glinski	Laporte Township	Elected or Appointed Official
Rich Marks	Laporte Township	Elected or Appointed Official
Dale Shisler	Fox Township	Elected or Appointed Official
Andy Trostle	Fox Township	Elected or Appointed Official
Donna Iannone	Sullivan County Commissioner	Elected or Appointed Official
Brian Hoffman	Sullivan County Commissioner	Elected or Appointed Official
Diane Fitzgerald	Cherry Township	Elected or Appointed Official
Richard Smith	Forksville Borough	Elected or Appointed Official
Kay Wilson	Eagles Mere Borough	Elected or Appointed Official
Lee Middleton	Eagles Mere Borough	Elected or Appointed Official
Tim Brown	Colley Township	Elected or Appointed Official
Daniel Cox	Davidson Township	Elected or Appointed Official
Ellen Chase	Dushore Borough	Elected or Appointed Official
Dave Carson	Eagles Mere Borough	Elected or Appointed Official
Michael Pennella	Hillsgrove Township	Elected or Appointed Official
Carl Vough	Forks Township	Elected or Appointed Official
Holly Miller	Sullivan County Conservation District	District Manager
Douglas Lindner	Sullivan County School District	Business Manager
Robert Montgomery	Sullivan County Sheriff's Office	Sheriff
Kristin Montgomery	Sullivan County Assessment Office	Chief Assessor
Corey Richmond	Sullivan County Conservation District	Watershed Specialist
Mark Haas	Sullivan County Planning/GIS	Economics Development
Debora DiBono	Sullivan County DES	Operations & Planning Manager
Jason Dickson	Sullivan County 911	911 Coordinator, Deputy Director
Joe Carpenter	Sullivan County DES	Director
Robert Anderson	MCM Consulting Group, Inc.	Senior Consultant

Sullivan County Hazard Mitigation Plan Update Local Planning Team		
Name	**Organization**	**Position**
Corbin Snyder	MCM Consulting Group, Inc.	Project Coordinator
Michael Rearick	MCM Consulting Group, Inc.	Project Manager

3.3. Meetings and Documentation

Public meetings with local elected officials and the local planning team were held. At each of the public meetings, municipal officials were strongly encouraged to submit hazard mitigation project opportunity forms, complete their respective portions of the capability assessment and review and eventually adopt the multi-jurisdictional HMP. No public comments were received during the public comment period.

Table 5 - HMP Process Timeline lists the meetings held during the HMP planning process, which organizations and municipalities attended and the topic that was discussed at each meeting. All meeting agendas, sign-in sheets, presentation slides, any other documentation is located in Appendix C. Note: The October 11, 2018 local planning team meeting agenda was incorrectly dated October 10, 2018.

A final public meeting was held on February 7, 2019 to present the draft plan and invite public comments. The meeting was advertised in the local newspaper and made available digitally on the Sullivan County web site at: www.sullivancounty-pa.us The Sullivan County website was used to make a digital copy of the draft hazard mitigation plan available.

The public comment period remained open until March 6, 2019. All public comments were to be submitted in writing to Joe Carpenter at the Sullivan County Department of Emergency Services. No public comments were received during the public comment period.

Table 5 - HMP Process Timeline

Sullivan County HMP Process - Timeline		
Date	**Meeting**	**Description**
02/14/18	Sullivan County Hazard Mitigation Plan (HMP) Kick-Off Meeting	Identified challenges and opportunities as they relate to fulfilling the DMA 2000 requirements. Identified existing studies and information sources relevant to the hazard mitigation plan. Identified stakeholders, including the need to involve local officials.
03/21/18	Local Planning Team Initial Meeting	Defined hazard mitigation planning and identified roles and responsibilities. Discussed the 2014 hazard mitigation plan and defined a timeline to complete the update.
09/25/18	Local Planning Team Meeting	Risk assessment and capability assessment work
10/11/18	Local Planning Team Meeting	Risk factor assessment, finalize capability assessment

Sullivan County HMP Process - Timeline		
Date	**Meeting**	**Description**
11/07/18	Local Planning Team Meeting	Review draft risk assessment section and start the mitigation strategy section
11/07/18	Public Meeting	Conducted a public meeting to review the draft risk assessment section of the Sullivan County Hazard Mitigation Plan update.
12/11/18	Council of Government Presentation	Conducted a meeting at the Council of Government meeting to engage elected officials not yet participating in the hazard mitigation plan update process. Presented what all is entailed with the hazard mitigation process, capability assessment section review, risk assessment review, mitigation assessment review, and discussed other topics related to hazard mitigation.
12/12/18	Local Planning Team Meeting	2019 goals, objectives, actions and projects development
12/12/18 12/13/18	Meeting with Municipal Officials	Educated county and local elected officials on the hazard mitigation planning process. Presented the findings of the hazard vulnerability analysis and risk assessment. Sought input for mitigation projects throughout the county. Distributed Hazard Mitigation Project Opportunity Forms.
01/16/19	Local Planning Team Meeting	Mitigation strategy section update work and 2019 mitigation action plan develop
02/07/19	Local Planning Team Meeting	Draft 2019 HMP review
02/07/19	Sullivan County Hazard Mitigation Plan – Draft Plan Review Public Meeting	An update of the hazard mitigation planning process was delivered. The Draft HMP was reviewed with the municipal representatives and public. Attendees were informed about the timeline and their opportunity to review the entire draft plan and provide written comments for inclusion into the plan.

3.4. Public and Stakeholder Participation

Sullivan County engaged numerous stakeholders and encouraged public participation during the HMP update process. Advertisements for public meetings were completed utilizing the local newspaper and the Sullivan County website. Copies of those advertisements are located in Appendix C. Municipalities and other county entities were invited to participate in various meetings and encouraged to review and update various worksheets and surveys. Copies of all meeting agendas, meeting minutes and sign-in sheets are located in Appendix C. Worksheets and surveys completed by the municipalities and other stakeholders are summarized in this plan update as well. Municipalities were also encouraged to review hazard mitigation related items with other constituents located in the municipality like businesses, academia, private and nonprofit interests.

The tools listed below were distributed with meeting invitations, provided directly to municipalities to complete and return to the Sullivan County Department of Emergency Services or at meetings to solicit information, data and comments from both local municipalities and other key stakeholders. Responses to these worksheets and surveys are available for review at the department of emergency services.

1. **Risk Assessment Hazard Identification and Risk Evaluation Worksheet:** Capitalizes on local knowledge to evaluate the change in the frequency of occurrence, magnitude of impact and/or geographic extent of existing hazards and allows communities to evaluate hazards not previously profiled using the Pennsylvania Standard List of Hazards.
2. **Capability Assessment Survey:** Collects information on local planning, regulatory, administrative, technical, fiscal and political capabilities that can be included in the countywide mitigation strategy.
3. **Municipal Project Opportunity Forms and Mitigation Actions:** Copies of the 2014 mitigation opportunity forms that were included in the current HMP were provided to the municipalities for review and amendment. The previous mitigation actions were provided and reviewed at update meetings. New 2019 municipal project opportunity forms are included as well, located in Appendix G**.**

A schedule that provided appropriate opportunities for public comment was utilized during the review and drafting process. Any public comment that was received during public meetings or during the draft review of the plan were documented and included in the plan. One comment was received during the public comment period. Copies of newspaper public meeting notices, website posted public notices and other correspondence are included in Appendix C of this plan.

Sullivan County invited all contiguous counties to review the 2019 draft hazard mitigation plan. A letter was sent to the emergency management coordinator in Bradford, Lycoming, Columbia, Luzerne and Wyoming Counties on January 22, 2019. Copies of these letters are included in Appendix C. The Bradford County Emergency Management Coordinator advised that she reviewed the entire update draft hazard mitigation plan.

3.5. Multi-Jurisdictional Planning

Sullivan County used an open, public process to prepare this HMP. Meetings and letters to municipal officials were conducted to inform and educate them about hazard mitigation planning and its local requirements. Municipal officials provided information related to existing codes and ordinances, the risks and impacts of known hazards on local infrastructure and critical facilities and recommendations for related mitigation opportunities. The pinnacle to the municipal involvement process was the adoption of the final plan. *Table 6 - Worksheets, Surveys and Forms Participation* reflects the municipality participation by completing worksheets, surveys and forms.

Table 6 - Worksheets, Surveys and Forms Participation

Municipality Participation in Worksheets, Surveys and Forms			
Municipality	**Capability Assessment Survey**	**Risk Assessment Hazard Identification and Risk Evaluation Worksheet**	**Hazard Mitigation Opportunity Form Review and Updates**
Sullivan County	X	X	X
Cherry Township	X	X	X
Colley Township	X	X	
Davidson Township	X	X	X
Dushore Borough	X	X	X
Eagles Mere Borough	X	X	X
Elkland Township	X	X	X
Forks Township	X	X	X
Forksville Borough	X	X	X
Fox Township	X	X	X
Hillsgrove Township	X	X	X
Laporte Borough	X	X	X
Laporte Township	X	X	
Shrewsbury Township	X	X	X

All thirteen municipalities within Sullivan County have adopted the 2014 Sullivan County Hazard Mitigation Plan as the municipal hazard mitigation plan. The Sullivan County Local Planning Team goal is 100% participation by municipalities in adopting the 2019 Sullivan County Hazard Mitigation Plan.

4. Risk Assessment

4.1. Update Process Summary

A key component to reducing future losses is to first have a clear understanding of what the current risks are and what steps may be taken to lessen their threat. The development of the risk assessment is the critical first step in the entire mitigation process, as it is an organized and coordinated way of assessing potential hazards and risks. The risk assessment identifies the effects of both natural and human caused hazards and describes each hazard in terms of its frequency, severity and county impact. Numerous hazards were identified as part of the process.

A risk assessment evaluates threats associated with a specific hazard and is defined by probability and frequency of occurrence, magnitude, severity, exposure and consequences. The Sullivan County risk assessment provides in-depth knowledge of the hazards and vulnerabilities that affect Sullivan County and its municipalities. This document uses an all-hazards approach when evaluating the hazards that affect the county and the associated risks and impacts each hazard presents.

This risk assessment provides the basic information necessary to develop effective hazard mitigation/prevention strategies. Moreover, this document provides the foundation for the Sullivan County Emergency Operations Plan (EOP), local EOPs and other public and private emergency management plans.

The Sullivan County risk assessment is not a static document, but rather, is a biennial review requiring periodic updates. Potential future hazards include changing technology, new facilities and infrastructure, dynamic development patterns and demographic and socioeconomic changes into or out of hazard areas. By contrast, old hazards, such as brownfields and landfills, may pose new threats as county conditions evolve.

Using the best information available and geographic information systems (GIS) technologies, the county can objectively analyze its hazards and vulnerabilities. Assessing past events is limited by the number of occurrences, scope and changing circumstances. For example, ever-changing development patterns in Pennsylvania have a dynamic impact on traffic patterns, population density and distribution, storm water runoff and other related factors. Therefore, limiting the risk assessment to past events is myopic and inadequate.

The Sullivan County Local Planning Team reviewed and assessed the change in risk for all natural and human caused hazards identified in the 2014 hazard mitigation plan. The mitigation planning team then identified hazards that were outlined within the Pennsylvania Hazard Mitigation Plan but not included in the 2014 Sullivan County Hazard

Mitigation Plan that could impact Sullivan County. The team utilized the hazard identification and risk evaluation worksheet that was provided by the Pennsylvania Emergency Management Agency.

The Sullivan County Steering committee met with municipalities and provided guidance on how to complete the municipal hazard identification and risk evaluation worksheet. All thirteen municipalities returned completed worksheets, along with one completed by the Sullivan County School District, and one completed by county officials. This information was combined with the county information to develop an overall list of hazards that would need to be profiled.

Once the natural and human caused hazards were identified and profiled, the local planning team then completed a vulnerability assessment for each hazard. An inventory of vulnerable assets was completed utilizing GIS data and local planning team knowledge. The team used the most recent Sullivan County assessment data to estimate loss to particular hazards. Risk factor was then assessed to each profiled hazard utilizing the hazard prioritization matrix. This assessment allows the county and its municipalities to focus on and prioritize local mitigation efforts on areas that are most likely to be damaged or require early response to a hazard event.

4.2. Hazard Identification

4.2.1. Presidential and Gubernatorial Disaster Declarations

Table 7 - Gubernatorial and Presidential Disaster Declaration History presents a list of all Presidential and Governor's Disaster Declarations that have affected Sullivan County from 1972 through 2018, according to the Pennsylvania Emergency Management Agency. *Table 8 - Municipal Disaster Declarations* summarizes past declarations from within Sullivan County.

Table 7 - Gubernatorial and Presidential Disaster Declaration History

Sullivan County Gubernatorial and Presidential Disaster Declaration History *(Pennsylvania Emergency Management Agency)*		
Date	**Hazard Event**	**Action**
November, 2018	Severe Storms & Flooding	Presidential Disaster Declaration for Public Assistance
January, 2018	Opioid Epidemic	Presidential & Gubernatorial Proclamation of Disaster Emergency
March, 2017	Severe Winter Weather	Gubernatorial Proclamation of Disaster Emergency
November, 2016	Heavy Rain	Gubernatorial Proclamation of Disaster Emergency

Sullivan County Gubernatorial and Presidential Disaster Declaration History *(Pennsylvania Emergency Management Agency)*		
Date	**Hazard Event**	**Action**
January, 2016	Severe Winter Weather	Gubernatorial Proclamation of Disaster Emergency
August, 2015	Severe Thunderstorm & Winds	Gubernatorial Proclamation of Disaster Emergency
January, 2015	Severe Winter Weather	Gubernatorial Proclamation of Disaster Emergency
October, 2012	Hurricane Sandy	Presidential Disaster Declaration and Gubernatorial Proclamation of Emergency for Public Assistance
September, 2011	Hurricane Irene	Presidential Disaster Declaration for Individual Assistance
September, 2011	Tropical Storm Lee	Presidential Disaster Declaration for Public and Individual Assistance
February, 2007	Severe Winter Storm	Presidential Disaster Declaration for Public Assistance
September, 2004	Tropical Depression Ivan	Presidential Disaster Declaration for Public and Individual Assistance
September, 2003	Hurricane Isabel/Henri	Presidential Disaster Declaration for Public and Individual Assistance
September, 1999	Hurricane Floyd	Presidential Disaster Declaration for Public and Individual Assistance
January, 1996	Severe Winter Storms	Presidential Disaster Declaration for Individual Assistance
October, 1976	Severe Storms and Flooding	Presidential Disaster Declaration
September, 1975	Severe Storms, Heavy Rains and Flooding	Presidential Disaster Declaration
June, 1972	Tropical Storm Agnes	Presidential Disaster Declaration

Table 8 - Municipal Disaster Declarations

Municipal Disaster Declarations *(Sullivan County EMA)*		
Municipality	**Disaster Event**	**Date**
Hillsgrove Township	Flooding	10/26/12
Laporte Township and Hillsgrove Township	Flooding from Tropical Storm Lee	09/07/11
Hillsgrove Township	Flooding	01/25/10

4.2.2. Summary of Hazards

The Sullivan County Local Planning Team (LPT) was provided the Pennsylvania Standard List of Hazards to be considered for evaluation in the 2019 HMP Update. Following a review of the hazards considered in the 2014 HMP and the standard list of hazards, the local planning team decided that the 2019 plan should identify, profile and analyze twenty-six hazards. These hazards include all of the hazards profiled in the 2014 plan. The list below contains the hazards that have the potential to impact Sullivan County as identified through previous risk assessments, the Sullivan County Hazards Vulnerability Analysis and input from those that participated in the 2019 HMP update. Hazard profiles are included in Section 4.3 for each of these hazards.

Identified 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).

Extreme Temperatures

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

months. Extreme heat is responsible for more deaths in Pennsylvania than all other natural disasters combined.

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. 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.

Hurricanes, Tropical Storms

Hurricanes and tropical storms 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 tornados. 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 which is typically June through November (FEMA, 1997).

Invasive Species

An invasive species is a species that is not indigenous to the ecosystem under consideration which thrives in the novel ecosystem. Such species often cause environmental or economic harm. Invasive species can be any type of organism, such as plants, fish, invertebrates, mammals, insects, and even diseases or pathogens. Not all non-native species cause problems, however many can cause agricultural hardships, defoliate and kill native plants and trees and interfere with native ecological systems.

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, rock falls, 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).

Lightning Strike

Lightning is a discharge of electrical energy resulting from the build-up of positive and negative charges within a thunderstorm. The flash or "bolt" of light usually occurs within clouds or between clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000˚F. On average, 89 people are killed each year by lightning strikes in the United States. Within Pennsylvania, the annual average number of thunder and lightning events in a given area is expected to be between 40 and 70 events per year (FEMA, 1997).

Pandemic and Infectious Diseases

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). Infectious diseases such as West Nile Virus or Lyme disease are also important to monitor and mitigate.

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).

Subsidence, Sinkhole

Subsidence is a natural geologic process that commonly occurs in areas with underlying limestone bedrock and other rock types that are soluble in water. Water passing through naturally occurring fractures dissolves these materials leaving underground voids. Eventually, overburden on top of the voids causes a collapse which can damage structures

with low strain tolerances. This collapse can take place slowly over time or quickly in a single event, but in either case. Karst topography describes a landscape that contains characteristic structures such as sinkholes, linear depressions, and caves. In addition to natural processes, human activity such as water, natural gas, and oil extraction can cause subsidence and sinkhole formations. (FEMA, 1997). Sinkholes can also be caused by abandoned mined land.

Tornado, Wind Storm

A wind storm can occur during severe thunderstorms, winter storms, coastal storms, or tornados. Straight-line winds such as a downburst have the potential to cause wind gusts that exceed one hundred miles per hour. Based on forty years of tornado history and over one hundred 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. Tornados are most often generated by thunder-storm 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 wind-blown de-bris. 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 tornados are a few dozen yards wide and touch down briefly, but even small, short-lived tornados 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. Campgrounds and people staying in tents or mobile campers are also vulnerable to severe wind storms. Waterspouts are weak tornados that form over warm water and are relatively uncommon in Pennsylvania. Each year, an average of over 800 tornados is reported nationwide, resulting in an average of eighty deaths and 1,500 injuries (NOAA, 2002). Based on NOAA Storm Prediction Center Statistics, the number of recorded F3, F4, & F5 tornados 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 wild-fires 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). Wildfires can also be natural and important parts of some ecosystems.

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).

Identified Human Caused Hazards

Civil Disturbance

Civil disturbance hazards encompass a set of hazards emanating from a wide range of possible events that cause civil disorder, confusion, strife and economic hardship. Civil disturbance hazards include the following:

- Famine; involving a widespread scarcity of food leading to malnutrition and increased mortality (Robson, 1981).
- Economic Collapse, Recession; Very slow or negative growth, for example (Economist, 2009).
- Misinformation; erroneous information spread unintentionally (Makkai, 1970).
- Civil Disturbance, Public Unrest, Mass Hysteria, Riot; group acts of violence against property and individuals, for example (18 U.S.C. § 232, 2008).
- Strike, Labor Dispute; controversies related to the terms and conditions of employment, for example (29 U.S.C. § 113, 2008).

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, Pennsylvania, 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).

Disorientation

Large numbers of people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. As a result, people can become lost or trapped in remote and rugged wilderness areas. Search and rescue may be required for people who become accidentally disoriented, especially those suffer from medical problems or injuries. Search and rescue efforts are focused in and around state forests and state park lands (DCNR, 2009)

Drowning

Drowning is death from suffocation underwater, typically associated with swimming, fishing, boating, bridge accidents, or suicide. It can be a significant hazard in communities with numerous residential pools or natural water bodies such as ponds, lakes, rivers, and reservoirs etc. where there is extensive outdoor recreational activity. Drowning rates are particularly high for children ages 1-14. The Centers for Disease Control and Prevention estimates that drowning is the second leading cause of injury and death after motor vehicle crashes among children ages 1-14 (CDC, 2008).

Emergency Services

Emergency medical services (EMS) and fire department services play a crucial role in the emergency response system, and the wellness of these emergency services directly impacts many of the other hazards profiles in this report. Both EMS and fire services face challenges from lack of funding and lower rates of volunteerism.

Environmental Hazard: Natural Gas Exploration & Manure Spills

Environmental hazards are hazards that pose threats to the natural environment, the built environment and public safety through the diffusion of harmful substances, materials, or products. Environmental hazards include the following:

- Hazardous material releases; at fixed facilities or as such materials are in transit and including toxic chemicals, infectious substances, biohazardous waste and any materials that are explosive, corrosive, flammable, or radioactive (PL 1990-165, § 207(e)).
- Air or Water Pollution; the release of harmful chemical and waste materials into water bodies or the atmosphere, for example (National Institute of Health Sciences, July 2009; Environmental Protection Agency, Natural Disaster PSAs, 2009).
- Superfund Facilities; hazards originating from abandoned hazardous waste sites listed on the National Priorities List (Environmental Protection Agency, National Priorities List, 2009).

- Manure Spills; involving the release of stored or transported agricultural waste, for example (Environmental Protection Agency, Environmental Impacts of…, 1998).
- Product Defect or Contamination; highly flammable or otherwise unsafe consumer products and dangerous foods (Consumer Product Safety Commission, 2003).

Opioid Epidemic

The opioid epidemic is the rapid increase in the use of prescription and non-prescription opioid drugs in the United States beginning in the late 1990s and continuing throughout the first two decades of the 2000s. Opioids are a diverse class of moderately strong painkillers, including oxycodone, hydrocodone, and a very strong painkiller, fentanyl, which is synthesized to resemble other opiates such as opium-derived morphine and heroin. The potency and availability of these substances, despite their high risk of addiction and overdose, have made them popular both as formal medical treatments and as recreational drugs. Due to their sedative effects on the part of the brain which regulates breathing, opioids in high doses present the potential for respiratory depression and may cause respiratory failure and death. It has become more useful to view opioid addiction as a disease rather than an illicit behavior requiring criminal consequences.

The Commonwealth of Pennsylvania, along with other states in the nation has enacted legislation to curb the prescription and distribution of these drugs to try to prevent addiction rising from abuse as a painkiller. This includes but is not limited to restrictions to prescribing to minors, quantity limits, a prescription database with entry requirements and other limits to its availability.

Structure/ Building Collapse

The loss of structural integrity of a building or structure that results in significant personal injury, death or imposing major economic loss.

Terrorism

Terrorism is use of force or violence against persons or property with the intent to intimidate or coerce. Acts of terrorism include active shooters, threats of terrorism, assassinations, kidnappings, hijackings, bomb scares and bombings, cyber-attacks (computer-based), and the use of chemical, biological, nuclear and radiological weapons. (FEMA, 2009).

Transportation Accidents

Transportation accidents can result from any form of air, rail, water, or road travel. It is unlikely that small accidents would significantly impact the larger community. However, certain accidents could have secondary regional impacts such as a hazardous materials release or disruption in critical supply/access routes, especially if vital transportation corridors or junctions are present. (Research and Innovative Technology Administration,

2009). Traffic congestion in certain circumstances can also be hazardous. Traffic congestion is a condition that occurs when traffic demand approaches or exceeds the available capacity of the road network. This hazard should be carefully evaluated during emergency planning since it is a key factor in timely disaster or hazard response, especially in areas with high population density. (Federal Highway Administration, 2009).

Urban Fire and Explosion

An urban fire involves a structure or property within an urban or developed area. For hazard mitigation purposes, major urban fires involving large buildings and/or multiple properties are of primary concern. The effects of a major urban fire include minor to significant property damage, loss of life, and residential or business displacement. Explosions are extremely rapid releases of energy that usually generate high temperatures and often lead to fires. The risk of severe explosions can be reduced through careful management of flammable and explosive hazardous materials. (FEMA, 1997).

Utility Interruption

Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications and public works and information network sectors. Utility interruption hazards include the following:

- Geomagnetic Storms; including temporary disturbances of the Earth's magnetic field resulting in disruptions of communication, navigation and satellite systems (National Research Council et al., 1986).
- Fuel or Resource Shortage; resulting from supply chain breaks or secondary to other hazard events, for example (Lebanon 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).

4.2.3. Climate Change

Impacts of Climate Change on Identified Hazards

Humans have become the dominant species on Earth and our society and influence is globalized. Human activity such as the large-scale consumption of fossil fuels and deforestation has caused atmospheric carbon dioxide concentrations to significantly increase and a notable diversity of species to go extinct. The result is rapid climate change unparalleled in Earth's history and an extinction event approaching the level of a mass extinction (Barnosky et al., 2011; Wake & Vredenburg, 2008). The corresponding rise of average atmospheric temperatures is intensifying many natural hazards, and further threatening biodiversity. The effects of climate change are starting to be felt for some natural hazards, and these effects are expected to intensify over time as temperatures continue to rise.

The seemingly most apparent change that climate change is causing is in regard to extreme temperature (Section 4.3.3). The annual average temperature has increased by 1.2˚F across the continental United States during the years 1986 to 2016 compared to the time period 1901 to 1960, and temperatures are expected to continue rising (Vose et al., 2017). In recent years, record high temperatures have outnumbered low temperatures (Meehl et al., 2009; Vose et al., 2017) so it expected that the risk of extreme heat will be amplified whereas the risk of extreme cold will be attenuated. While there may be fewer extreme cold events, those that do occur are expected to more often reach record setting low temperatures (Vose et al., 2017).

Less immediately apparent, climate change could increase the prevalence of the West Nile Virus (Section 4.3.9). Some studies show increased insect activities during a similar rapid warming event in Earth's history (Curano et al., 2008). Other studies make projections that with the warming temperatures and lower annual precipitation that are expected with climate change, there will be an expansion of the suitable climate for mosquitos and West Nile Virus, potentially increasing the risk that the disease poses (Harrigan et al., 2014). Climate change is also contributing to the introduction of new invasive species (Section 4.3.6). As maximum and minimum seasonal temperatures change, non-native species are able to establish themselves in previously inhospitable climates where they have a competitive advantage. This may shift the dominance of ecosystems in the favor of non-native species, contributing to species loss and the risk of extinction.

Climate change is likely to increase the risk of droughts (Section 4.3.1). Higher average temperatures mean that more precipitation will fall as rain rather than snow, snow will melt earlier in the spring, and evaporation and transpiration will increase. As such the risk of hydrological and agricultural drought is expected to increase (Sheffield & Wood, 2008; EPA, 2016). Correspondingly this will impact wildfires (Section 4.3.13). Drought is accompanied by drier soils and forests, resulting in an elongated wildfire season and more intense and long-burning wildfires (Pechony & Shindell, 2010). However, the

Southwest United States is at a greater risk of this increased drought and wildfire activity than Sullivan County in the Eastern United States.

While it may seem counterintuitive considering the increased risk of drought, there is also an increased risk of flooding associated with climate change (Section 4.3.4). As previously mentioned, warmer temperatures mean more precipitation will fall as rain rather than snow. Combined with the fact that warmer air holds more moisture, the result is heavier and more intense rainfalls. Pennsylvania has seen an increase in annual average precipitation of five to ten percent is the last century, with precipitation from extreme storms increasing seventy percent since 1958, and these numbers are expected to continue to rise (EPA, 2016). These changes to precipitation will impact agriculture and increase the risk of flooding and dam and levee failures. Similarly, winter storms are expected to become more intense, if possibly less frequent (Section 4.3.14).

Climate change is expected to result in more intense hurricanes and tropical storms (Section 4.3.5). With the rise of atmospheric temperatures, ocean surface temperatures are rising, resulting in warmer and moister conditions where tropical storms develop (Stott et al., 2010). A warmer ocean stores more energy and is capable of fueling stronger storms. It is projected that the Atlantic hurricane season is elongating, and there will be more category 4 and 5 hurricanes than before (Trenberth, 2010). The unexpectedly devastating Hurricane Harvey in August 2017 in Houston is widely regarded as an example of a hurricane supercharged by warmer ocean temperatures (Trenberth et al., 2018).

The impacts of climate change are no longer hypothetical concepts set in the future, but rather tangible and hazardous realities. Hurricane Harvey's destruction is an example of the increased hazard of tropical storms. Additionally, wildfires in California are largely believed to be burning faster and hotter due to worsening drought conditions that are being caused by climate change (Cvijanovic et al., 2017). The wildfire season in California in both 2017 and 2018 each broke records for having unprecedentedly devastating fires. The November 2018 Camp Fire in Butte County California burned 153,336 acres, 18,804 structures (including the town of Paradise), and claimed 86 lives (Cal Fire, January 2019). While these specific events were not especially close to Pennsylvania, they are early illustrations of the impact that climate change is having, and they confirm the best available scientific predictions of what is to come. It is important to properly connect these intensifying occurrences to climate change in order to inform future actions for all hazards that climate change will impact.

On January 8, 2019, Governor Tom Wolf issued executive order 2019-01, reestablishing the Governor's Green Government Council and setting achievable climate goals for the Commonwealth of Pennsylvania. The climate goals were based on the November 2018 report *Pennsylvania Climate Action Plan* (PA DEP, 2018) and include the following benchmarks for the Commonwealth:

- 26% reduction of net greenhouse gas emissions by 2025 (from 2005 levels).

- 80% reduction of net greenhouse gas emissions by 2050 (from 2005 levels).

These goals are similar to those that over twenty other states have set as targets in the last few years, and similar to those outlined in the international 2015 Paris climate agreement. From the year 2000 to 2015, Pennsylvania had the third most greenhouse gas emissions among states in the nation (EIA, 2018), making the Commonwealth an important state to work towards reducing emissions. The Green Government Council also is intended to reduce energy consumption within government agencies and included the following goals for all agencies under the Governor's jurisdiction (Exec. Order No. 2019-01):

- Collectively reduce overall energy consumption by three percent per year, and twenty-one percent by 2025 (from 2017 levels).
- Replace twenty-five percent of the state passenger car fleet with batter electric and plug-in electric hybrid cars by 2025 and evaluate opportunities for the reduction of vehicle miles traveled and incorporation of new technology where appropriate.
- Procure renewable energy to offset at least forty percent of the Commonwealth's annual electricity use and evaluate opportunities to source electricity through Pennsylvania Certified Tier I credits, and/or direct purchase of renewable power generation sited within Pennsylvania.
- Consider green options in any new building construction project with a goal of a ten percent reduction in the energy consumption over ANSI/ASHRAE/IES Standards.

This type of sudden global change is novel to humanity. All research and many recent events point to the intensification of the hazards mentioned above, especially if human society does not make swift and significant changes to reduce emissions and species losses. Individuals can work to reduce emissions and support green practices in their own ways, however the most significant reductions are made on a systematic level.

4.3. Hazard Profiles

4.3.1. Drought

4.3.1.1 Location and Extent

While Pennsylvania is generally more water-rich than many U.S. states, the Commonwealth may be subject to drought conditions. A drought is broadly defined as a time period of prolonged dryness that contributes to the depletion of ground and surface water. Droughts are regional climatic events, so when such an event occurs in Sullivan County, impacts are not restricted to the county and are often more widespread. The spatial extent of the impacted area can range from localized areas in Pennsylvania to the entire Mid-Atlantic region.

There are three types of drought:

Meteorological Drought – A deficiency of moisture in the atmosphere compared to average conditions. Meteorological drought is defined by the duration of the deficit and degree of dryness, and is often associated with below average rainfall. Depending on the severity of the drought, it may or may not have a significant impact on agriculture and the water supply.

Agricultural Drought – A drought inhibiting the growth of crops, due to a moisture deficiency in the soil. Agricultural drought is linked to meteorological and hydrologic drought.

Hydrologic Drought – A prolonged period of time without rainfall that has an adverse effect on streams, lakes, and groundwater levels, potentially impacting agriculture.

Sullivan County has glaciated plateau topography which features extensive forest lands as well as scattered lakes, bogs and marsh wetlands. *Table 9 - Hydrologic Features* identifies lakes, ponds, swamps and watershed inventories in Sullivan County.

Table 9 - Hydrologic Features

Hydrologic Features	
Lakes, Ponds & Swamps	
Bearwallow Pond	Lake Jean
Celestia Lake	Lopez Pond
Connell Pond	Maple Lake
Dutchman Swamp	Mokoma Lake
Eagles Mere Lake	Painter Den Pond
Elk Lake	Pine Marsh
Ganoga Lake	Rainbow Lake
Hunters Lake	Rouse Pond
Lake Akela	Splashdam Pond
Watersheds	
Fishing Creek	Lycoming Creek
Huntington Creek	Mehoopany Creek
Little Fishing Creek	Muncy Creek
Loyalsock Creek	Towanda Creek

4.3.1.2 Range of Magnitude

Rural farming areas of Sullivan County are most at risk when a drought occurs. A drought can be a significant financial burden even in a County such as Sullivan where only approximately 6% of the county land use is devoted to crop cultivation. Wildfires are often the most severe secondary effect associated with drought. Wildfires can devastate wooded and agriculture areas, threatening natural resources, structures near high wildfire loads, and farm production facilities. Prolonged drought conditions can have a lasting impact on the economy and can cause major ecological changes, such as increases in scrub growth, flash flooding and soil erosion.

Long-term water shortages during severe drought conditions can have a significant impact on agribusiness, public utilities, and other industries reliant on water for production services. *Table 10 - Drought Preparation Phases* shows the FEMA defined levels of drought

severity along with suggested actions, requests and goals. Drought can cause municipalities to enforce water rationing and distribution.

The Commonwealth uses five parameters to assess drought conditions:

- Stream flows (compared to benchmark records).
- Precipitation (measured as the departure from normal, thirty-year average precipitation).
- Reservoir storage levels in a variety of locations such as three New York City reservoirs in the upper Delaware River Basin.
- Groundwater elevations in a number of counties (comparing to past month, past year and historic record).
- Soil moisture via the Palmer Drought Index (*See Table 11 - Palmer Drought Severity Index*) - a soil moisture algorithm calibrated for relatively homogeneous regions which measures dryness based on recent precipitation and temperature.

Table 10 - Drought Preparation Phases

Drought Preparation Phases ***(PA DEP, 2017)***				
Phase	**General Activity**	**Actions**	**Request**	**Goal**
Drought Watch	Early stages of planning and alert for drought possibility	Increased water monitoring, awareness and preparation for response among government agencies, public water suppliers, water users and the public	Voluntary water conservation	Reduce water use by 5%
Drought Warning	Coordinate a response to imminent drought conditions and potential water shortages	Reduce shortages - relieve stressed sources, develop new sources if needed	Continue voluntary water conservation, impose mandatory water use restrictions if needed	Reduce water use by 10-15%
Drought Emergency	Management of operations to regulate all available resources and respond to emergency	Support essential and high priority water uses and avoid unnecessary uses	Possible restrictions on all nonessential water uses	Reduce water use by 15%

Table 11 - Palmer Drought Severity Index

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

Local Water Rationing: With the approval of the PA Emergency Management Council, local municipalities may implement local water rationing to share a rapidly dwindling or severely depleted water supply in designated water supply service areas. These individual water rationing plans, authorized through provisions of 4 PA Code Chapter 120, will require specific limits on individual water consumption to achieve significant reductions in use. Under both mandatory restrictions imposed by the Commonwealth and local water rationing, procedures are provided for granting of variances to consider individual hardships and economic dislocations. Local water rationing can strain the availability of consumable water for the community, and can increase the county's vulnerability to other hazards such as severe weather, extreme heat, and public health emergencies.

4.3.1.3 Past Occurrence

Table 12 - Drought Occurrence shows declared drought status for Sullivan County from 1980 to October 2018 as reported by the Pennsylvania Department of Environmental Protection (PA DEP) and the table also includes past disaster declarations impacting Sullivan County due to drought events. *Figure 6 - Palmer Drought Severity Index History* shows that Sullivan County has experienced severe drought (PDSI ≤ -3) between five and ten percent of the time from 1895-1995, which gives a good idea of how often the county has been affected by drought events in the last century.

A significant drought occurred in 1963 when precipitation statewide averaged below normal for ten of twelve months. Drought emergency status led to widespread water use restrictions, and reservoirs dipped to record low levels. Corn, hay, and other agricultural products desiccated in parched fields, causing economic losses. Governor William Scranton sought drought aid for Pennsylvania in the face of mounting agricultural losses, and the event became a presidentially declared disaster in September 1963.

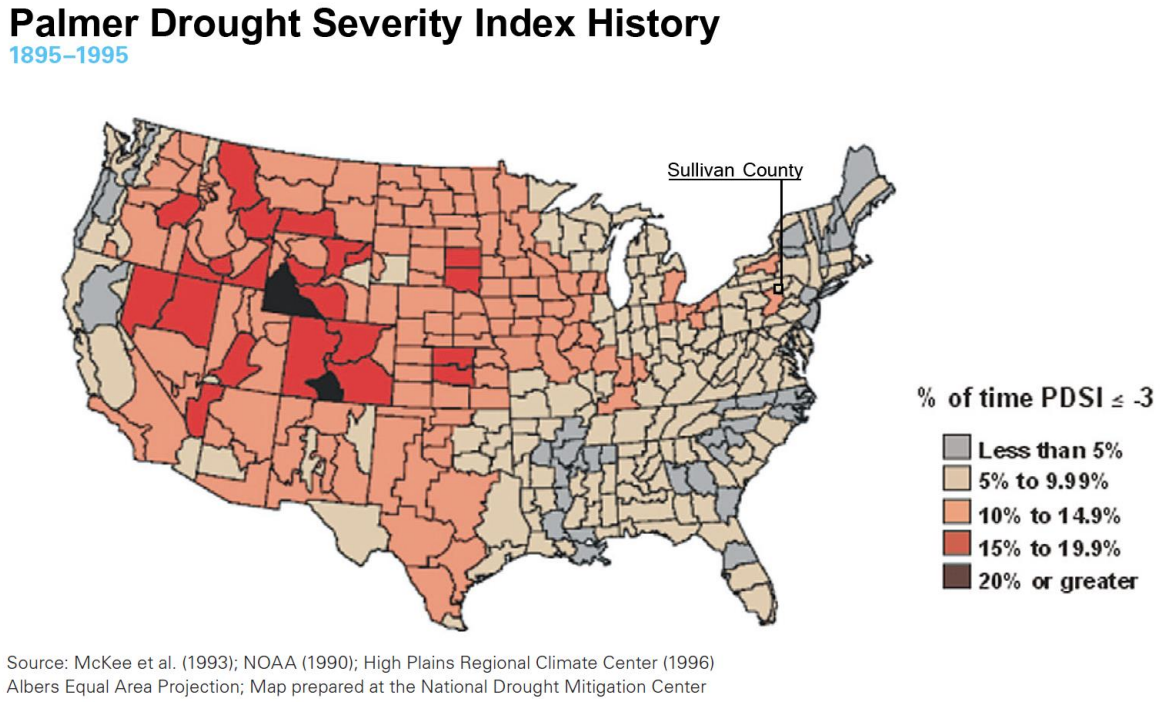
Another devastating drought occurred throughout the year in 1999, culminating with the governor of Pennsylvania declaring a drought emergency for most of the Commonwealth on July 21, 1999. Corn crop losses alone were estimated to be approximately

$100 million with total crop losses estimated at over $500 million. Other than agricultural losses, the drought resulted in low stream levels which caused some deaths of fishes in abnormally dry streams. The drought emergency was lifted on September 30, 1999 with the arrival of Hurricane Floyd on September16.

Table 12 - Drought Occurrence

Drought Occurrence ***(PA DEP, 2018)***			
Start	**End**	**Status**	**Duration**
11/18/1980	04/20/1982	Emergency	1 year, 5 months, 2 days
04/26/1985	12/19/1985	Watch	7 months, 23 days
07/07/1988	12/12/1988	Watch	5 months, 5 days
06/28/1991	07/24/1991	Warning	11 months, 26 days
07/24/1991	10/21/1991	Emergency	
10/21/1991	06/23/1992	Warning	
09/01/1995	09/20/1995	Warning	3 months, 17 days
09/20/2995	11/08/1995	Emergency	
11/08/1995	12/18/1995	Warning	
07/17/1997	01/16/1998	Watch	5 months, 30 days
12/03/1998	12/14/1998	Watch	1 year, 5 months, 2 days
12/14/1998	03/15/1999	Warning	
03/15/1999	06/10/1999	Watch	
06/10/1999	07/20/1999	Warning	
07/20/1999	09/30/1999	Emergency	
09/30/1999	05/05/2000	Watch	
11/06/2001	06/14/2002	Watch	7 months, 8 days
09/05/2002	11/07/2002	Watch	2 months, 2 days
04/11/2006	06/30/2006	Watch	2 months, 19 days
08/06/2007	01/11/2008	Watch	5 months, 5 days
09/16/2010	11/10/2010	Watch	1 months, 25 days
08/05/2011	09/02/2011	Watch	0 months, 28 days
03/24/2015	07/10/2015	Watch	3 months, 16 days
08/10/2016	02/15/2017	Watch	6 months, 5 days
12/19/2017	02/13/2018	Watch	1 months, 25 days

Figure 6 - Palmer Drought Severity Index History



Source: McKee et al. (1993); NOAA (1990); High Plains Regional Climate Center (1996)
Albers Equal Area Projection; Map prepared at the National Drought Mitigation Center

4.3.1.4 Future Occurrence

It is difficult to forecast the exact severity and frequency of future drought events, and the future of climate change will lead to increased uncertainty and extremity of climate events, suggesting that it is best to be prepared for potentially adverse conditions. Sullivan County has experienced severe drought between five and ten percent of the time between 1895 and 1995 (*Figure 6 - Palmer Drought Severity Index History)*, which can be used to make a rough estimate of the future probability of drought in Sullivan County, although it does not account for uncertainty introduced by climate change. *Figure 7 - Recent Drought Severity Index* shows a recent Palmer Drought Severity Index reading for the continental United States and as of September 8, 2018, Sullivan County is experiencing a very moist spell, with a PDSI between 3.0 and 3.9. *Figure 8 – Long-Term Drought Indicator* shows that Sullivan County is currently in the percentile that is least vulnerable to drought events.

Figure 7 - Recent Drought Severity Index

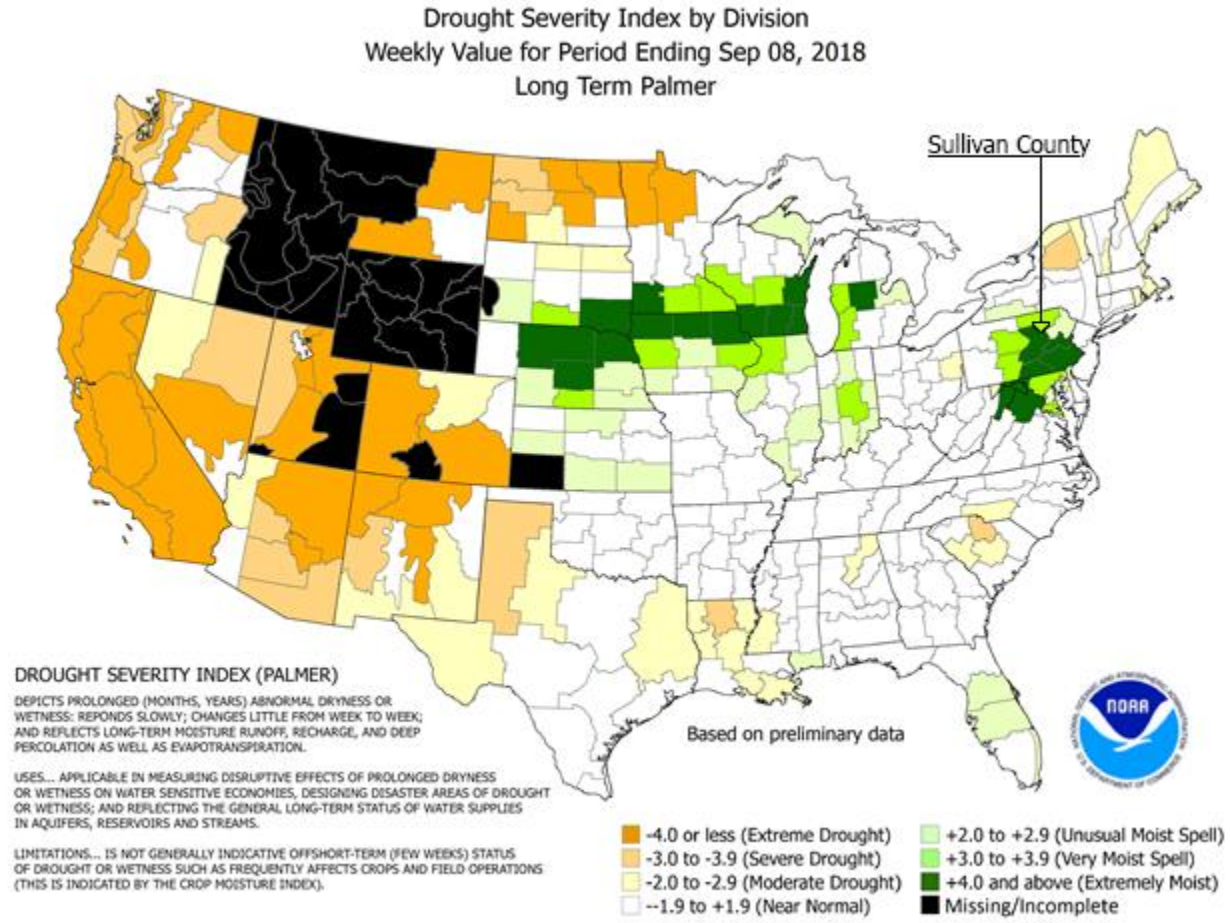
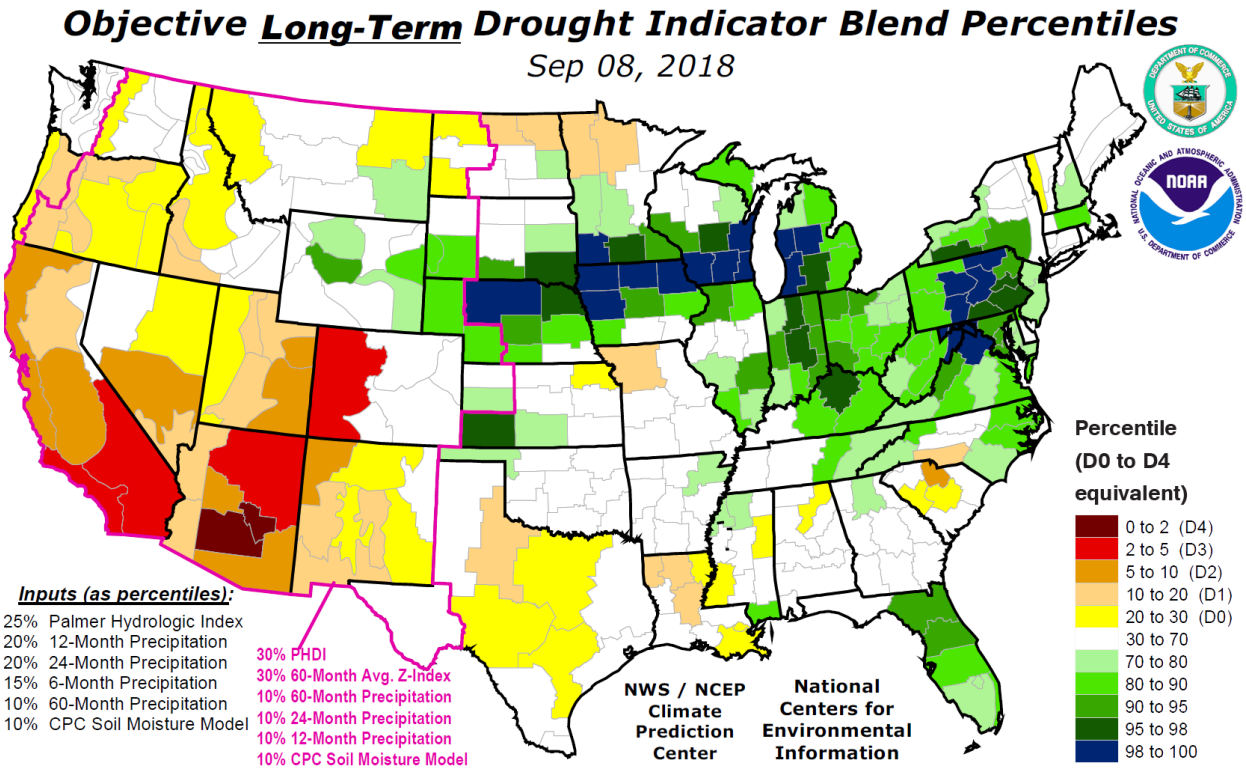


Figure 8 – Long-Term Drought Indicator



4.3.1.5 Vulnerability Assessment

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

While these were statewide impacts, they illustrate the potential for droughts to severely impair the local economy in more agricultural communities. As of the 2012 Census of Agriculture, there were an estimated 179 farms in Sullivan County, at an average size of 209 acres. Sullivan County ranks 60th of 67 counties in the Commonwealth for agricultural production, totaling almost ten million dollars (USDA, 2012). The majority of this production comes from livestock, poultry and their products (~$7 million). The remaining agricultural production comes from crops, including nursery and greenhouse crops (~$2.5 million).

Water supplies are also vulnerable to the effects of drought. Public water service areas cover 0.3% of the county, including most of Dushore and Laporte Boroughs *(See Figure 9 - Drought Vulnerability). Table 14 - Addresses in Public Water Supply Area* shows the

number of addressable structures that are in public water supply areas by municipality, and residential versus commercial designations for these structures was not available at the time of this study. Municipalities that are not listed do not have structures with public water service, and the majority of the county relies on wells for their fresh drinking water. Droughts will quickly affect systems that rely on surface supplies, whereas systems with wells are more capable of handling short-term droughts without issue. Longer-term droughts inhibit the recharging of groundwater aquifers which has an impact on well owners. Depending on the severity of the drought, this could cause the well to dry up, rendering the well owner at a loss for useable water, meaning Sullivan County residents who use private domestic wells are vulnerable to drought events. *Table 13 - Domestic Water Wells* shows the number of wells in each municipality in Sullivan County. Well data was gathered from the Pennsylvania Groundwater Information System (PaGWIS), which relies on voluntary submissions by well drillers. While this is the best dataset of domestic wells available for Sullivan County, it is not comprehensive due to the voluntary nature of the data submission. Not all wells were reported including a location designation.

The EPA provides a guide published in October 2017 for water utilities to aid in drought response and recovery. The guide outlines what goes into a good drought response plan, and how to manage water supply and demand during a drought, outlines best practices for communication and partnerships with other local utilities and provides case studies to discuss examples of drought management practices (EPA, 2017).

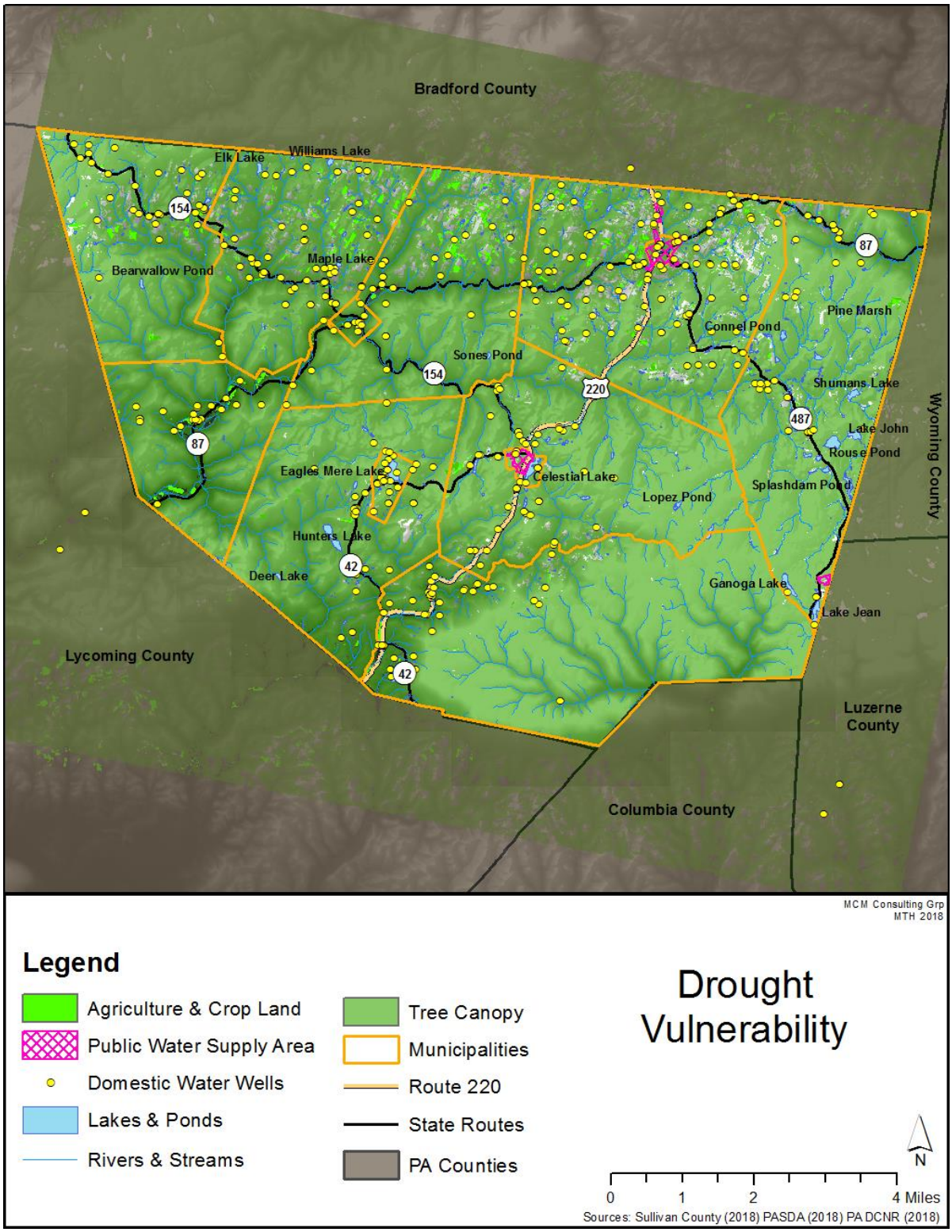
Table 13 - Domestic Water Wells

Domestic Water Wells ***(PA DEP, 2018)***	
Municipality	**Domestic Water Wells**
Cherry Township	138
Colley Township	53
Davidson Township	49
Dushore Borough	18
Eagles Mere Borough	28
Elkland Township	77
Forks Township	47
Forksville Borough	14
Fox Township	51
Hillsgrove Township	27
Laporte Borough	8
Laporte Township	51
Shrewsbury Township	30
Undesignated	576
Total	**1167**

Table 14 - Addresses in Public Water Supply Area

Addresses in Public Water Supply Area ***(Sullivan Co. GIS, 2018)***	
Municipality	**Addressable Structures**
Cherry Township	81
Colley Township	1
Dushore Borough	305
Elkland Township	1
Laporte Borough	202
Total	**590**

Figure 9 - Drought Vulnerability



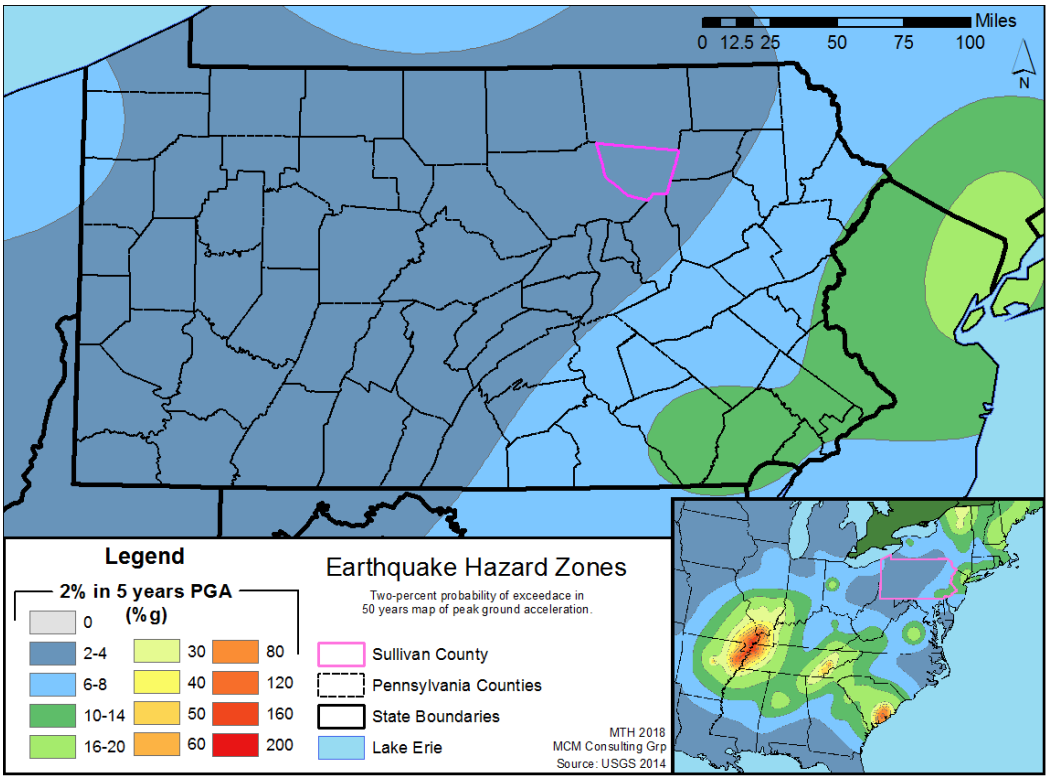
4.3.2. Earthquake

4.3.2.1 Location and Extent

An earthquake is sudden movement of the earth's surface caused by the release of stress accumulated within or along the edge off the earth's tectonic plates, a volcanic eruption, or by a human induced explosion (DCNR, 2007). Earthquake events in Pennsylvania, including Sullivan County are usually mild events; impacting areas no greater than sixty-two miles in diameter from the epicenter. A majority of earthquakes occur along boundaries between tectonic plates, and some earthquakes occur at faults on the interior of plates. Today, Eastern North America, including Sullivan County, Pennsylvania, is far from the nearest plate boundary. That plate boundary is the Mid-Atlantic Ridge, and is approximately 2,000 miles to the east.

When the supercontinent of Pangaea broke apart about 200 million years ago, the Atlantic Ocean began to form. Since then, many faults have developed. Locating all of the faults would be an idealistic approach to identifying the region's earthquake hazard; however, many of the fault lines in this region have no seismicity associated with them. The best way to determine earthquake history for Sullivan County is to conduct a probabilistic earthquake-hazard analysis with the earthquakes that have already happened in and around the county (*See Figure 10 - Earthquake Hazard Zones*).

Figure 10 - Earthquake Hazard Zones



4.3.2.2 Range of Magnitude

Earthquakes result in the propagation of seismic waves, which are detected using seismographs. These seismograph results are measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake. *Table 15 - Richter Scale* summarizes Richter Scale magnitudes as they relate to the spatial extent of impacted areas. The Modified Mercalli Intensity Scale (*Table 16 - Modified Mercalli Intensity Scale*) is an alternative measure of earthquake intensity that is broken down by the impacts of the earthquake event. Earthquakes have many secondary impacts, including disrupting critical facilities, transportation routes, public water supplies and other utilities.

Table 15 - Richter Scale

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

Table 16 - Modified Mercalli Intensity Scale

Scale	Intensity	Earthquake Effects	Richter Scale Magnitude
I	**Instrumental**	Detected only on seismographs	<4.2
II	**Feeble**	Some people feel it	
III	**Slight**	Felt by people resting; like a truck rumbling by	
IV	**Moderate**	Felt by people walking	
V	**Slightly Strong**	Sleepers awake; church bells ring	<4.8
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

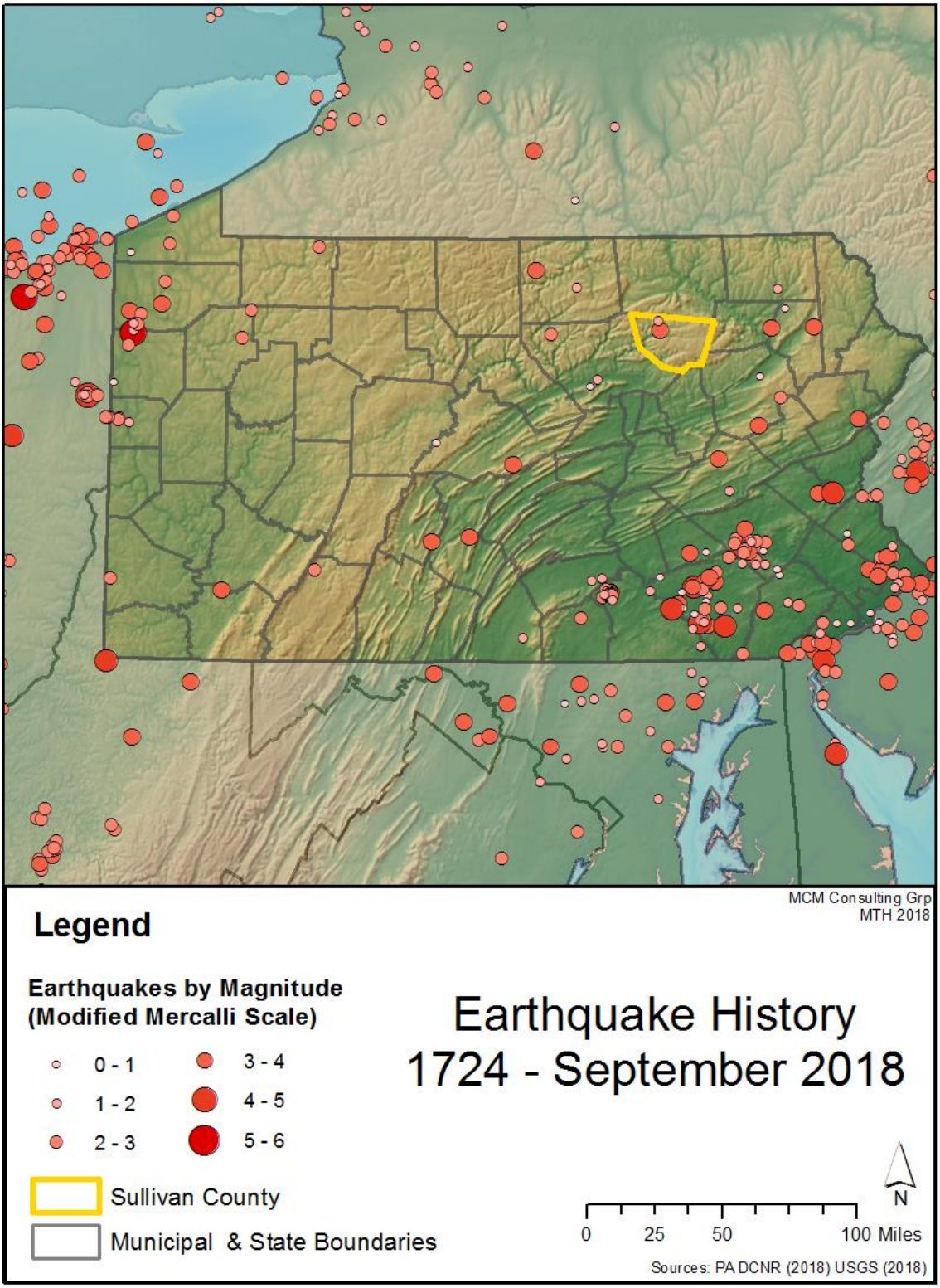
Scale	Intensity	Earthquake Effects	Richter Scale Magnitude
IX	Ruinous	Some houses collapse, ground cracks, pipes break open	
X	Disastrous	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed, general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction, trees fall, ground rises and falls in waves	>8.1

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

4.3.2.3 Past Occurrence

Two earthquakes have been recorded that originated in Sullivan County – one occurred on October 28, 1946 with a magnitude of 3.6 on the Richter Scale and was located in the Huntly Mountain formation near Little Loyalsock Creek. The other occurred on May 22, 2016 with a magnitude of 1.58 and was about 17 km northwest of Laporte. A total of eighteen earthquake events occurred within 100 km of Sullivan County between 1724 and September 2018 – all events were relatively minor quakes with Modified Mercalli magnitudes less than four. All earthquake events that occurred in the area surrounding Sullivan County since 1724 can be seen in *Figure 11 - Earthquake History*.

Figure 11 - Earthquake History



4.3.2.4 Future Occurrence

Earthquake activity and intensities are difficult to predict, but a probabilistic analysis of prior earthquakes can assist in gauging the likelihood of future occurrences. *Figure 10 - Earthquake Hazard Zones* shows that Sullivan County is in the lowest non-zero hazard zone for earthquake activity according to the USGS (2014), suggesting a low probability of earthquake occurrence. However, according to the USGS, there has been a recent trend increasing the frequency of magnitude 3 and larger earthquakes in the central and eastern US (*Table 17 - Recent Earthquake Trends in Central and Eastern United States*). This uptick in seismicity is considered to be due to hydraulic fracturing activities, and specifically occurs as a result of waste water from the fracking process being injected into the earth (Meyer, 2016). Recent studies have moved towards being able to predict such induced seismicity by looking at uplift after injections, but more work needs to be done to confirm uplift as a reliable indicator of induced seismicity (Shirzei et al., 2016). As of September 2018, Sullivan County has ninety-eight active wells (PA DEP, 2018). It is important to note that seismicity can occur even after wells become inactive and injections rates decline (Shirzaei et al., 2016).

Table 17 - Recent Earthquake Trends in Central and Eastern United States

Year	Number of M3+ Earthquakes (average per year)
1973-2008	21
2009-2013	99
2014	659
2015	1000+

4.3.2.5 Vulnerability Assessment

According to the U.S. Geological Society Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect a resident's normal activities. For Sullivan County this could include: surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, and seiches (sloshing of a closed body of water from earthquake shaking).

Earthquakes usually occur without warning, and can impact areas a great distance from their point of origin (epicenter). Ground shaking is the greatest risk to building damage within Sullivan County. Risk to public safety and loss of life from an earthquake is dependent upon the severity of the event. Injury or death to those inside buildings, or people walking below building ornamentation and chimneys is a higher risk to Sullivan County's general public during an earthquake.

While historically the risk of earthquakes in south western PA is low (*See Figure 10 - Earthquake Hazard Zones*), the uptick in seismicity due to hydraulic fracturing increases the likelihood of Sullivan County experiencing a damaging earthquake. Marcellus shale exploration for natural gas is widespread throughout Pennsylvania, meaning there has been widespread hydraulic fracturing. Considering the current knowledge of increased seismicity due to hydraulic fracturing, Sullivan County should expect to experience more

magnitude 3 and larger earthquakes. The increase lasts even after hydraulic fracturing stops, so the increased seismic risk should be expected to last well into the future.

4.3.3. Extreme Temperatures (Hot or Cold)

4.3.3.1 Location and Extent

Extreme temperatures can be devastating: extreme heat can cause sunburn, heat cramps, heat exhaustion, heat stroke, and dehydration while extreme cold can cause hypothermia and frostbite. Both can potentially cause long-lasting disabilities. *Figure 12 - Average Maximum Temperature* and *Figure 13 - Average Minimum Temperature* show annual mean maximum and minimum temperatures for Pennsylvania. July is typically the warmest month for Sullivan County, with normal temperatures ranging from mid-70s to low 80s. January or February is typically the coldest month for Sullivan, with normal temperatures ranging from teens to mid-30s. Temperatures can vary across Sullivan County due to elevation changes in topography.

Figure 12 - Average Maximum Temperature

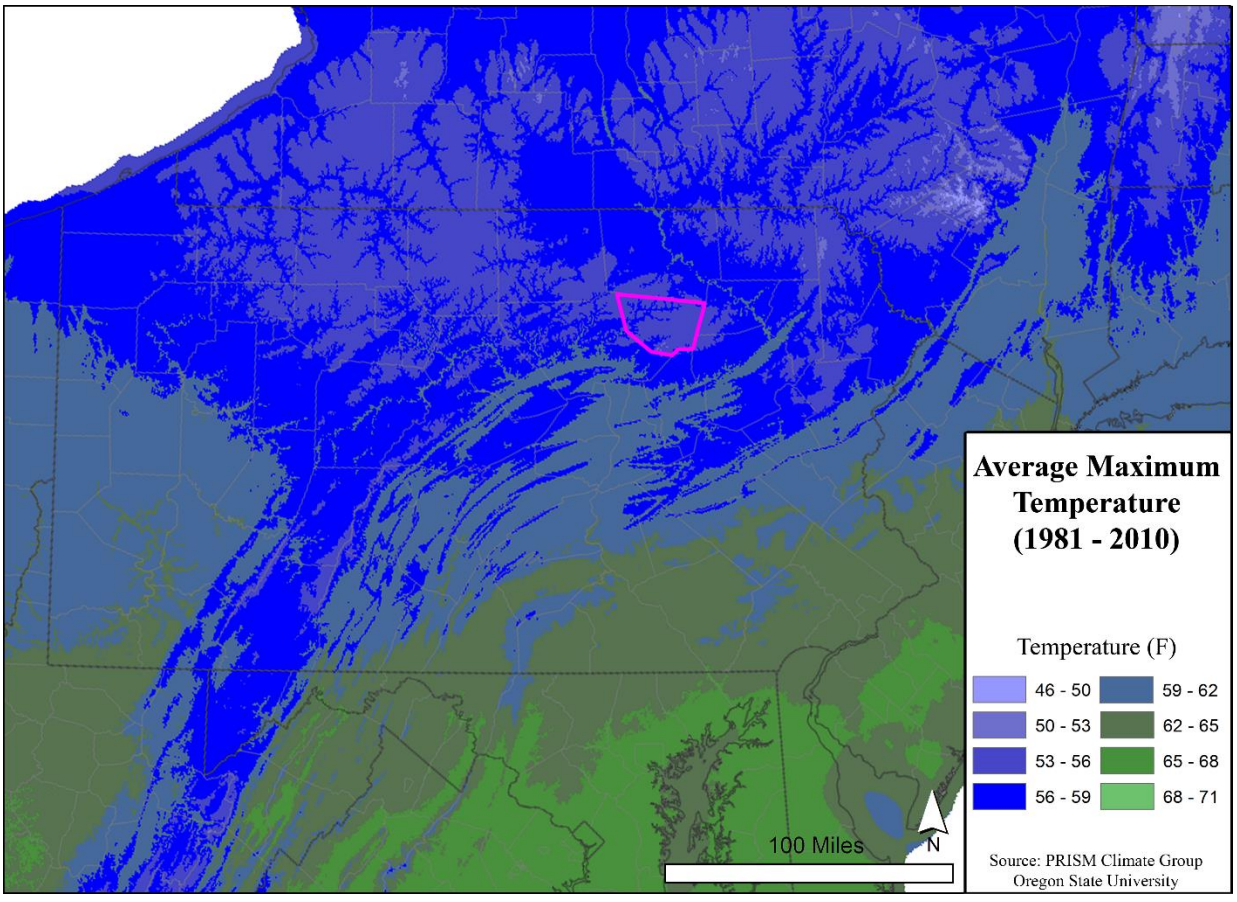
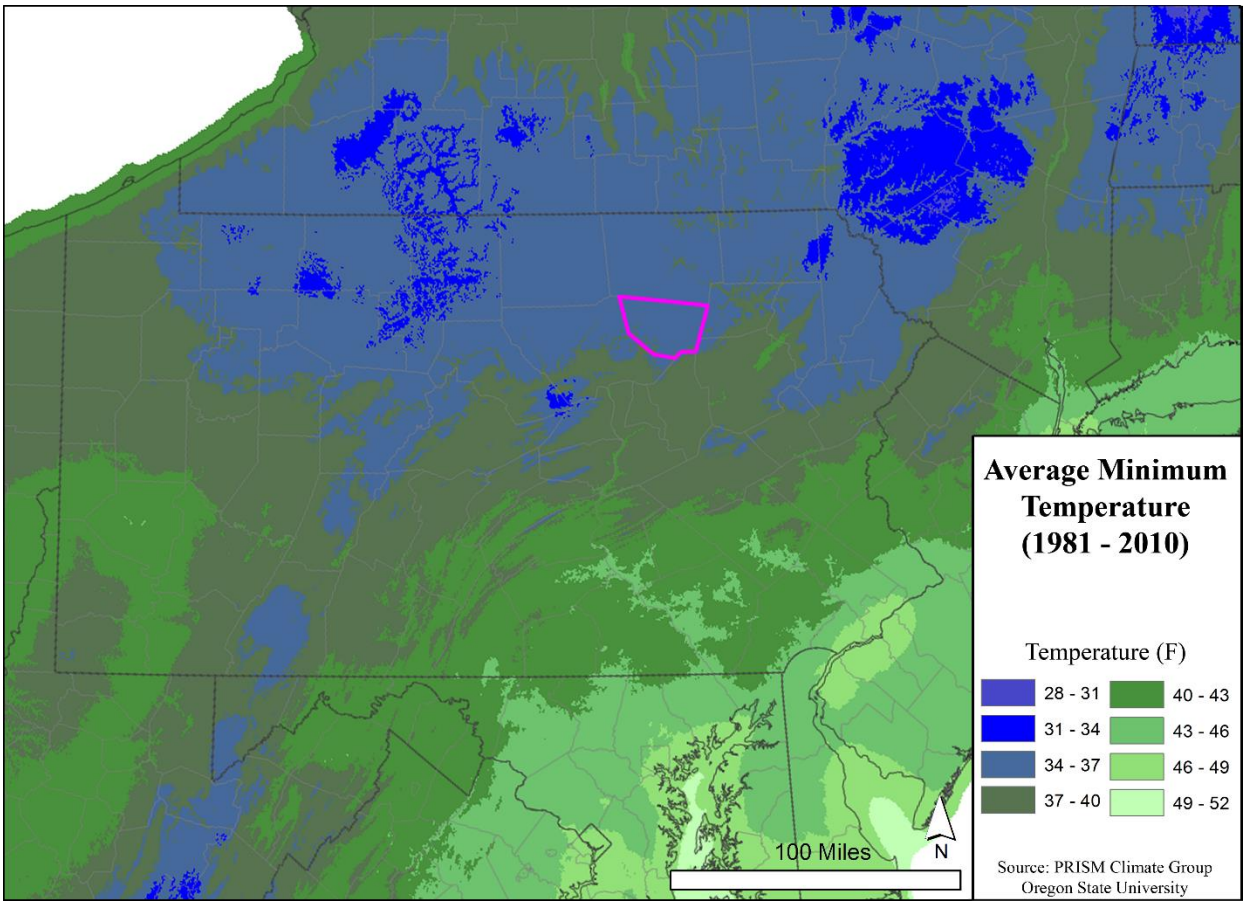


Figure 13 - Average Minimum Temperature



4.3.3.2 Range of Magnitude

When extreme temperature events occur, they typically impact the entirety of Sullivan County, including the surrounding region. Extreme heat is described as temperatures that hover at least 10ºF above the average high temperature for a region during the summer months. Extreme heat is responsible for more deaths in Pennsylvania than all other natural disasters combined. The apparent temperature of the air increases as relative humidity increases, and the National Weather Service created a Heat Index chart (*Figure 14 - National Weather Service Heat Index*) which shows the likelihood of heat disorders relative to the temperature and relative humidity. *Heat Advisories* are issued when the heat index will be equal to or greater than 100°F, but less than 105°F, *Excessive Heat Warnings* are issued when heat indices will attain or exceed 105°F, and *Excessive Heat Watches*, are issued when there is a possibility that excessive heat warning criteria may be experienced within twelve to forty-eight hours (NOAA NWS, 2010). A potential worst-case extreme temperature scenario would be if widespread areas of the Commonwealth experienced 90°F or higher temperatures for an extended number of days. The heat could

overwhelm the power grid and cause widespread blackouts, cutting off vital HVAC services for residents.

Extreme cold temperatures drop well below typical temperatures, and are often associated with winter storm events. Wind can make the apparent temperature drop further, and exposure to such extreme cold temperatures can cause hypothermia, frost bite and death. The National Weather Service created a wind chill chart *(Figure 15 - National Weather Service Wind Chill)* which shows the time frostbite takes to set in depending on temperature and wind speed. Wind chill warnings are issued when wind chills drop to -25°F or lower. Wind chill advisories are issued in the southeast and western sections of Pennsylvania when wind chill values drop to -10°F to -24°F. South-central to northern sections of the Commonwealth when wind chills drop to -15°F to -24°F (NOAA NWS, 2010).

Figure 14 - National Weather Service Heat Index

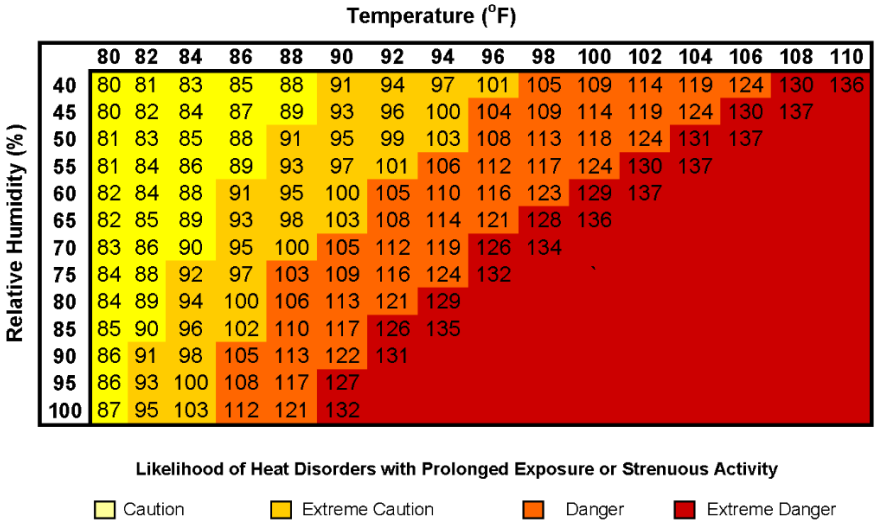
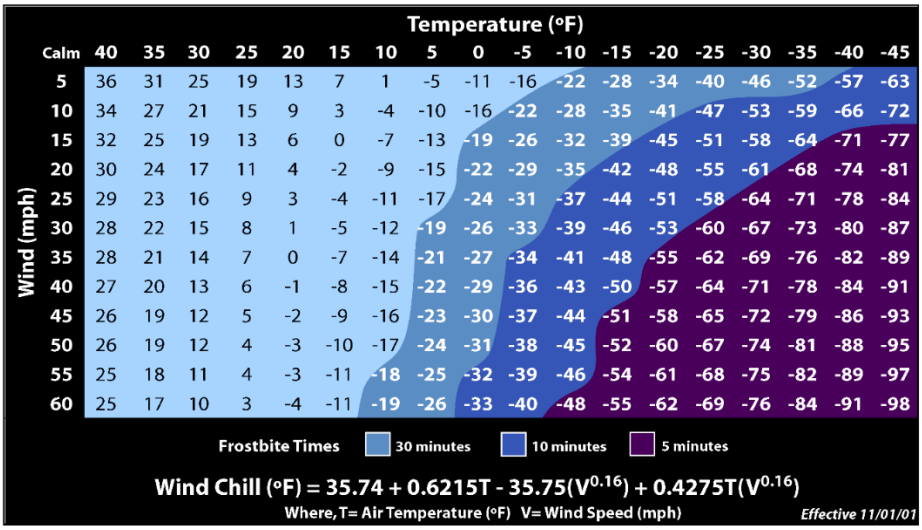


Figure 15 - National Weather Service Wind Chill



4.3.3.3 Past Occurrence

In the state of Pennsylvania, there have been 315 extreme temperature events between 1950 and 2013, resulting in 587 deaths and 530 injuries (NCDC, 2013). Of those events, 71 were extreme cold (27 deaths, 129 injuries), and 205 were extreme heat (560 deaths, 401 injuries) (NCDC, 2013). From 2004 until November 2018, there were fifteen extreme cold events reported to the NOAA NCEI Storm Events database (see *Table 18 - Extreme Temperature History).* While exact occurrence data for Sullivan County is somewhat limited below, it should be assumed that the county experienced the effects of extreme temperatures more than it has been documented – these instances serve as a sample of all events. The NOAA NCEI reports no extreme heat events for Sullivan County, which does not mean there have not been any extreme heat events that have impacted the County, and it likely represents a reporting bias for the County.

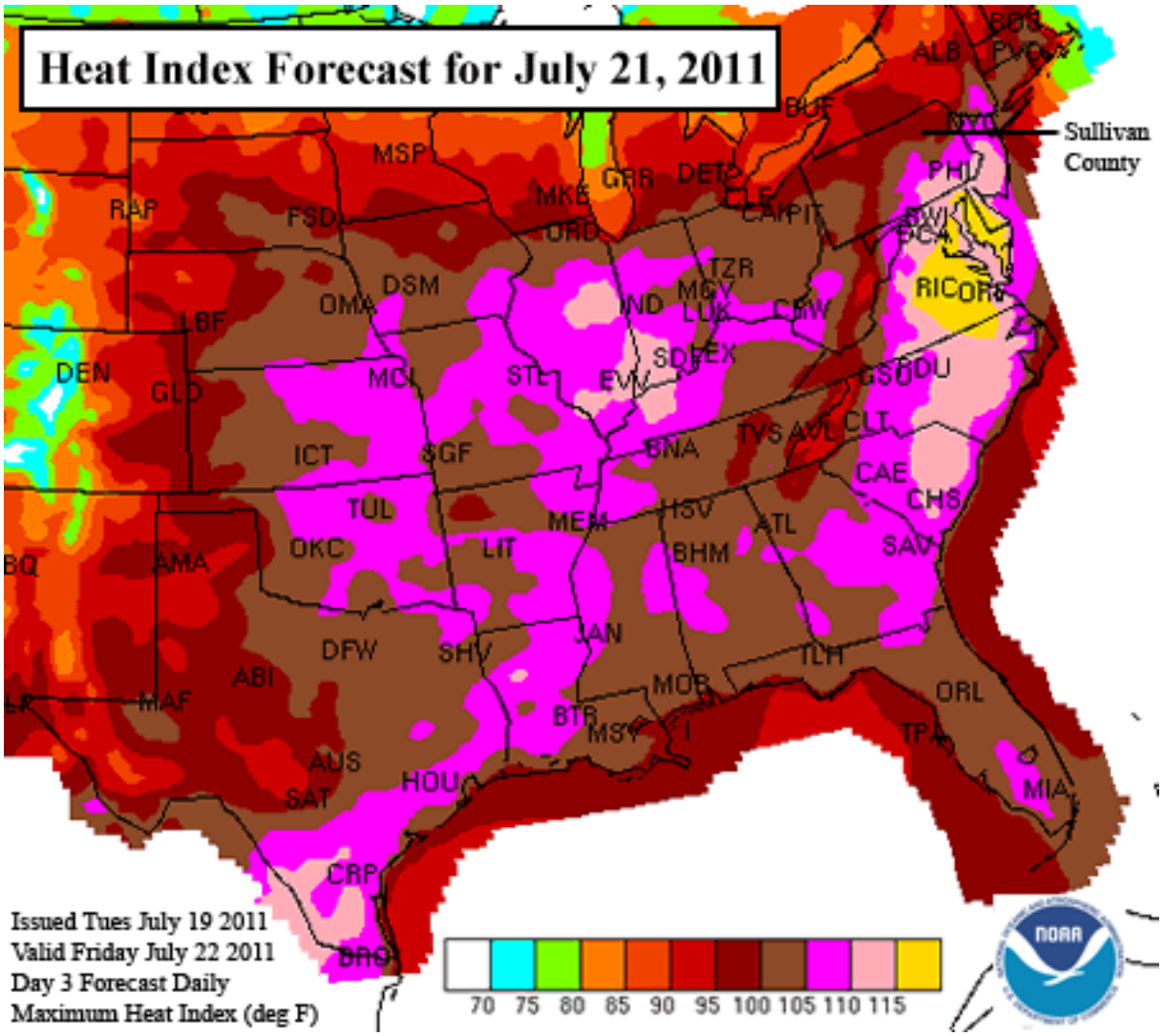
In 2011, Pennsylvania experienced record-breaking heat in nineteen counties and a total of forty-five broken heat records. *Figure 16 - Heat Index Forecast for July 21, 2011* shows the temperatures for July 21, 2011. Pennsylvania was again hit with record breaking temperatures on July 9, 2012 when daily record highs were broken in several cities in eastern Pennsylvania, including Harrisburg, Lancaster, and Chambersburg, which each reached 101 °F (38.3 °C).

Table 18 - Extreme Temperature History

Extreme Temperature History *(NCEI, 2018)*		
Date	**Type**	**Description**
12/20/2004	Cold/Wind Chill	
02/03/2007	Extreme Cold/Wind Chill	Temperatures within a few degrees of zero, combined with west winds of 10 to 20 mph, produced persistent wind chills of 15 to 20 degrees below zero, and occasionally dropping to between 25 and 30 degrees below zero during the overnight and early morning hours of the 5th.
02/16/2007	Extreme Cold/Wind Chill	West winds of 10 to 20 mph, combined with low temperatures in the single digits, produced wind chill readings around 15 degrees below zero.
03/06/2007	Extreme Cold/Wind Chill	Northwest winds of 20 to 25 mph, with gusts up to 40 mph, combined with cold temperatures to produce wind chills of 15 to 20 degrees below zero.
02/10/2008	Extreme Cold/Wind Chill	Bitterly cold temperatures combined with brisk west-northwest winds produced wind chills of ten to twenty degrees below zero. Arctic air combined with gusty winds produced wind chill values of ten to twenty degrees below zero from the evening of the 10th through the early morning on the 11th.
12/21/2008	Extreme Cold/Wind Chill	Blustery west winds combined with bitterly cold temperatures associated with an arctic air mass to produce frigid wind chills of fifteen to twenty degrees below zero across much of northern and western Pennsylvania.
01/15/2009	Extreme Cold/Wind Chill	An unusually strong arctic air mass brought sub-freezing temperatures and extreme wind chills too much of central Pennsylvania. This was one of the coldest air masses to affect the region in years. Overnight low temperatures fell to almost thirty below zero in some locations, while highs struggled to climb out of the single digits above and below zero. The cold outbreak closed or delayed many schools over the two to three-day period.
03/02/2009	Extreme Cold/Wind Chill	Wind chill readings of 15 to 25 degrees below zero were reported across Sullivan County.

Extreme Temperature History *(NCEI, 2018)*		
Date	**Type**	**Description**
01/06/2014	Extreme Cold/Wind Chill	The coldest air mass in nearly two decades brought extreme cold temperatures and dangerous wind chills to much of central Pennsylvania from January 6-8. Temperatures bottomed on the morning of the 7th with lows ranging from 0˚ to -20˚F with wind chills between -25˚ to -50F. The most recent comparable, though colder arctic outbreaks occurred in January 1994 and 1996 respectively. The arctic cold outbreak closed schools, set or tied low temperature records and prompted Gov. Tom Corbett to issue a "Proclamation of Propane and Heating Oil Emergency" to waive federal and state motor carrier regulations related to hours of service for drivers of commercial motor vehicles transporting propane gas and heating oil in Pennsylvania. The extreme cold outbreak caused serious logistical problems associated with the distribution and delivery of propane gas and heating oil within the state. Temperatures generally varied between -10˚ and -20˚F with wind chills around -40˚F in Sullivan County.
02/12/2015	Extreme Cold/Wind Chill	Extreme cold combined with gusty winds resulted in wind chill or apparent temperature values in the -25˚ to -35˚ range.
02/15/2015	Extreme Cold/Wind Chill	Extreme cold combined with gusty winds resulted in wind chill or apparent temperature values in the -25˚ to -35˚ range.
02/19/2015	Extreme Cold/Wind Chill	Extreme cold combined with gusty winds resulted in wind chill or apparent temperature values in the -25˚ to -35˚ range.
02/23/2015	Extreme Cold/Wind Chill	Extreme cold combined with gusty winds resulted in wind chill or apparent temperature values in the -25˚ to -35˚ range.
02/13/2016	Extreme Cold/Wind Chill	Observed minimum wind chill values ranged between -25˚F to -35˚F.
01/05/2018	Extreme Cold/Wind Chill	Observed minimum wind chills dipped to -25˚F to -30˚F.

Figure 16 - Heat Index Forecast for July 21, 2011



4.3.3.4 Future Occurrence

Extreme temperatures will continue to impact Sullivan County. Anthropogenic climate change is causing extreme climatic events to occur more frequently, suggesting that extreme temperatures are becoming a more threatening hazard as the impacts of climate change intensify. In recent years, record high temperatures have outnumbered record low temperatures 2:1 (Meehl et al., 2009) so it is expected that the risk of extreme heat will be amplified whereas the risk of extreme cold will be attenuated. This change is not evident in the reported past occurrence data for Sullivan County, however the discrepancy is likely due to reporting biases.

4.3.3.5 Vulnerability Assessment

Extreme temperatures are usually a regional hazard when they occur. The elderly and young people (27% and 11% of the county's population as of 2017, respectively) are most vulnerable to extreme temperatures due to mobility challenges and disabilities (United States Census Bureau, 2018). Extreme temperatures can increase the demand for utility services, often resulting in an increased cost to consumers. The increased expense can make it difficult for the consumer to afford the service. The increased demand for services may cause a decrease in availability of these services or failure of the system. A decrease or failure of the utility system during extreme temperature events puts a large population at great risk. Extreme temperature events can also drastically increase the volume of emergency calls, potentially overwhelming the Public Safety Answering Point. Extreme heat events may also contribute to drought conditions, which in turn increases the risk of wildfires.

4.3.4. Flood, Flash Flood and Ice Jams

4.3.4.1 Location and Extent

Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in Pennsylvania. Flooding events are generally the result 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. Flash floods are the most common type of flooding in Sullivan County. 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.

Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often then breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams. All forms of flooding can damage infrastructure.

Floodplains are lowlands adjacent to rivers, streams and creeks that are subject to recurring floods. The size of the floodplain is described by the recurrence interval of a given flood. Flood recurrence intervals are explained in more detail in Section 4.3.4.4. However, in assessing the potential spatial extent of flooding, it is important to know that a floodplain associated with a flood that has a 10% chance of occurring in a given year is smaller than the floodplain associated with a flood that has a 0.2% annual chance of occurring. The National Flood Insurance Program (NFIP) publishes digital flood insurance rate maps

(DFIRMs). These maps identify the 1% annual chance of flood area. Special flood hazard area (SFHA) and base flood elevations (BFE) are developed from the 1% annual chance flood event, as seen in *Figure 17 - Flooding and Floodplain Diagram*. Structures located in the SFHA have a 26% chance of flooding in a thirty-year period. The SFHA serves as the primary regulatory boundary used by FEMA, the Commonwealth of Pennsylvania and Sullivan County local governments. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply to the following high-risk special flood hazard areas in *Table 19 - Flood Hazard High Risk Zones*. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Sullivan County with vulnerable structures and critical facilities identified using the most current DFIRM data for Sullivan County dated 2014.

Past flooding events have been primarily caused by heavy rains which cause small creeks and streams to overflow their banks, often leading to road closures. Flooding poses a threat to critical facilities, agricultural areas, and those who reside or conduct business in the floodplain. The most significant hazard exists for facilities in the floodplain that process, use and/or store hazardous materials. A flood could potentially release and transport hazardous materials out of these areas. As the water recedes it would spread the hazardous materials throughout the area. Most flood damage to property and structures located in the floodplain is caused by water exposure to the interior, high velocity water and debris flow.

Figure 17 - Flooding and Floodplain Diagram

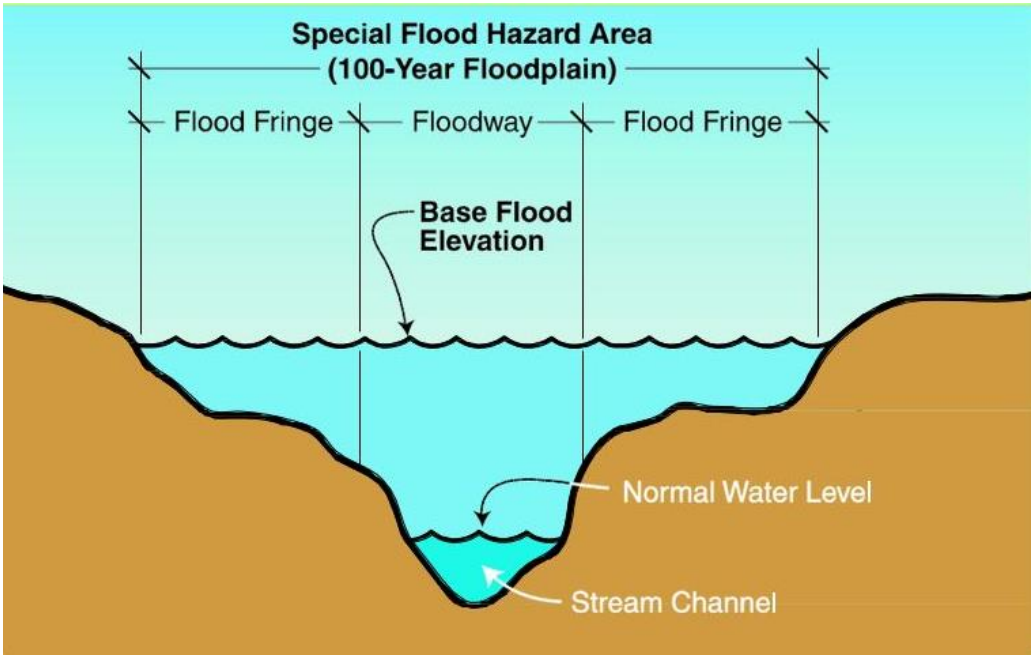


Table 19 - Flood Hazard High Risk Zones

Flood Hazard High Risk Zones *(FEMA, 2017)*	
Zone	**Description**
A	Areas subject to inundation by the 1% annual chance flood event. Because detailed hydraulic analyses have not been performed, no base flood elevations or flood depths are shown
AE	Areas subject to inundation by the 1% annual chance flood event determined by detailed methods. BFEs are shown within these zones.
AH	Areas subject to inundation by the 1% annual chance shallow flooding (usually areas of ponding) where average depths are 1-3 feet. BFEs derived from detailed hydraulic analysis are shown in this zone.
AO	Areas subject to inundation by the 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1-3 feet. Average flood depths derived from detailed hydraulic analysis are shown within this zone.
AR	Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection.

4.3.4.2 Range of Magnitude

The Loyalsock Creek is a major waterway that passes through Sullivan County - it is a tributary of the West Branch Susquehanna River. The majority of Sullivan County is covered by the Loyalsock Creek stormwater watershed. Muncy Creek is another tributary of the West Branch Susquehanna River and is the second largest stormwater watershed in Sullivan.

Several factors determine the severity of floods, including rainfall intensity and duration, topography, ground cover and rate of snowmelt. Water runoff is greater in areas with steep slopes and little to no vegetative ground cover. The mountainous terrain of Sullivan County can cause more severe floods as runoff reaches receiving water bodies more rapidly over steep terrain. Urbanization typically results in the replacement of vegetative ground cover with impermeable surfaces like asphalt and concrete, increasing the volume of surface runoff and stormwater, particularly in areas with poorly planned stormwater drainage systems. A large amount of rainfall over a short time span can cause flash floods. Additionally, small amounts of rain can cause floods in locations where the soil is frozen, saturated from a previous wet period, or if the area is rife with impermeable surfaces such as large parking lots, paved roadways and other developed areas. The county occasionally experiences intense rainfall from tropical storms in late summer and early fall which can potentially cause flooding as well.

Severe flooding can cause injuries and deaths and can have long-term impacts on the health and safety of the citizens. Severe flooding can also result in significant property damage, potentially disrupting the regular function of critical facilities and have long-term negative impacts on local economies. Industrial, commercial and public infrastruc-

ture facilities can become inundated with flood waters, threatening the continuity of government and business. The special needs population must be identified and located in flooding situations, as they are often home-bound. Mobile homes are especially vulnerable to high water levels. Flooding can have significant environmental impacts when flood waters release and/or transport hazardous materials and can also result in spreading diseases.

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

Severe flooding also comes with many secondary effects that could have long lasting impacts on the population, economy and infrastructure of Sullivan County. Power failures are the most common secondary effect associated with flooding. Coupled with a shortage of critical services and supplies, power failures could cause a public health emergency. Critical infrastructure, such as sewage and water treatment facilities, can be severely damaged, having a significant effect on public health. High flood waters can cause sewage systems to fail and overflow, contaminating groundwater and drinking water. Flooding also has the potential to trigger other hazards, such as landslides, hazardous material spills and dam failures.

The maximum threat of flooding in Sullivan County is estimated by looking at potential loss data and repetitive loss data, both analyzed in the risk assessment portion of the hazard mitigation plan. In these cases, the severity and frequency of damage can result in permanent population displacement, and businesses may close if they are unable to recover from the disaster.

Dushore Borough has the highest estimated potential loss due to flooding among Sullivan County municipalities at $14,627,771 in market value. Hillsgrove Township has the second highest estimated potential loss due to flooding at approximately $6,696,111 and also has the most repetitive loss properties (twelve). Davidson Township ranks third with $4,618,757 in market value. HAZUS software was used to estimate potential losses from a one-hundred-year flood event, and the full report can be found in Appendix F. Total building related economic loss from a one-hundred-year flood is expected to be approximately $53 million, with $31.7 million coming from residential homes. Residential occupancies account for nearly 60% of all flooding related losses as estimated by HAZUS.

Although floods can cause deaths, injuries and damage to property, they are naturally occurring events that benefit riparian systems which have not been disrupted by human actions. Such benefits include groundwater recharge and the introduction of nutrient rich sediment which improves soil fertility. However, human development often disrupts natural riparian buffers by changing land use and land cover, and the introduction of chemical or biological contaminants that often accompany human presence can contaminate habitats after flood events.

4.3.4.3 Past Occurrence

Sullivan County has experienced numerous flooding, flash flooding and ice jam flooding events in the past. The flooding and flash flooding were caused by a variety of heavy storms, tropical storms and other issues. A summary of flood event history for Sullivan County from 1996 until October 2018 is found in *Table 20 - Flood Event History*. Details of each event can be found in NOAA's NCEI Storm Events Database (www.ncdc.noaa.gov/stormevents).

Ice jam flooding has been reported on Muncy Creek and Loyalsock Creek in Laporte Township, and has negatively impacted three bridges in Forksville Borough. August and September 2018 were uncommonly wet for Pennsylvania, resulting in saturated soils and ripe conditions for flash flooding. Several locations in Sullivan County were reported as being subject to flash flooding, including Art McMahon Road, Airport Road, and Chaneey Road in Cherry Township.

Sullivan County experienced significant damage from the remnants of Tropical Storm Lee in 2011. Sonestown, Dushore and Hillsgrove all reported significant flooding. This flooding event is the record flood for the Loyalsock Creek. Approximately ten roads were closed in the county due to flooding from creeks and streams. A preliminary total of twenty-four buildings were destroyed, sixty-four suffered major damage and 144 suffered minor damage, making a total of 248 affected structures. Pennsylvania Governor Corbett requested a presidential declaration from President Obama on September 12, 2011 due to the excess of damage throughout the Commonwealth of Pennsylvania. A presidential disaster declaration was issued for individual assistance and public assistance on September 13, 2011.

Another severe flooding event occurred on October 21, 2016 when over eight inches of rain fell across the headwaters of Mill Creek, Elk Creek and the Hoagland Branch resulting in flash floods in Hillsgrove, Elkland and Fox Townships. Three primary residences and fourteen seasonal structures were destroyed, and the bridge over Mill Creek at Hillsgrove was destroyed, resulting in the closure of Route 87 until the bridge could be replaced. Several other roads and bridges were damaged in the flooding, and the Sullivan County EMA estimated the total damage to be $2 million and the Storm Events database lists the final property damage total at $7 million.

Table 20 - Flood Event History

Flood Event History ***(NOAA, 2018)***			
Location	**Date**	**Type**	**Property Damage ($USD)**
Countywide	01/19/1996	Flash Flood	0
Sullivan County	01/19/1996	Flood	0
Countywide	12/01/1996	Flash Flood	0

Flood Event History *(NOAA, 2018)*			
Location	**Date**	**Type**	**Property Damage ($USD)**
Countywide	12/13/1996	Flash Flood	0
Countywide	01/08/1998	Flash Flood	0
Countywide	12/17/2000	Flash Flood	0
Hillsgrove	09/24/2001	Flash Flood	0
Dushore	05/13/2002	Flash Flood	0
Laporte	07/31/2004	Flash Flood	0
Sullivan County	09/17/2004	Flood	0
Sullivan County	03/29/2005	Flood	0
Countywide	06/27/2006	Flash Flood	0
Countywide	06/28/2006	Flood	0
Laporte	11/16/2006	Flash Flood	0
Shunk	03/05/2008	Flood	0
Shunk, Hugos Corners	01/25/2010	Flood, Snow Melt	0
Thorndale, Laporte	03/06/2011	Flood	0
Sonestown	03/10/2011	Flood	0
Dushore	04/26/2011	Flash Flood	1,830,000
Colley, Whellerville	08/28/2011	Flash Flood, Tropical System	2,000,000
Colley, Cherry Mills	09/07/2011	Flood	0
Dushore, Nordmont	09/07/2011	Flash Flood	0
Dushore, Nordmont	09/07/2011	Flash Flood	0
Hillsgrove	10/21/2016	Flash Flood	7,000,000

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. The hazard mitigation assistance (HMA) definition of a repetitive loss property is a structure covered by a contract for flood insurance made available under the NFIP that has incurred flood-related damage on two occasions, in which the cost of the repair, on the average, equaled or exceeded twenty five percent of the market value of the structure at the time of each such flood event; and at the time of the second incidence of flood-related damage, the contract for flood insurance contains in-creased cost of compliance coverage.

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 September 30, 2018, there are twenty-one repetitive loss properties and no severe repetitive loss properties in Sullivan County. This is a slight increase from 2014 when there were seventeen repetitive loss properties, but still no severe repetitive loss properties.

Most municipalities in Sullivan County participate in the NFIP except for Eagles Mere Borough. Information on each participating municipality is located in *Table 22 - Municipal NFIP Policies & Vulnerability*.

Table 21 - Repetitive Loss Properties

Repetitive Loss Properties (PEMA, 2018)					
Community Name	**Comm. Num.**	**Total Building Payments**	**Total Contents Payments**	**Losses**	**Properties**
Davidson Township	422060	$ 266,837.20	$ 16,278.69	16	6 Residential
Forksville Borough	420811	$ 98,557.65	$ 35,365.72	9	3 Residential
Hillsgrove Township	422064	$ 710,787.60	$ 219,003.60	29	11 Residential 1 Non-Res
Total		**$ 1,076,182.45**	**$ 270,648.01**	**54**	**20 Residential 1 Non-Res**

Table 22 - Municipal NFIP Policies & Vulnerability

Municipal NFIP Policies & Vulnerability *(PEMA, 2018; Sullivan Co. GIS, 2018)*				
Community Name	**Community Number**	**Losses**	**Active Contracts**	**Vulnerable Buildings**
Cherry Township	422058	3	1	27
Colley Township	422059	1	3	27
Davidson Township	422060	36	19	192
Dushore Borough	420810	4	11	57
Eagles Mere Borough	Not Participating	0	0	0
Elkland Township	422061	3	5	45
Forks Township	422062	8	10	47
Forksville Borough	420811	20	2	67
Fox Township	422063	2	6	40
Hillsgrove Township	422064	67	18	97
Laporte Borough	422057	0	1	14
Laporte Township	422065	0	2	25
Shrewsbury Township	422066	2	0	9
Total		**146**	**78**	**647**

4.3.4.4 Future Occurrence

Table 23 - Flood Probability Summary (FEMA)

Flood Recurrence Intervals	Annual Chance of Occurrence
10-year	10.00%
50-year	2.00%
100-year	1.00%
500-year	0.20%

Flooding is a frequent problem throughout Pennsylvania. Sullivan County will certainly be impacted by flooding events in the future – Sullivan County experiences some degree of flooding annually. The threat of flooding is compounded in the late winter and early spring months, as melting snow can overflow streams, creeks and tributaries, increasing the amount of groundwater, clogging stormwater culverts and bridge openings. The NFIP recognizes the 1%-annual-chance flood, also known as the base flood or one-hundred-year flood, as the standard for identifying properties subject to federal flood insurance purchase requirements. A 1%-annual-chance flood is a flood which has a 1% chance of occurring over a given year, or is likely once every one hundred years. The digital flood insurance rate maps (DFIRMs) are used to identify areas subject to the 1% annual-chance flooding. A property's vulnerability to a flood is dependent upon its location in the floodplain. Properties along the banks of a waterway are the most vulnerable. The property within the floodplain is broken into sections depending on its distance from the waterway. The ten-year flood zone is the area that has a ten percent chance of being flooded every year. However, this label does not mean that this area cannot flood more than once every ten years. It just designates the probability of a flood of this magnitude every year. Further away from this area is the fifty-year flood-plain. This area includes all of the ten-year floodplain plus additional property. The probability of a flood of this magnitude occurring during a one-year period is two percent. A summary of flood probability is shown in *Table 23 - Flood Probability Summary (FEMA)*.

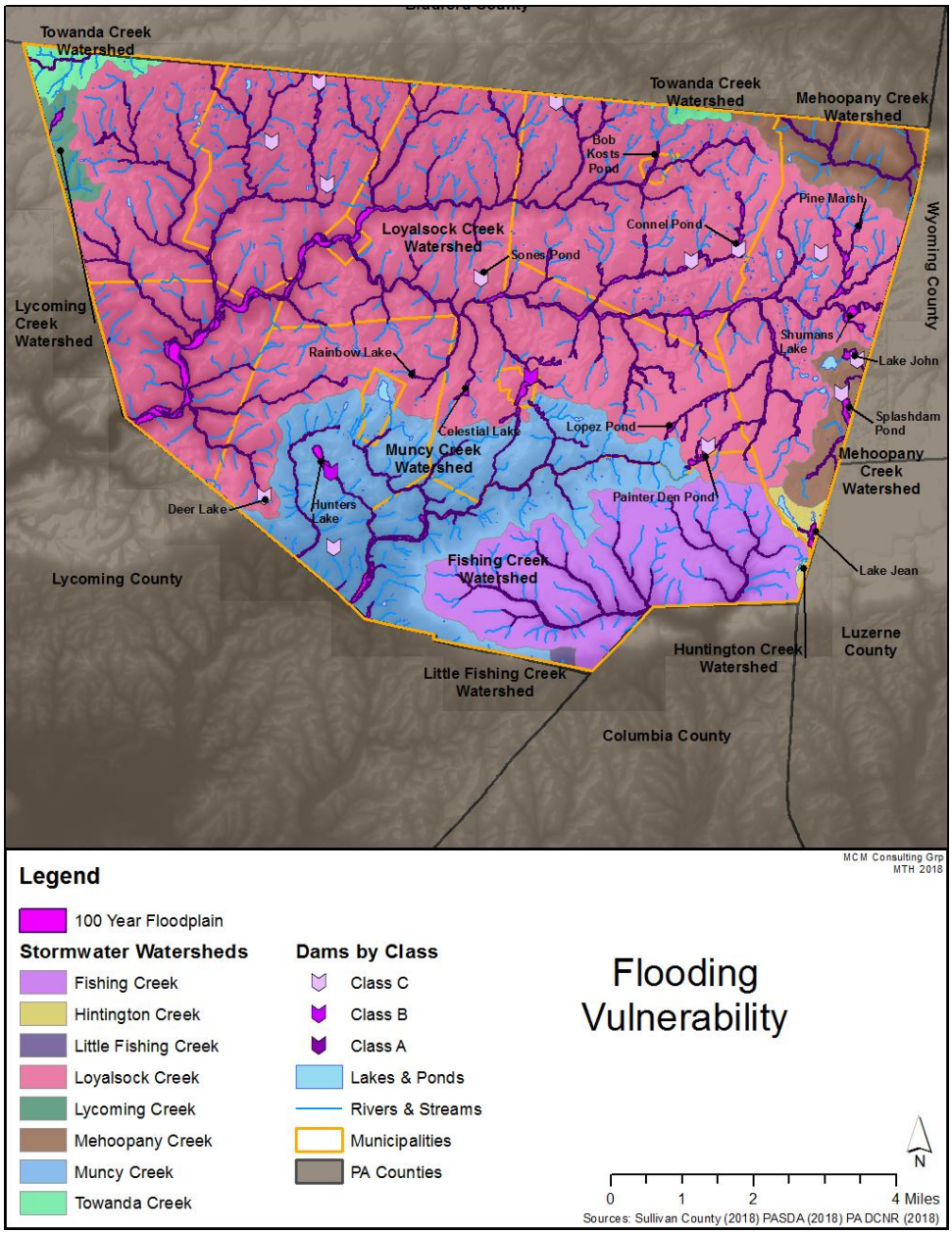
4.3.4.5 Vulnerability Assessment

Sullivan County is vulnerable to flooding events. Flooding puts the entire population at some level of risk, whether through the flooding of homes, businesses, places of employment, or the road, sewer and water infrastructure. *Table 22 - Municipal NFIP Policies & Vulnerability* identifies how many structures located in the special flood hazard area by municipality using county GIS data. It's important to note that the building dataset used for this analysis is a dataset of digitized building footprints, so it includes non-addressable structures such as barns, garages, and other out-buildings. Critical facilities are facilities that if damaged would present an immediate threat to life, public health and safety. Appendix D of this hazard mitigation plan includes a flooding vulnerability map for each municipality in Sullivan County with vulnerable structures and critical facilities identified. There are two critical facilities that are located within the special flood hazard area, all located within Dushore Borough (see *Table 24 - Critical Facilities Vulnerable to Flooding*)

Table 24 - Critical Facilities Vulnerable to Flooding

Critical Facilities Vulnerable to Flooding *(Sullivan Co GIS, 2018; PEMA, 2018)*			
Type	**Name**	**Municipality**	**Address**
Fire Company	Dushore Fire Company Station 57	Dushore Borough	212 Julia St
Government Building	Sullivan County Library	Dushore Borough	206 Center St

Figure 18 - Flooding Vulnerability



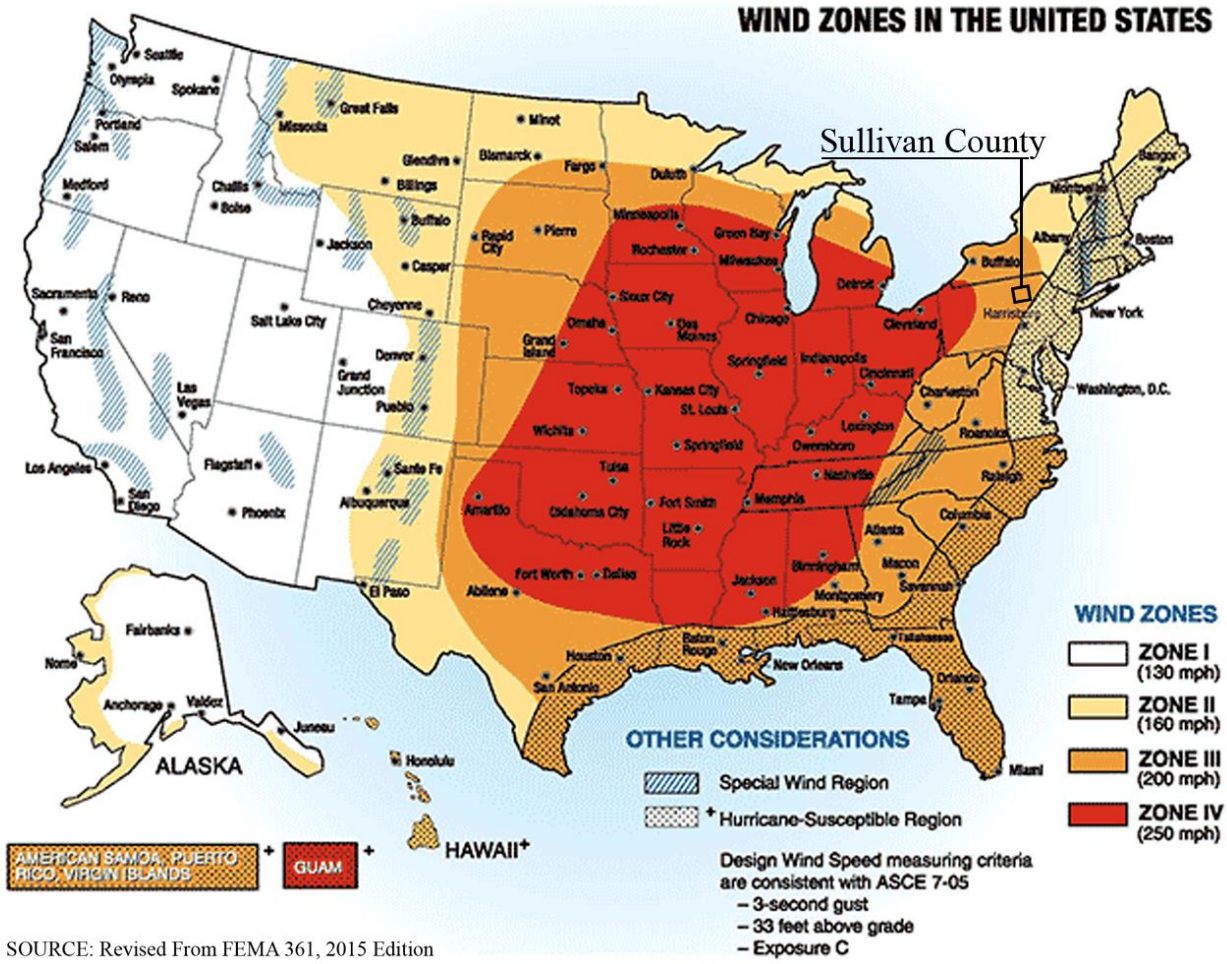
4.3.5. Hurricane, Tropical Storms

4.3.5.1 Location and Extent

Tropical depressions are cyclones with maximum sustained winds of less than thirty-nine miles per hour (mph). The system becomes a tropical storm when the maximum sustained winds reach between thirty-nine to seventy-four miles per hour. When wind speeds exceed seventy-four mph, the system is considered a hurricane. Tropical storms impacting Sullivan County develop in tropical or sub-tropical waters found in the Atlantic Ocean, Gulf of Mexico, or Caribbean Sea. Another type of tropical storm is nor'easters, which are large cyclones that rotate clockwise and are typically associated with the Atlantic Ocean and the East Coast of the United States between North Carolina and Massachusetts. The name nor'easter comes from the direction that the strongest winds typically blow from the cyclone.

While Sullivan County is located over one hundred and fifty miles inland of the East Coast of the United States, tropical storms can track inland and cause heavy rainfall and strong winds. Sullivan County is located just inland of the East Coast region designated by FEMA as being Hurricane-Susceptible (see *Figure 19 - Wind Zones*). Sullivan County falls within the wind Zone III, which suggests that shelters and critical facilities should be able to withstand a 3-second gust of wind up to 200 miles per hour (*Figure 19 - Wind Zones*). All communities within Sullivan County are equally subject to the impacts of hurricanes and tropical storms that track near the county. Areas in Sullivan County which are subject to flooding, wind and winter storm damage are particularly vulnerable.

Figure 19 - Wind Zones



SOURCE: Revised From FEMA 361, 2015 Edition

4.3.5.2 Range of Magnitude

Table 25 - Saffir-Simpson Scale

Saffir-Simpson Hurricane Scale		
Category	Wind Speed	
	mph	knots
5	≥156	≥135
4	131-155	114-134
3	111-130	96-113
2	96-110	84-95
1	74-95	65-83
Non-Hurricane Classifications		
Tropical Storm	39-73	34-64
Tropical Depression	0-38	0-33

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 (*Table 25 - 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 Sullivan County). Categories 3, 4, and 5 are classified as "major" hurricanes. While major hurricanes comprise only twenty of all tropical cyclones making landfall, they account for over seventy percent of the damage in the United States. While hurricanes can cause high winds and associated impacts, it is also important to recognize the potential for flooding events during hurricanes, tropical storms and nor'easters; the risk assessment and associated impact for flooding events is included Section 4.3.4.5.

4.3.5.3 Past Occurrence

Table 26 - Coastal Storms Impacting Sullivan County lists all coastal storms that have impacted Sullivan County from 1970 to September 2018. Although impacts of tropical storms are commonly felt in the Commonwealth, it is rare that a hurricane would track through Sullivan County.

Hurricane Agnes was a severe coastal storm event in 1972 that impacted Sullivan County. After making first landfall as a hurricane near Panama City, Florida, Agnes weakened and exited back into the Atlantic off the North Carolina coast. The storm skirted along the coast, and made a second landfall near New York City as a tropical storm and merged with an extra-tropical low-pressure system over northern Pennsylvania. This brought extremely heavy rains to Pennsylvania, with a concentration of rain in the Susquehanna River Basin. Pennsylvania incurred $2.1 billion in damages and 48 deaths statewide. Fire and flood destroyed 68,000 homes and 3,000 businesses, and left 220,000 Pennsylvanians homeless. The event triggered a Presidential Disaster Declaration for the region.

In 2004 Tropical Storm Ivan caused extensive flooding as well, also resulting in a Presidential Disaster Declaration for regions in Pennsylvania. The Ivan event produced flooding somewhat less than 100-year event crests in some locations.

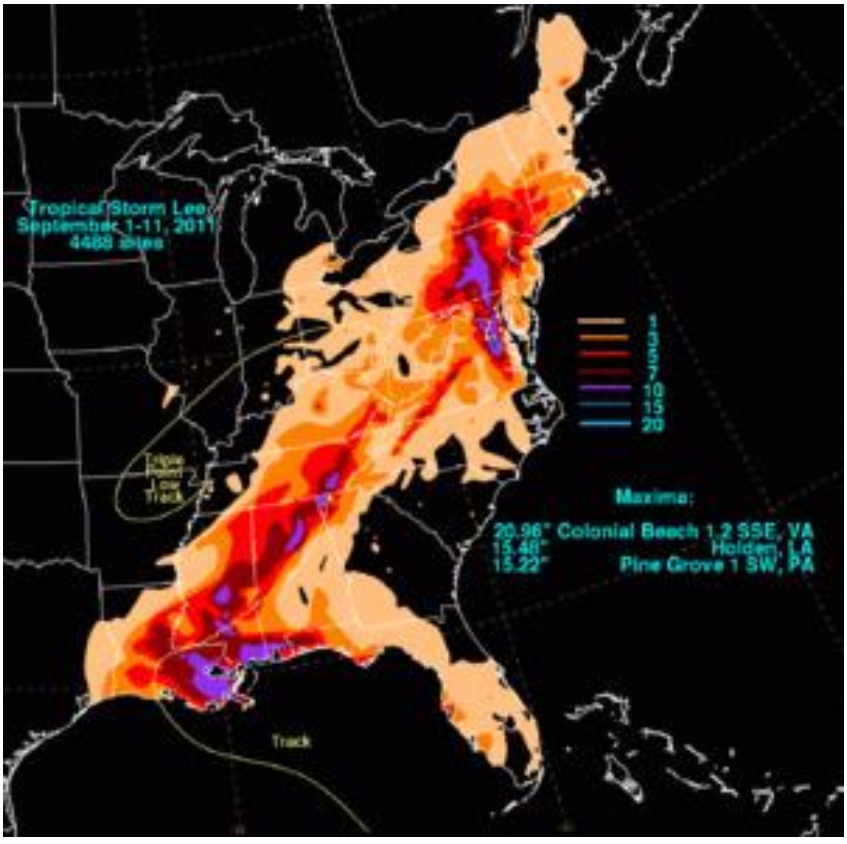
Table 26 - Coastal Storms Impacting Sullivan County

History of Coastal Storms Impacting Sullivan County	
Year	**Name**
1972	Tropical Storm Agnes
1999	Hurricane Floyd
2003	Tropical Storm Henri
2003	Tropical Storm Isabel
2004	Tropical Depression Frances
2004	Tropical Depression Ivan
2005	Hurricane Katrina
2006	Tropical Depression Ernesto
2008	Hurricane Ike
2011	Hurricane Irene
2011	Tropical Storm Lee
2012	Hurricane Sandy
2017	Tropical Storm Cindy

Tropical Storm Lee in September of 2011 was the most severe tropical storm to impact Sullivan County, causing significant flooding and damage (see *Figure 20 - Tropical Storm Lee Rainfall Totals*). The village of Sonestown was almost completely destroyed by Tropical Storm Lee, and a dam on Birch Creek in the village of Mildred collapsed, causing a large swath of damage along US Route 220.

Hurricane Sandy was the deadliest and most destructive hurricane of the 2012 Atlantic hurricane season, and the second-costliest hurricane in US history. Sandy was a Category 3 storm at its peak intensity when it made landfall in Cuba. It was classified as a Category 2 storm off the coast of the Northeastern United States, but because of the unusual merge with a frontal system, the hurricane was termed "Superstorm Sandy." At least 285 people were killed along the path of the storm in seven countries. In the United States, there were seventy-two people killed with an additional eighty-seven fatalities as indirect result of the storm. Superstorm Sandy caused an estimated $65 billion in damages in the United States alone.

Figure 20 - Tropical Storm Lee Rainfall Totals

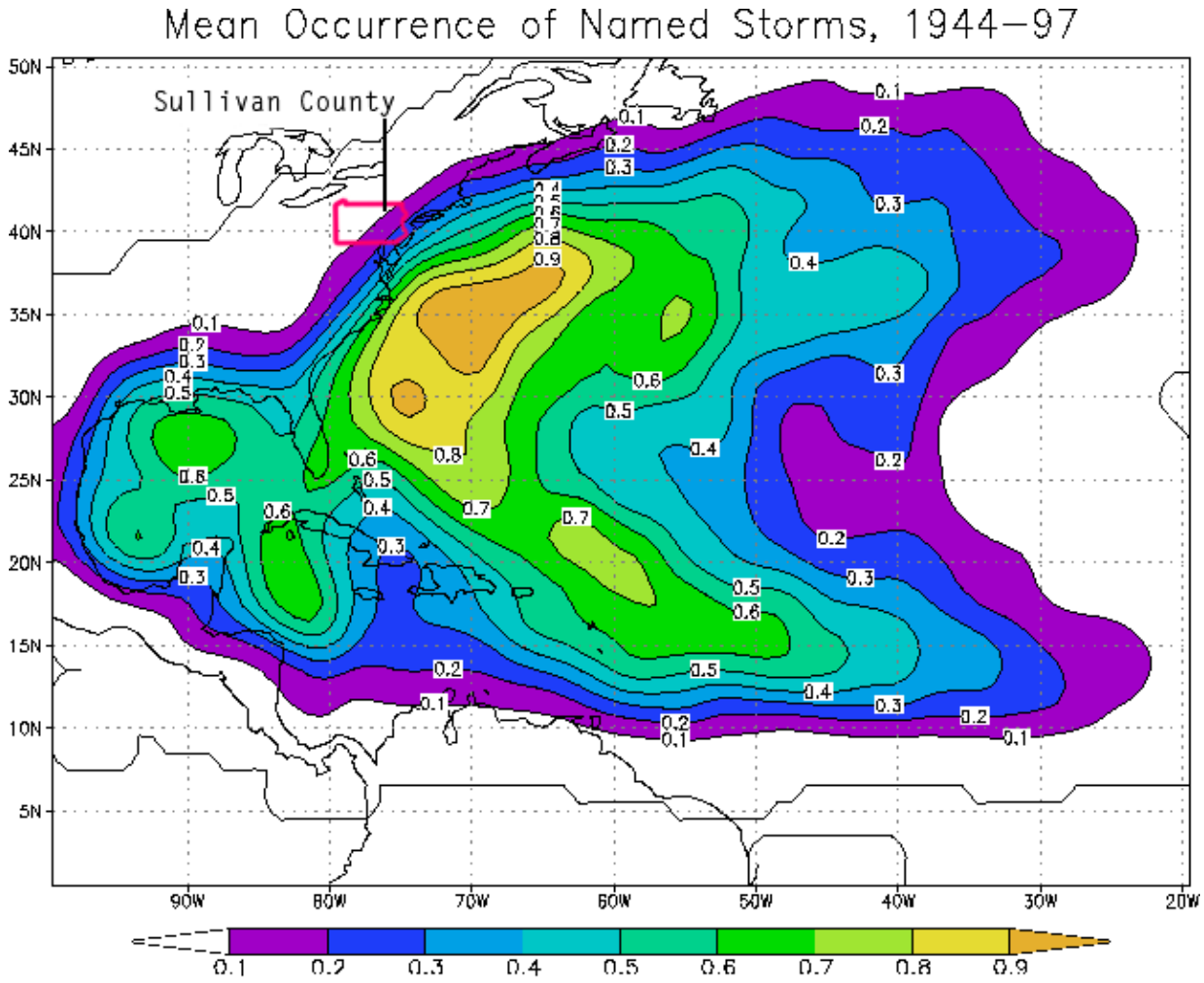


4.3.5.4 Future Occurrence

Although hurricanes and tropical storms can cause flood events consistent with 100- and 500-year flood lev-

els, the probability of occurrence of hurricanes and tropical storms is measured relative to wind speed. *Table 27 - Annual Probability of Wind Speeds* shows the annual probability of winds that reach the strength of tropical storms and hurricanes in Sullivan County and the surrounding areas based on a sample period of forty-six years. NOAA's Hurricane Research Division estimates that Sullivan County will experience impacts from a named tropical storm or hurricane up to once every ten years, with a probability between 0 and 10% annually (*Figure 21 - Mean Occurrence of Named Storms 1944-1997)*. However according to FEMA, there is a high probability each year that Sullivan County will experience winds from coastal storms that could cause minimal to moderate damages (*Table 27 - Annual Probability of Wind Speeds*). The probability of winds exceeding 118 mph is less than .1% annually.

Figure 21 - Mean Occurrence of Named Storms 1944-1997



Average number of tropical storms and hurricanes that affect the area throughout the hurricane season. The data used was from 1944 to 1997 and counted hits when a storm or hurricane was within ~100 miles (165km).

Source:NOAA Hurricane Research Division 2015

Table 27 - Annual Probability of Wind Speeds

Annual Probability of Wind Speeds (FEMA, 2000)		
Wind Speed (mph)	**Saffir-Simpson Scale**	**Annual Probability of Occurrence (%)**
45-77	Tropical Storms// Category 1 Hurricane	91.59
78-118	Category 1 to 2 Hurricanes	8.32
119-138	Category 3 to 4 Hurricanes	.0766
139-163	Category 4 to 5 Hurricanes	.0086
164-194	Category 5 Hurricanes	.00054
195+	Category 5 Hurricanes	.00001

Climate change is causing atmospheric temperatures to rise, which corresponds to a rise in ocean surface temperatures, resulting in warmer and moister conditions where tropical storms develop (Stott et al., 2010). Warmer oceans store more energy, and are capable of fueling stronger storms and it is projected that Atlantic hurricanes will become more intense and produce more precipitation as ocean surface temperatures rise (Trenberth, 2010). There are expected to be more category 4 and 5 hurricanes in the Atlantic, and the hurricane season may be elongating. Sullivan County can be affected by Atlantic coastal storms, so the county should be prepared to deal with impacts of coastal storms more frequently in the future.

4.3.5.5 Vulnerability Assessment

Tropical storms tracking nearby Sullivan County can still cause high winds and heavy rains. A vulnerability assessment for hurricanes and tropical storms focuses on the impacts of flooding and severe wind. The assessment for flood-related vulnerability is addressed in Section 4.3.4.5 and discussion of wind related vulnerability is addressed in Section 4.3.12.5.

4.3.6. Invasive Species

4.3.6.1 Location and Extent

An invasive species is a species that is not indigenous to a given ecosystem and that, when introduced to a non-native environment, tends to thrive. The spread of an invasive species often alters ecosystems, which can cause environmental and economic harm and pose a threat to human health. The phenomena of invasive species is due to human activity. Human society is globalized, and people have the capability to traverse the globe at rates unparalleled in the history of the Earth. Either intentionally or unintentionally, other species may accompany people when they travel, introducing the stowaway species

to a novel ecosystem. In a foreign ecosystem, a transported species may thrive, potentially restructuring the ecosystem and threatening its health. Common pathways for invasive species introduction to Pennsylvania include (PA DOA, 2010):

- Contamination of internationally traded products
- Hull fouling
- Ship ballast water release
- Discarded live fish bait
- Intentional release
- Escape from cultivation
- Movement of soil, compost, wood, vehicles or other materials and equipment
- Unregulated sale of organisms
- Smuggling activities
- Hobby trading or specimen trading

Invasive species threats are typically divided into two main subsets:

Aquatic Invasive Species (AIS) are nonnative, invertebrates, fishes, aquatic plants, and microbes that threaten the diversity or abundance of native species, the ecological stability of the infested waters, human health and safety, or commercial, agriculture, or recreational activities dependent on such waters.

Terrestrial Invasive Species (TIS) are nonnative plants, vertebrates, arthropods, or pathogens that complete their lifecycle on land whose introduction does or is likely to cause economic or environmental harm or harm to human health.

The location and extent of invasive threats is dependent on the preferred habitat of the species, as well as the species' ease of movement and establishment. *Table 28 - Prevalent Invasive Species* lists invasive species that have been found in Sullivan County.

4.3.6.2 Range of Magnitude

Some invasive species are not considered agricultural pests, and do not harm humans or cause significant ecological problems. Other invasive species can have many negative impacts and cause significant changes in the composition of ecosystems. For example, the Emerald Ash Borer has a ninety-nine percent mortality rate for any ash tree it infects. Didymo, an aggressive form of algae not yet found in Sullivan County, can clog waterways and smother native aquatic plants and animals.

The aggressive nature of many invasive species can cause significant reductions in biodiversity by crowding out native species. This can affect the health of individual host organisms as well as the overall well-being of the affected ecosystem. An example of a worst-case scenario for invasive species is the success of the Emerald Ash Borer in Sullivan County and the surrounding region. The Emerald Ash Borer has already become established in Sullivan County and the surrounding region, and there is a high mortality rate for trees associated with this pest. Hardwood forests in the county have been negatively impacted due to this invasive species and there have been many ash tree fatalities.

Degradation of forest health which cascades into other problems. Among other benefits, forests prevent soil degradation and erosion, protect watersheds, and sequester carbon from the atmosphere. Forests have a key role in hydrologic systems, so losing a forest amplifies the effects of erosion and flooding. Forest degradation also has adverse economic effects, impacting such activities as logging, tourism, foraging and other production activities dependent on lumber.

The magnitude of an invasive species threat is generally amplified when the ecosystem or host species is already stressed, such as in times of drought. The already weakened state of the native ecosystem causes it to more easily succumb to an infestation.

4.3.6.3 Past Occurrence

Invasive species have been entering Pennsylvania since the arrival of European settlers. There are large swatches of public forested land in Sullivan County, including the Loyalsock State Forest, Worlds End State Park, Ricketts Glen State Park and several State Game Lands. There are many invasive plants that are widespread in Sullivan County that are common problems throughout the Commonwealth, some of the most problematic include:

- Garlic Mustard
- Japanese Stiltgrass
- Multiflora Rose
- Japanese Barberry

Because these species are so established and widespread, they are not often actively treated unless they are in a project area that is receiving attention otherwise. In the past these species have been cut back to slow their spread, and treated with foliar herbicide when they re-sprout.

There are several invasive pests that have moved through Sullivan County and the surrounding region which have resulted in the deaths of many trees. PennDOT summarizes these invasive species:

> *Pennsylvania has been inhabited by an invasive beetle known as the Emerald Ash Borer. This green-colored insect has infested many ash trees, which has resulted in a pandemic level of dead ash trees. In addition, the Gypsy Moth Caterpillar defoliated Western Pennsylvania at least twice within the last twenty years. This insect infested the oak tree species and many of those trees have died as well. The Wooly Adelgid and needle blight fungi are also currently affecting the white pine and hemlock trees, resulting in their premature deaths. (PennDOT, 2017)*

These occurrences represent lost battles to invasive species, and these species are widespread in Sullivan County and the surrounding region. Once a species is established in an area and it causes a change in the ecology, it is quite difficult if somewhat futile to turn back the clock on the prevalence of the species, however Sullivan County can work towards mitigating the negative impacts of such widespread invasive species. In the case

of the Emerald Ash Borer and other tree killing invasive species, PennDOT has identified one way that the threat needs to be mitigated in the wake of the surge of dead trees:

> *[The Emerald Ash Borer, Gypsy Moth and Wooly Adelgid] have left … tens of thousands of dead trees either within the State Department of Transportation's (PennDOT) right-of-way or on private property, but within close proximity to falling on our highways. Although random in nature, several fatalities have been associated with trees falling on motorists or motorists running into downed trees across the highway…*
>
> *PennDOT has been incorporating select tree removal into roadway construction projects using both federal and state funding. Since July 1, 2016, PennDOT Department Force Crews have also increased their efforts in select manual tree removal. This work is often done during the winter when crews are not engaged in snow removal operations. Dead tree removal is quickly becoming a major focus of PennDOT, however a sustained funding source to remove all of these potential hazards is simply not available. The PA Department of Agriculture has established strict firewood and lumber quarantine areas in some of these districts so additional costs may be incurred.*

Table 28 - Prevalent Invasive Species lists problematic non-native species that are established in Sullivan County. While all species listed here are not native to Sullivan County, those species highlighted in yellow pose a larger ecological threat than some of the others (see 4.3.5.5. Vulnerability Assessment for additional discussion). For some species such as the European Bark Beetle, the Sirex Woodwasp and the Larch Sawfly, Sullivan County is on the edge of the species range, meaning control efforts taken in the county can help limit the propagation of the threat even beyond the county (*Table 29 - Vulnerable Species*).

Table 28 - Prevalent Invasive Species

Prevalent Invasive Species *(EDDMaps, 2018; PA DCNR, 2018; USDA FS, 2018; iMapInvasives, 2018)*		
Common Name	**Scientific Name**	**Type**
Bush Honeysuckles (Exotic)	Lonicera spp.	Plant
Canada Thistle	Cirsium arvense	Plant
Common Yarrow	Achillea millefolium	Plant
Garlic Mustard	Alliaria petiolata	Plant
Japanese Barberry	Berberis thunbergii	Plant
Japanese Stiltgrass, Nepalese Browntop	Microstegium vimineum	Plant
Meadow Timothy	Phleum pratense	Plant
Morrow's Honeysuckle	Lonicera morrowii	Plant
Multiflora Rose	Rosa multiflora	Plant
Reed Canary Grass	Phalaris arundinacea	Plant
Tatarian Honeysuckle	Lonicera tatarica	Plant
Emerald Ash Borer	Agrilus planipennis	Insect
European Bark Beetle (H.Opacus)	Hylastes opacus	Insect

Prevalent Invasive Species *(EDDMaps, 2018; PA DCNR, 2018; USDA FS, 2018; iMapInvasives, 2018)*		
Common Name	**Scientific Name**	**Type**
Gypsy Moth	Lymantria dispar	Insect
Hemlock Woolly Adelgid	Adelges tsugae	Insect
Japanese Beetle	Popillia japonica	Insect
Larch Sawfly	Pristiphora erichsonii	Insect
Maple Petiole Borer	Caulocampus acericaulis	Insect
Sirex Woodwasp	Sirex noctilio	Insect
Beech Bark Disease Complex		Disease
Butternut Canker	Sirococcus clavigignenti-juglandacearum	Disease
Chestnut Blight	Cryphonectria parasitica	Disease
Elongate Hemlock Scale	Fiorinia externa	Disease
White Pine Blister Rust	Cronartium ribicola	Disease
Marshpepper Knotweed; Smartweed	Persicaria hydropiper	Aquatic Plant
Common Carp	Cyprinus carpio	Aquatic Animal
Freshwater Jellyfish	Craspedacusta sowerbyi	Aquatic Animal
Japanese Mysterysnail	Cipangopaludina japonica	Aquatic Animal

4.3.6.4 Future Occurrence

According to the Pennsylvania Invasive Species Council (PISC), the probability of future occurrence for invasive species threats is growing due to the increasing volume of transported goods, increasing efficiency and speed of transportation, and expanding international trade agreements. Expanded global trade has created opportunities for many organisms to be transported to and establish themselves in new counties and regions. Climate change is contributing to the introduction of new invasive species. As maximum and minimum seasonal temperatures change, pests are able to establish themselves in previously inhospitable climates. This also gives introduced species an earlier start and increases the magnitude of their growth, possibly shifting the dominance of ecosystems in the favor of nonnative species.

In order to combat the increase in future occurrences, the PISC (a collaboration of state agencies, public organizations and federal agencies) released the Invasive Species Management Plan in April of 2010, and updated the plan in 2017. The plan outlines the Commonwealth's goals for managing the spread of nonnative invasive species and creates a framework for responding to threats through research, action, and public outreach and communication. More information can be found at invasivespeciescouncil.com.

There are several invasive species that are found near Sullivan County but have not yet been detected inside the county (see *Table 29 - Vulnerable Species*). Especially in cases like this, control efforts, heightened awareness, and public outreach and education can help prevent an invasive species from becoming established. Once a species is established, it is much more difficult to eradicate it from an ecosystem meaning prevention is

very important. Autumn Olive, Mile-A-Minute Vine and Japanese Knotweed are widespread and highly problematic in nearby counties but have not been reported in Sullivan. The forests of Sullivan County would greatly benefit if these species can be kept out of the area.

For a more inclusive list of invasive plants found in Pennsylvania and a list of invasive plants on the Pennsylvania watch list, see the referenced PA DCNR publication "DCNR Invasive Plants" (PA DCNR, 2016). Species highlighted in yellow were identified as priority species for prevention (see 4.3.6.5. vulnerability assessment for more additional discussion).

Table 29 - Vulnerable Species

Vulnerable Species *(EDDMaps, 2018; PA DCNR, 2018; USDA FS, 2018; iMapInvasives, 2018)*		
Common Name	**Scientific Name**	**Type**
Amur Honeysuckle	Lonicera maackii	Plant
Autumn Olive	Elaeagnus umbellata	Plant
European common reed	Phragmites australis ssp. australis	Plant
Giant Hogweed	Heracleum mantegazzianum	Plant
Japanese Honeysuckle	Lonicera japonica	Plant
Japanese Knotweed	Reynoutria japonica	Plant
Mile-A-Minute Vine	Persicaria perfoliata	Plant
Oriental Bittersweet	Celastrus orbiculatus	Plant
Poison Hemlock	Conium maculatum	Plant
Purple Loosestrife	Lythrum salicaria	Plant
Sweetflag, Calamus	Acorus calamus	Plant
Touch-Me-Not Bittercress	Cardamine impatiens	Plant
Tree-Of-Heaven	Ailanthus altissima	Plant
Yellow Iris	Iris pseudacorus	Plant
Asian Long-Horned Beetle	Anoplophora glabripennis	Insect
Birch Leafminer	Fenusa pusilla	Insect
European Pine Needle Midge	Contarinia baeri	Insect
European Pine Sawfly	Neodiprion sertifer	Insect
Imported Willow Leaf Beetle	Plagiodera versicolora	Insect
Larch Casebearer	Coleophora laricella	Insect
Mountain Ash Sawfly	Pristiphora geniculata	Insect
Pear Sawfly	Caliroa carasi	Insect
Smaller European Elm Bark Beetle	Scolytus multistriatus	Insect
Spotted Lanternfly (Lycorma)	Lycroma delicatula	Insect
Dogwood Anthracnose	Discula destructiva	Disease
Dutch Elm Disease	Ophiostoma novo-ulmi	Disease

Vulnerable Species *(EDDMaps, 2018; PA DCNR, 2018; USDA FS, 2018; iMapInvasives, 2018)*		
Common Name	**Scientific Name**	**Type**
Oak Pit Scale A. Minus	Asterolecanium minus	Disease
Oak Wilt	Ceratocystis fagacearum	Disease
American Water Lotus	Nelumbo lutea	Aquatic Plant
Eurasian Water-Milfoil	Myriophyllum spicatum	Aquatic Plant
Water Speedwell	Veronica anagallis-aquatica	Aquatic Plant
Watercress	Nausturtium officinale	Aquatic Plant
Asiatic Clam	Corbicula fluminea	Aquatic Animal

4.3.6.5 Vulnerability Assessment

Sullivan County's vulnerability to invasion depends on the species in question. Human activity and mobility are ever increasing, and combined with the prospects of climate change, invasive species are becoming increasingly threatening. Invasive species can have adverse economic effects by impacting agriculture and logging activities. Natural forest ecosystems provide clean water, recreational opportunities, habitat for native wildlife, and places to enjoy the tranquility and transcendence of nature. The balance of forest ecosystems and forest health are vulnerable to invasive species threats. While there are significant portions of State Forest, State Parks and Game Lands in Sullivan County where forest managers can impact invasive species, private lands can provide refuge for invasive species if landowners are unaware of or apathetic towards the threat.

An interesting facet of the invasive species problem in Pennsylvania is that deer do not eat many invasive plants, giving invasive species a competitive advantage over the native species that fall prey to deer. As such, the management of deer populations in Sullivan County has a significant impact on the vulnerability of an ecosystem to invasive species, where overpopulation of deer favors invasive species.

There are five primary components to managing invasive plants:

Prioritize: Public use areas such as state parks and other healthy forest ecosystems should be prioritized over developed and private areas. Locations with lower densities of invasive plants are often easier to control and should be given quick attention. Locations where humans are disturbing the landscape opens up niche space, and often times the aggressive invasive species move in faster than native species. Such locations include: road work, ditch/culvert work, logging activities, stream improvement/stabilization and bridge work. Some species pose a higher risk than others - invasive species are easiest to control before they become widespread and established in an area, and for that reason, species that are less widespread should be prioritized for management.

The Spotted Lanternfly was not reported to be present in Sullivan County according to the databases surveyed in this report (EddMaps, iMapInvasives, Alien Pest Explorer)

however members of the local government identified the species as a threat. The Spotted Lanternfly (Lycorma) could be early in its colonization of Sullivan County, meaning management actions could be highly beneficial.

Furthermore, it is best to take action before a species can become established in the County, so management should be aware of invasive species found nearby Sullivan County but are not yet present in the County (priority species in *Table 29 - Vulnerable Species*). Public outreach and education is important for these species in order to improve identification and prevention of invasion. The Asian Long-horned Beetle first attacks red maple trees, followed by many other hardwoods by boring half inch holes through the trees, weakening them structurally and causing limbs to break off, ultimately killing trees. Sullivan County has many red and sugar maple trees, so if the Asian Long-horned Beetle ever became established in the county, it could spread quickly and have a devastating impact.

Locate: Detailed locations should be recorded for invasive plants so sites can be easily relocated, treated and monitored.

Delineate: The scale and extent of the infestation should be recorded and mapped so that the progress of the infestation can be monitored.

Control: Methods of control depend on the specific infestation, but the most common approaches are mechanical (cutting and hand-pulling) and chemical (herbicide treatments).

Monitor: Identified sites should be monitored and revisited as often as several times in a growing season (depending on the location/species). Monitoring can allow for early detection of spreading infestations. Most importantly, it prevents a relapse towards full-blown infestation.

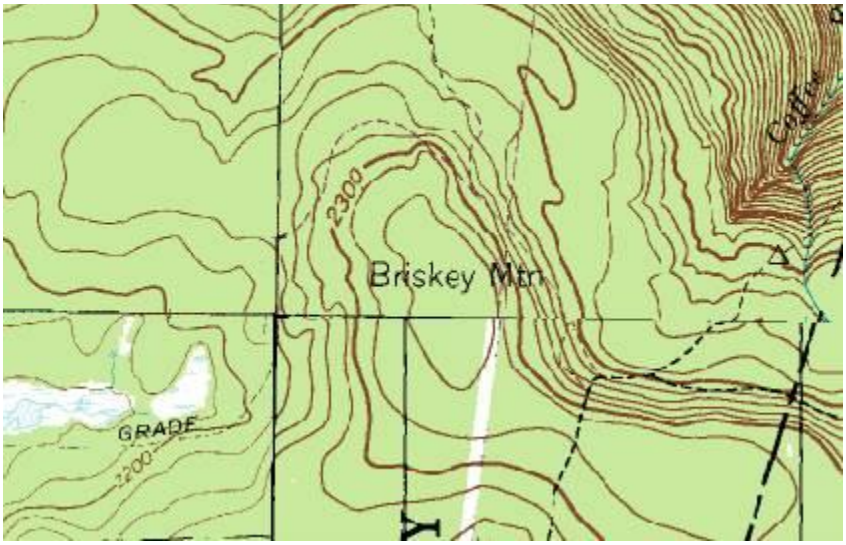
4.3.7. Landslides

4.3.7.1 Location and Extent

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

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

Figure 22 - Briskey Mountain



Elevation in Sullivan County ranges from 2,593 feet at North Mountain in Davidson Township, to 770 feet on the Loyalsock Creek at the Lycoming County line. These elevations are characterized as gently folded and faulted sedimentary rocks. ***Error! Reference source not found.*** shows Briskey Mountain, near the town of Lopez, PA located at latitude- longitude of N 41.50174 W -76.24521.

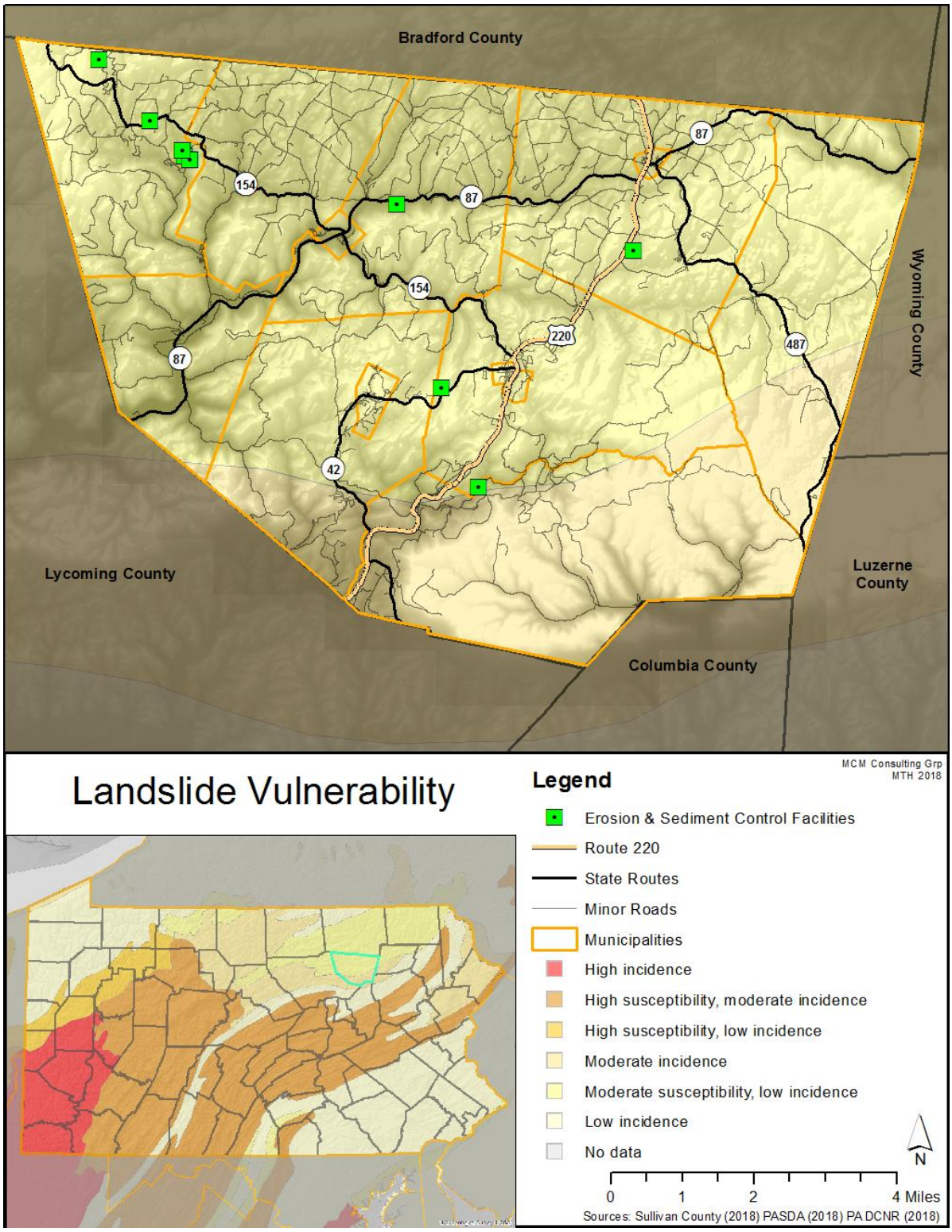
4.3.7.2 Range and Magnitude

Landslides can cause damage to utilities as well as transportation routes, resulting in road closure or travel delays. Fortunately, deaths and injuries due to landslides are rare in Pennsylvania and Sullivan County. Most reported deaths due to landslides have occurred when rockfalls or other slides along highways have involved vehicles. The most traveled highways in Sullivan County include U.S. Route 220 and State Routes 154, 487,

2002, 2003 and 3009. Storm-induced debris flows can also sometimes cause death and injury. As residential and recreational development increases on and near steep mountain slopes, the hazard from these rapid events will also increase. Most Pennsylvania landslides are moderate to slow moving and damage property rather than people.

The Pennsylvania Department of Transportation 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 ten million per year is spent on landslide repair contracts across the Commonwealth and a similar amount is spent on mitigation costs for grading projects. A number of highway sites in Pennsylvania are in need of permanent repair at estimated costs of $300,000 to $2 million each (DCNR, 2010). The USGS identifies the southern quarter of Sullivan County as falling into a low incidence zone for landslides, with the northern three quarters of the County considered to be a moderate susceptibility but low incidence zone (see *Figure 23 - Landslide Vulnerability*). Areas that are susceptible to landslides are geologically prone to giving way after significant precipitation events.

Figure 23 - Landslide Vulnerability



4.3.7.3 Past Occurrence

No comprehensive list of landslide incidents in Sullivan County is available, as there is no formal reporting system in place. PennDOT and municipal maintenance departments are responsible for slides that inhibit the flow of traffic or damage to roads and bridges, but they can generally only repair the road itself and right-of-way areas. There is one recorded landslide that was reported to the Knowledge Center which occurred on December 4, 2015 in Forks Township.

4.3.7.4 Future Occurrence

The majority of Sullivan County is not at high risk for landslides, however mismanaged development in steeply sloped areas would increase the frequency of occurrence of landslides. Road cuts are the most common development that puts an area at a heightened probability of a slide. The PA Department of Environmental Protection has an Erosion and Sediment (E&S) program that sets requirements for development projects of a certain scale that are intended to mitigate erosion, which are similar practices to prevent causing landslides.

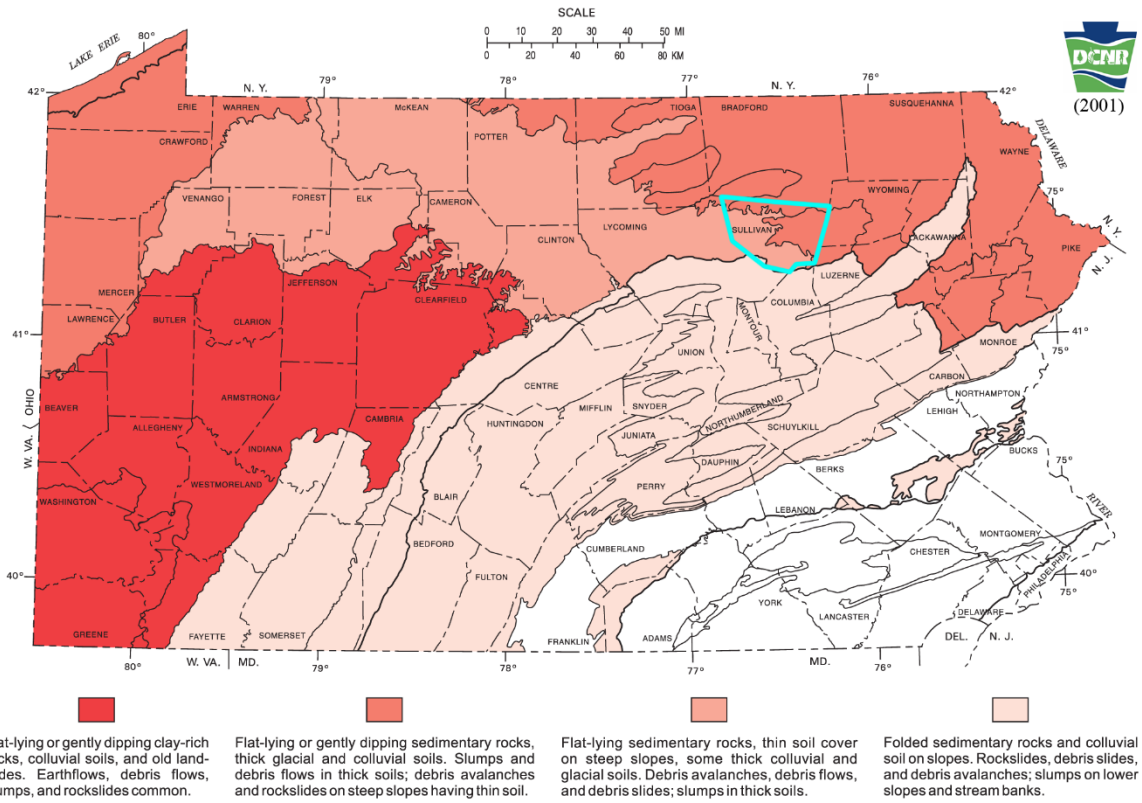
4.3.7.5 Vulnerability Assessment

Landslides are often precipitated by other natural hazards such as earthquakes or floods, and a serious landslide can cause millions of dollars in damages. Continued enforcement of floodplain management and proper road and building construction helps to mitigate the threat of landslides. Floodplain management is important where mining has occurred within close proximity to watercourses and associated flat-lying areas. Surface water may permeate into areas that still have open fractures and the build-up of surface water in fractures could lead to unexpected flood events.

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

- On or close to steep hills
- Areas of steep road cuts or excavations
- Steep areas where surface run-off is channeled
- Fan shaped areas of sediment and rock accumulations
- Evidence of past sliding such as tilted utility lines, tilted trees, cracks in the ground and irregularly surfaced ground.

Figure 24 - Landslide Rock Type



Flat-lying or gently dipping clay-rich rocks, colluvial soils, and old landslides. Earthflows, debris flows, slumps, and rockslides common.

Flat-lying or gently dipping sedimentary rocks, thick glacial and colluvial soils. Slumps and debris flows in thick soils; debris avalanches and rockslides on steep slopes having thin soil.

Flat-lying sedimentary rocks, thin soil cover on steep slopes, some thick colluvial and glacial soils. Debris avalanches, debris flows, and debris slides; slumps in thick soils.

Folded sedimentary rocks and colluvial soil on slopes. Rockslides, debris slides, and debris avalanches; slumps on lower slopes and stream banks.

The distribution of types of landslides most likely to occur in different geologic settings in Pennsylvania. Stream-bank slumps, soil creep, and rockfall/rockslide combinations on cut slopes can occur throughout Pennsylvania.

4.3.8. Lightning Strike

4.3.8.1 Location and Extent

Lightning is a massive electrostatic discharge between electrically charged regions within clouds, or between a cloud and the Earth's surface. The charged regions within the atmosphere temporarily equalize themselves through a lightning flash, commonly referred to as a strike if it hits an object on the ground. There are three primary types; from a cloud to itself (intra-cloud or IC); from one cloud to another cloud (CC) and finally between a cloud and the ground (CG). Although lightning is always accompanied by the sound of thunder, distant lightning may be seen but be too far away for the thunder to be heard. Lightning occurs approximately 40–50 times a second worldwide, resulting in nearly 1.4 billion flashes per year. Nearly as many people lose their lives to lightning strikes as they do tornadoes.

Lightning is a natural part of many ecosystems, introducing necessary fires. However, lightning can also ignite fires that are dangerous to human property and threaten human

lives. While fire from lightning strikes can be natural, it is important to not let it get out of control for human society to thrive.

Sullivan County is subject to lightning strikes and thunderstorm activity throughout the year, but the most active time for lightning strikes is from early spring to early fall seasons. While the impact of lightning events is highly localized, strong storms can result in numerous widespread events over a broad area within Sullivan County. Impacts of an event can be serious or widespread if lightning strikes a particularly significant location such as a power station or large public venue.

4.3.8.2 Range of Magnitude

Severe thunderstorms can cause significant damage and be life threatening. It is estimated that Sullivan County gets 25 to 32 days per year with lightning. Lightning can cause severe injury and can be fatal. Case histories of those struck by lightning can experience, loss of consciousness, amnesia, paralysis, burns, heart damage, inflated lungs and brain damage. Deaths and injuries to livestock and other animals, thousands of forest and brush fires, as well as millions of dollars in damage to buildings, communications systems, power lines, and electrical systems are also the result of lightning. The county's radio communications towers are located at high elevations and are vulnerable to lightning strike. A lightning strike to a radio tower could cripple emergency communications and prevent the swift deployment of police, fire, and rescue resources.

Between 1959 and 1994, Pennsylvania ranked third among all states in the United States with 644 lightning related casualties (deaths and injuries). This represents approximately five percent of lightning related casualties that occurred throughout the U.S. over that thirty-five-year period. Pennsylvania ranked first among all states in the U.S. with 1,441 damage reports, however it is unclear what the total dollar value is for these damages (NOAA NWS, 1997).

NOAA recommends that when thunder roars, go indoors! Thunderstorms are categorized by their physical characteristics and because there is a continuous spectrum of storms in the sky, it is difficult to sometimes place a storm into a specific category. NOAA describes five types of storms which can be seen in *Table 30 - Types of* Thunderstorms.

Table 30 - Types of Thunderstorms

Types of Thunderstorms	
Type	**Classification**
Ordinary or Single Cell Storm	Single cell storms are short lived, and usually not severe.
Pulse Storm	A Pulse Storm is a single-cell thunderstorm that is usually not strong; when it is of substantial intensity, it produces severe weather for short periods of time. Such a storm weakens and then generates another short burst or pulse.

Types of Thunderstorms	
Type	**Classification**
Multicellular Cluster	This type is the most common storm, consisting of a group of ordinary cells at various stages of the thunderstorm life cycle.
Multicellular Line	This category is a long line of storms with a continuous, well developed gust front along the leading edge.
Supercell	A supercell is a highly organized thunderstorm with an extremely strong updraft. They exhibit persistent storm-scale rotation of the updraft-downdraft couplet or mesocyclone.

4.3.8.3 Past Occurrence

Thunderstorms and lightning occur many times each year in Sullivan County (see *Table 31 - Sullivan County Annual Lightning Strikes*). Between 2003 and 2012, lightning has been responsible for eleven deaths and 312 injuries in Pennsylvania, and Pennsylvania ranked 26th in the United States in Cloud-To-Ground flash densities. During 2012, the National Lightning Detection Network (NDLN) recorded 393,759 Cloud-To-Ground flashes in Pennsylvania. According to data gathered by the NDLN between 2008 and 2017, Sullivan County experiences an estimated three to six lightning flashes per square mile each year (see *Figure 26 - Flash Density*). Nationally, fatalities from lightning strikes have decreased since the 1940s, but remain a threat, causing an average of twenty-seven deaths per year nationally over the last ten years (see *Table 31 - Sullivan County Annual Lightning Strikes*).

Table 31 - Sullivan County Annual Lightning Strikes

Sullivan County Annual Lightning Strikes *(2014 HMP)*			
Year	**Lightning Strikes**	**Year**	**Lightning Strikes**
1995	90	**2004**	216
1996	101	**2005**	180
1997	74	**2006**	248
1998	123	**2007**	246
1999	138	**2008**	207
2000	192	**2009**	164
2001	104	**2010**	96
2002	100	**2011**	262
2003	102	**2012**	287

Figure 25 - National Annual Lightning Fatalities

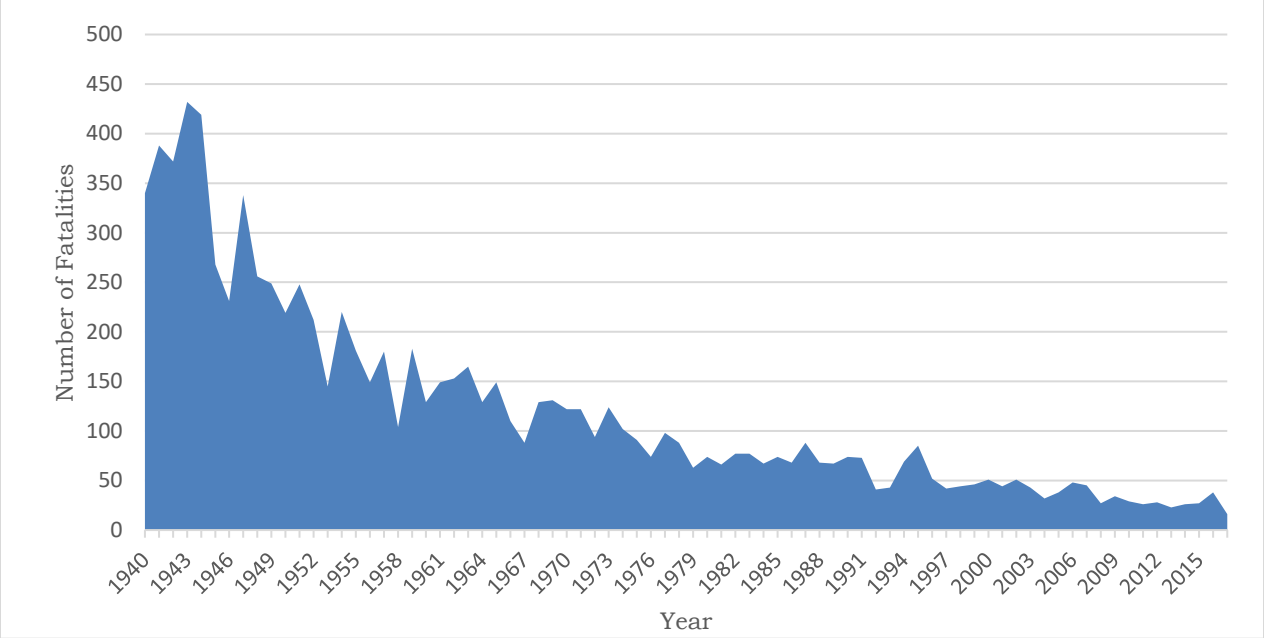
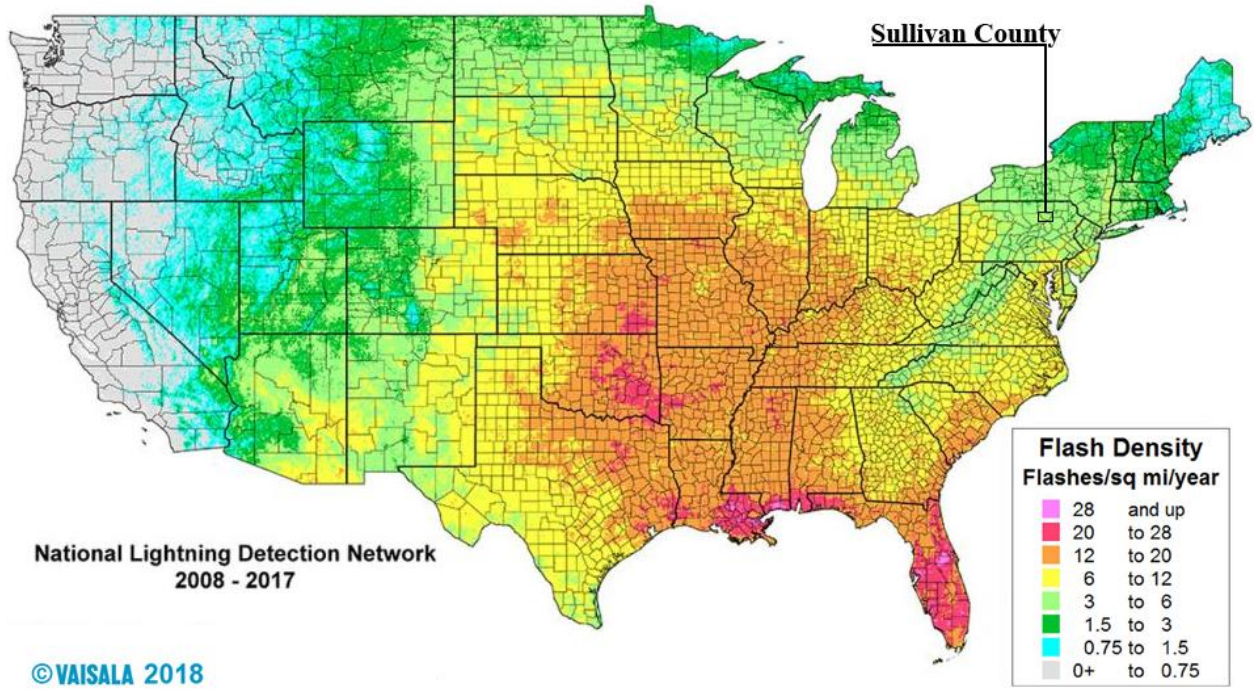


Figure 26 - Flash Density



4.3.8.4 Future Occurrence

Thunderstorms and lightning strikes are a regular occurrence in Sullivan County, and as such, lightning strikes can pose an unpredictable if somewhat unlikely threat. Fatalities from lightning strikes have been decreasing nationally since 1940, however this is

in large part due to education, not a decrease in lightning occurrence. Sullivan County should expect to experience an estimated 1,356 to 2,712 lightning flashes in Sullivan County each year (VAISALA, 2018).

4.3.8.5 Vulnerability Assessment

Radio communications towers are highly vulnerable to lightning strikes due to their metal construction and positioning at high elevations. These towers are key to emergency service communications during any event, no matter how minor or major, and to the daily deployment of police, fire, and rescue services as well as communications between the county emergency management agency and local coordinators.

Events being held outdoors during the summer months can be particularly vulnerable to lightning strikes. Tourism and recreational activities in Sullivan County are most active from spring until fall. It is important for those venturing outside during inclement weather to be educated on lightning safety protocols. The following are some guidelines for general lightning safety practices.

- Remain in a hard-topped vehicle or an indoor location for at least thirty minutes after you hear the last thunder clap. If you use radio equipment, avoid contact with it or other metal items inside your vehicle to minimize the impacts should lightning strike.
- If you are out on the water and skies are threatening, get back to land and find a fully enclosed building or hard-topped vehicle.
- Do not use a corded phone during a thunderstorm. Use a cordless phone or cell phone for all calls.
- Lighting victims do not carry an electrical charge, are safe to touch, and need urgent medical attention.

4.3.9. Pandemic and Infectious Disease

4.3.9.1 Location and Extent

Pandemic & Epidemic

Pandemic is a widespread outbreak of infectious disease that impacts an extensive region, potentially spanning continents and having global impacts. An epidemic also refers to an outbreak of a rapidly spreading infectious disease, but is more regional and less widespread than a pandemic. The spread of a disease depends on the mode of transmission of the disease, how contagious it is, and the amount of contact between infected and non-infected persons. In the event of a pandemic occurring in the eastern United States, the entirety of Sullivan County would likely be affected. Strains of influenza, or the flu have caused epidemics and pandemics, and they commonly attack the respiratory tract in humans. Influenza pandemic planning began in response to the H5N1 (avian) flu outbreak in Asia, Africa, Europe, the Pacific, and the Near East in the late 1990s and early 2000s. Avian flu did not reach pandemic proportions in the United States, but the county

began planning for flu outbreaks. The Pennsylvania Department of Health (PADOH) Influenza Pandemic Response Plan states that "an influenza pandemic is inevitable and will probably give little warning" (PADOH, 2005). For this reason, influenza is a primary concern regarding pandemic and infectious disease in Sullivan County.

Studies after the 2009 H1N1 influenza pandemic disproportionately impacted people younger than twenty-four (CIDRAP, 2010). Schools have potential to become outbreak centers due to their large young adult population, high levels of close social contact, and permeable boundaries. During a pandemic or disease outbreak, the population affected may exceed the seasonal norm of one-third of the student population. Because universities and schools can be sites of transmission, they may cause a virus to spread among the surrounding community as well.

Infectious Disease

West Nile Virus has been detected in all sixty-seven counties in the Commonwealth at least once in the past ten years, making it a hazard to Sullivan County. The disease is commonly spread by ticks or insects such as the mosquito. West Nile causes headaches, high fever, neck stiffness, disorientation, tremors, convulsions, muscle weakness, paralysis, and death in its most serious form. Blacklegged ticks in Sullivan County can also spread Lyme disease, a bacterial disease with symptoms including fever, headaches and a characteristic skin rash (erythema migrans). Untreated, Lyme disease can spread to joints, the heart and the nervous system (CDC, 2016).

4.3.9.2 Range of Magnitude

Pandemic

Advancements in medical technologies have greatly reduced the number of deaths caused by influenza over time. In the early 1900s, flu pandemics could cause tens of millions of deaths, while the 2009 Swine Flu caused fewer than 20,000 deaths worldwide, and many people infected with Swine flu in 2009 have recovered without needing medical treatment. However, the modern flu viruses are still quite dangerous. About seventy percent of those who were hospitalized with the 2009 H1N1 flu virus in the United States belonged to a high-risk group (CDC, 2009). High risk populations for influenza include children, the elderly, pregnant women, and patients with reduced immune system capability. Such high-risk populations are discussed in more detail in Section 4.3.9.5.

Infectious Disease

West Nile Virus originated in regions of East Africa around 1937 but spread globally. In 2012, West Nile Virus caused 286 deaths in the United States. Most West Nile infections in humans are subclinical, causing no symptoms. Approximately twenty percent of infections cause symptoms and less than one percent of cases result in severe neurological disease or death. Symptoms typically appear between two and fifteen days after infection

and there is currently no vaccine for West Nile Virus. Person to person transmission of West Nile is less prevalent than person to person transmission of influenza.

Each year since 2005, there are consistently well over 3,000 cases of Lyme disease in Pennsylvania, with 6,470 confirmed cases in 2014 (CDC, 2016). While most cases of Lyme disease can be treated with a few weeks of antibiotic use, undetected Lyme disease can seriously damage a body's musculoskeletal and nervous system, sometimes resulting in death.

4.3.9.3 Past Occurrence

Pandemic & Epidemic

Table 32 - Past Influenza Outbreaks and Pandemics

Past Influenza Outbreaks and Pandemics			
Year/Time Frame	**Common Name**	**Virus Type**	**Geographic Origin**
1889	Russian flu	H2N2 or H3N8	Russia
1918-1920	Spanish flu	H1N1	Germany, Britain, France and the United States
1957-1958	Asian flu	H2N2	China
1968-1969	Hong Kong flu	H3N2	Hong Kong
1976	Swine flu	H1N1	Fort Dix, United States
2006-2008	Avian (Bird) Flu	H5N1	India
2007	Equine flu	H3N8	Australia
2009	Swine Flu	H1N1	Mexico

Influenza outbreaks of Spanish flu, Asian flu, Hong Kong flu and Swine flu caused deaths in the United States and are considered pandemics. The 1918-1920 Spanish flu claimed fifty million lives worldwide and 500,000 in the United States with 350,000 cases in Pennsylvania. The Asian flu caused about 1.5-2 million deaths worldwide with 70,000 deaths in the United States, peaking between September 1957 and March 1958. Approximately fifteen percent of the population of Pennsylvania was affected by Asian flu. 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).

The most recent global flu outbreak to impact Sullivan County was the 2009 outbreak of Swine flu (H1N1). There were 10,940 cases reported in Pennsylvania resulting in seventy-eight deaths (PA DOH, 2010). With assistance of the Sullivan County Emergency Management Agency, the Pennsylvania Department of Health set up clinics through Sullivan County to administer vaccines. Clinics were established at the Eagles Mere Community Hall and the Muncy Valley Volunteer Fire Company. Approximately one hundred doses of the vaccine were administered to the residents. On June 25, 2009, the Pennsylvania Department of Health listed Sullivan County as having five confirmed cases of the Novel 2009 Influenza A/H1N1, after having no reported cases as of June 15, 2009 (See *Figure*

27 - Novel 2009 A/H1N1 Confirmed Counts June 15, 2009 and *Figure 28 - Novel 2009 A/H1N1 Confirmed Counts June 25, 2009*).

Figure 27 - Novel 2009 A/H1N1 Confirmed Counts June 15, 2009

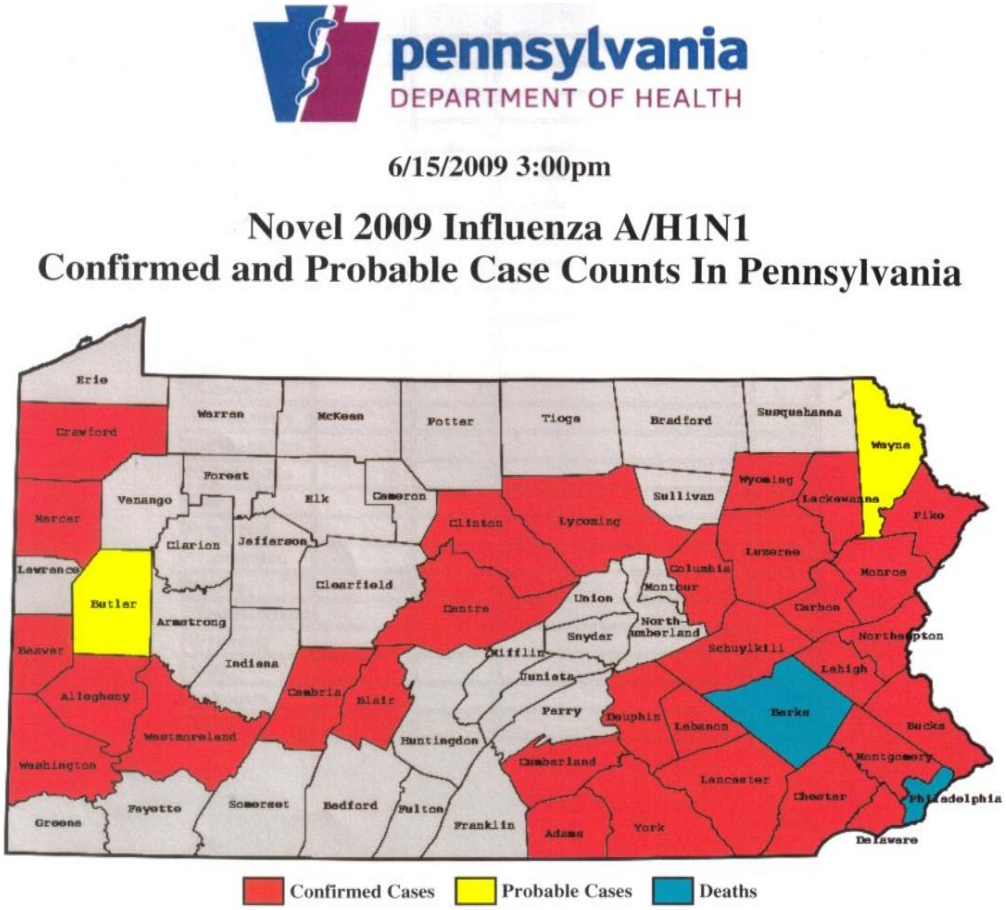
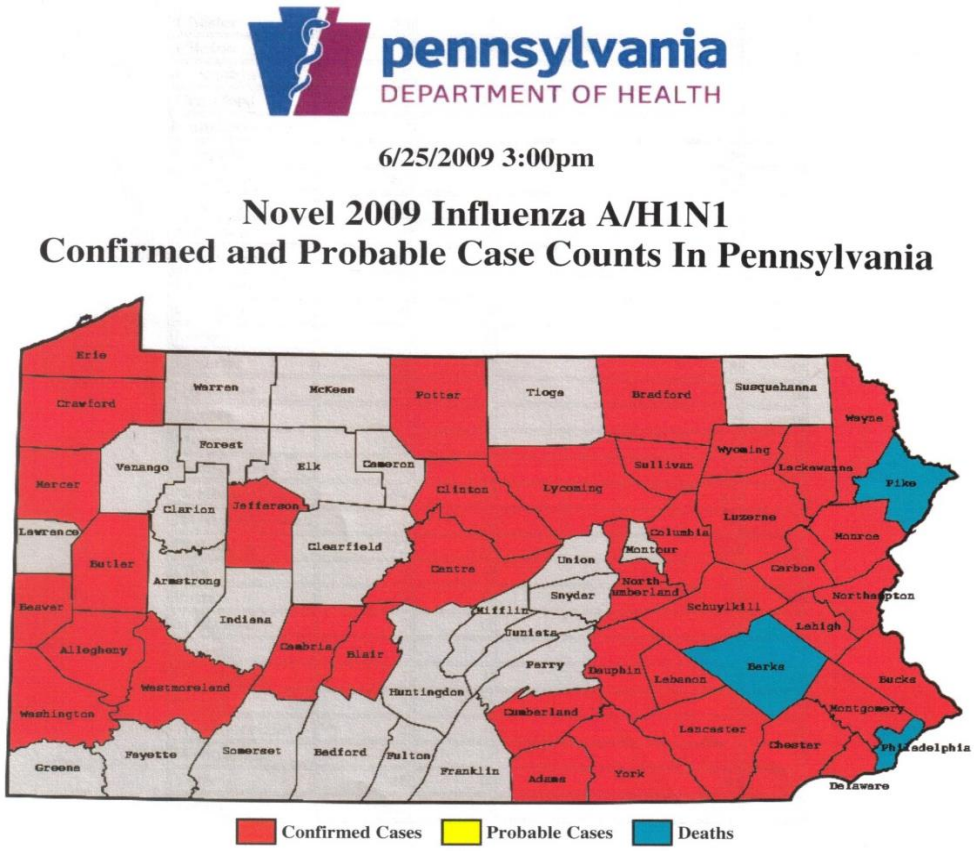


Figure 28 - Novel 2009 A/H1N1 Confirmed Counts June 25, 2009



Infectious Disease

West Nile Virus was first detected in Pennsylvania in the year 2000. The most annual reported cases of West Nile occurred in 2003, with 237 infected Pennsylvanians resulting in nine deaths. Since then, a comprehensive network has been developed in Pennsylvania to detect West Nile Virus, including trapping mosquitoes, collecting dead birds and monitoring horses, people, and in past years, sentinel chickens. West Nile Virus has been detected in fifty-seven of sixty-seven counties in the Commonwealth in 2018 (as of September 18th), with one human case (PA West Nile Virus Control Program, 2018). West Nile Virus has been detected in Sullivan County in four of the last eighteen years with no human cases (See *Table 33 - West Nile Virus Reported Cases*). The Commonwealth as well as Sullivan County has seen a recent spike in Lyme cases - reported cases are summarized in *Table 34 - Lyme Disease Reported Cases*.

Table 33 - West Nile Virus Reported Cases

West Nile Occurrences *(PAWNVCP, 2018)*			
Year	**Positive Detection**	**Human Cases**	**Deaths**
2001			
2002	✓	0	0
2003	✓	0	0
2004			
2005			
2006			
2007			
2008	✓	0	0
2009			
2010			
2011	✓	0	0
2012			
2013			
2014			
2015			
2016			
2017			
2018			
Totals	**4 of 18**	**0**	**0**

Table 34 - Lyme Disease Reported Cases

Lyme Disease Reported Cases *(CDC, 2018)*			
Year	**Number of Cases**	**Year**	**Number of Cases**
1980	0	1999	0
1981	0	2000	0
1982	0	2001	0
1983	0	2002	<4
1984	0	2003	<4
1985	0	2004	<4
1986	0	2005	<4
1987	0	2006	0
1988	0	2007	<4
1989	0	2008	0
1990	0	2009	0
1991	<4	2010	0
1992	0	2011	8
1993	0	2012	0
1994	0	2013	9
1995	0	2014	5
1996	<4	2015	13
1997	<4	2016	17
1998	0	**Total**	**~68**

Although the following incident was ultimately not caused by an infectious disease, the number of people transported to medical centers taxed the emergency services. On April 13, 2008, a mass casualty incident occurred four miles North of Forksville Borough. Two ambulances were dispatched for two ill individuals. Upon the arrival of an EMT, additional individuals started experiencing the same signs and symptoms. Patients stated they had been eating wild leaks, however it turned out to be skunk cabbage. A total of fourteen patients were transported by ambulance and helicopter to Towanda Memorial, Susquehanna Health System - Williamsport Campus and Geisinger Medical Center. Notifications were made to the Department of Agriculture, Health, and Conservation and Natural Resources and the Poison Control Center.

4.3.9.4 Future Occurrence

Pandemic & Epidemic

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. The emergence of a

novel virus is the first step towards pandemic, and based on historical events, is expected to occur every eleven to forty-one years. In the event of an influenza pandemic, colleges and universities can plan an integral role in protecting the health and safety of university members as well as the greater community.

In response to the 2009 H1N1 pandemic, the American College Health Association (ACHA) initiated a pandemic influenza surveillance project entitled the College Health Surveillance Network (CHSN) to gain an understanding of the influenza activity on college campuses. Epidemiologic data on novel H1N1 flu suggested significant risk among those in the college setting. Interested institutions of higher education voluntarily submitted data on a weekly basis regarding the number of new cases of influenza-like illnesses, and ACHA began reporting on the availability of the vaccine, along with the success uptake rate. This information was provided to the CDC, public health officials, and other college health professionals in an effort to continue assisting with tracking national vaccine trends. The H1N1 surveillance project was an important milestone for college health. Through the efforts of ACHA's national office and participating schools, the project resulted in an accurate representation of the epidemiology of the H1N1 outbreak on college campuses nationally. The data holds valuable lessons learned from the 2009 H1N1 outbreak.

Infectious Disease

Instances of West Nile Virus have been decreasing due to extensive planning and eradication efforts, however the prospect of climate change could increase the prevalence of the virus. Some studies show increased insect activities during a similar rapid warming event in Earth's history (Curano et al., 2008). Other studies make projections that with the warming temperatures and lower annual precipitation that are expected with climate change, there will be an expansion of the suitable climate for mosquitos and West Nile Virus, increasing the risk that the disease poses (Harrigan et al., 2014).

Lyme disease has become increasingly prevalent in recent years and is expected to continue this trend. Researchers point to climate change among other factors that bolster tick populations (Templeton, 2017). Ticks often use mice as hosts, and warmer winters have allowed small rodents such as mice to flourish, and in turn tick populations flourish. Human activity has also eliminated natural predators (like coyote) of small rodents, compounding the problem. Human suppression of natural fires may also increase the prevalence of ticks as fires in natural areas kills many insects including ticks, so fewer fires yields more ticks (Templeton, 2017).

4.3.9.5 Vulnerability Assessment

Certain groups are at higher risk of infectious disease infection, including people sixty-five years and older, children younger than five years, pregnant women, and people with certain chronic medical conditions. Such conditions include but are not limited to diabetes, heart disease, asthma, and kidney disease. Schools, convalescent centers, and

other institutions serving those younger than five years old and older than sixty-five are locations that are conducive to faster transmission of influenza. More generally, areas with higher population densities and places where people gather can be hotspots where influenza can spread more rapidly. *Figure 29 - Pandemic Vulnerability* shows the population density according to 2010 census data and locations of schools, daycares and health care facilities, shedding light on areas where the disease may more readily spread. The highest concentration of elevated-transmission risk locations in Sullivan County such as schools and medical facilities are found in the Laporte Borough and Dushore Borough areas.

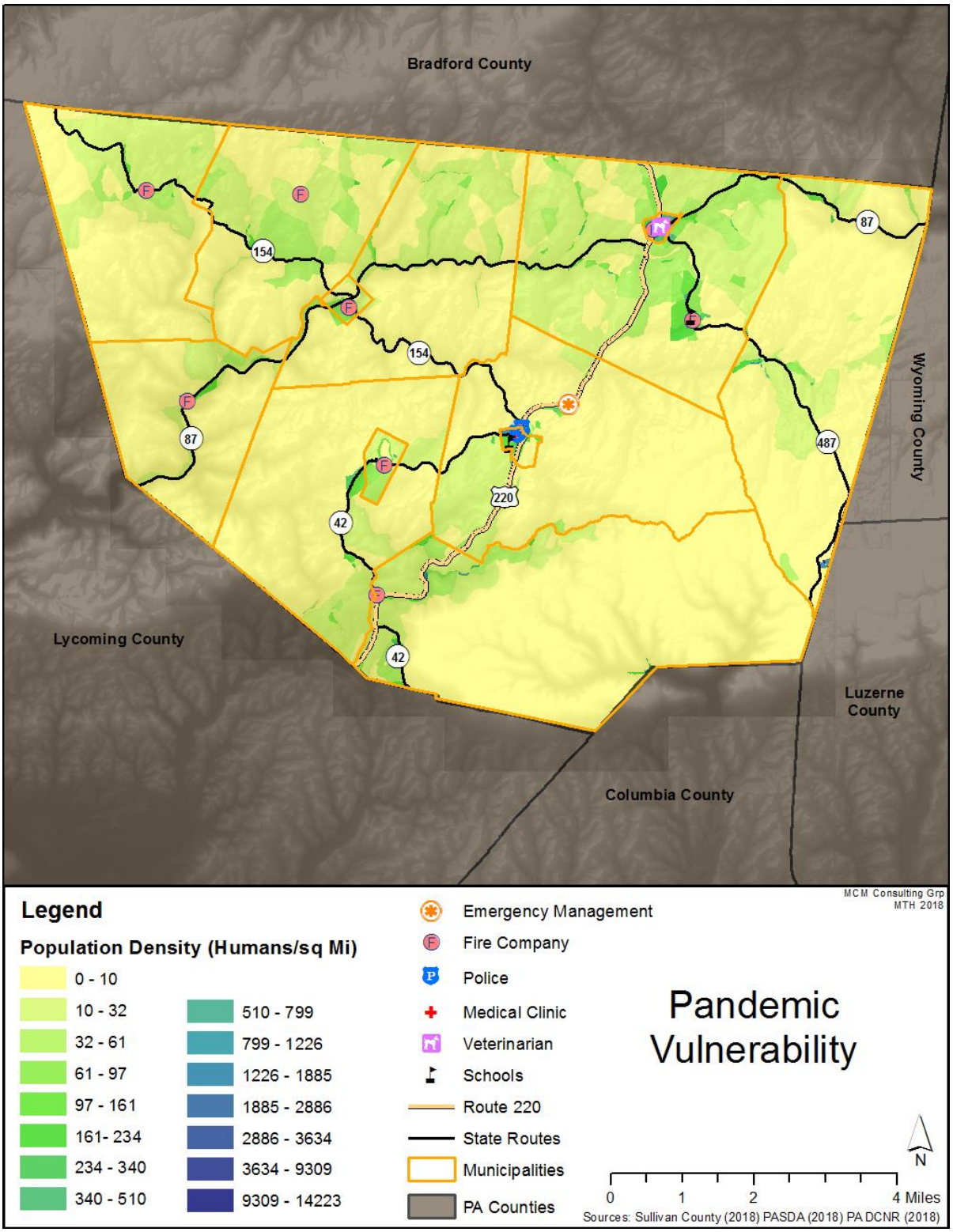
Persons who spend time in wooded areas are most at risk for contracting Lyme disease via tick bite. The application of tick repellent with DEET or permethrin is highly recommended. Residents should conduct thorough tick checks after spending time in woodland areas and keep on the lookout for the characteristic "bulls-eye" rash indicative of a tick bite infected with Lyme disease.

A pandemic will last much longer than most public health emergencies and may include waves of influenza activity separated by months – it has been typical for a second wave of influenza activity to occur three to twelve months after the first wave of cases. The number of healthcare workers and first responders available to work will likely be reduced – they will be at high risk of illness from exposure in the community and in healthcare settings. Some may miss work to care for ill family members, and resources in many locations could become limited, depending on the severity and spread of an influenza pandemic.

It is important to plan preparedness activities that will permit a prompt and effective public health response. The U.S. Department of Health and Human Services (HHS) supports the pandemic influenza activities in the areas of surveillance (detection), vaccine development and production, strategic stockpiling of antiviral medications, research, and risk communications. In May of 2005, the U.S. Secretary of HHS created a multi-agency National Influenza Pandemic Preparedness and Response Task Group. This unified initiative involves the CDC and many other agencies (international, national, state, local and private) in planning for a potential pandemic. Its responsibility includes revision of a U.S. National Pandemic Influenza Response and Preparedness Plan.

During a public health emergency, the Pennsylvania Department of Health (PA DOH) opens emergency medicine centers called "Points of Dispensing (PODs)" to ensure that medicine, supplies, vaccines, and information reach Pennsylvania residents during a public health emergency. An Open POD is where the general public goes to receive free emergency medicine and supplies from public health officials, while a closed POD provides free emergency medicine and supplies to a specific community, like a University, including faculty, staff and students. Dispensing of medications/vaccines is a core function of the Strategic National Stockpile plan, and preparedness of an Open POD.

Figure 29 - Pandemic Vulnerability



4.3.10. Radon Exposure

4.3.10.1 Location and Extent

Airborne radon gas is radioactive, and is a step in the radioactive decay of uranium to radium. Radon is a noble gas, cannot be seen and has no odor. Like other noble gasses, radon gas is very stable, so it does not easily combine with other chemicals. Two isotopes of radon are commonly found: 222Rn and 220Rn. The 220Rn isotope has a very short half-life, so it often only exists for fifty-five seconds, not long enough to pose a hazard to humans. The 222Rn isotope has a half-life of 3.8 days which is long enough to pose a threat to humans. Still, due to the relatively short half-life of 222Rn, it only exists in relatively close proximity to its radioactive parent, usually within tens of feet away. Radon is a carcinogen and when inhaled, it causes humans to develop lung cancer.

Radon was discovered as a significant source of natural radiation for humans in 1984 in the Reading Prong geologic province in Eastern Pennsylvania (south of Sullivan County), when routine monitoring of employees leaving the not yet active Limerick nuclear power plant showed readings that a construction worker working on the plant frequently exceeded expected radiation levels despite the fact that the plant was not active. The Environmental Protection Agency (EPA) guidelines state that mitigation actions should be taken if levels exceed 4pCi/L in a home, and most uranium miners have a maximum exposure of 67 pCi/L. Subsequent testing of the Limerick power plant worker's home showed high radon levels of 2,500 pCi/L (pico Curies per Liter), triggering the Reading Prong to become the focus of the first large-scale radon scare.

Radon gas is considered ubiquitous and can be found in indoor and outdoor environments, however there is no known safe level of exposure to radon. For most people in Pennsylvania, the greatest risk of radon exposure is from within their home in rooms that are below, directly in contact with, or immediately above the ground. Sources of radon include: radon in the air from soil and rock beneath homes, radon dissolved in water from private wells and exsolved during water use (rare in Pennsylvania), and radon emanating from uranium-rich building materials such as concrete blocks or gypsum wallboard (also rare in Pennsylvania). Key factors in radon concentration in homes are the rates of air flow into and out of the house, the location of air inflow, and the radon content of air in the surrounding soil. Because of the flow dynamics of air inside of most houses, even a small rate of soil radon gas inflow can lead to elevated radon concentrations.

There are several factors that contribute to higher radon levels in soil gas:

- Proximity to elevated uranium rich deposits (>50ppm). Areas within a few hundred feet of such deposits are most at risk. Such deposits are rare in Pennsylvania.
- Some more common rocks have higher than average uranium content (5 to 50 ppm), and proximity to such rocks also increases the risk of radon exposure.

These rock types include black shales as well as granitic and felsic alkali igneous rocks. This is the most common source of high radon levels in Pennsylvania. The Reading Prong elevated radon levels come from Precambrian granitic gneisses.

- Other soil and bedrock properties that facilitate radon mobility. The amount of pore space in the soil and its permeability – more porous soils will allow radon to travel more easily. Limestone-dolomite soils can also be predisposed to collect radon from radium resultant from weathering of iron oxide or clay surfaces. In some cases (like in State College in Centre County, PA) even with underlying bedrock having normal uranium concentrations (.5 to 5 ppm), the vast majority of locations built on limestone-dolomite soils exceed radon concentrations of 4pCi/L, and many exceeded 20 pCi/L.

4.3.10.2 Range of Magnitude

According to the EPA, about 21,000 lung cancer deaths each year in the U.S. are related to radon - it is the second leading cause of lung cancer after smoking and the number one cause of lung cancer among nonsmokers. There is no evidence that children are at a greater risk than adults. Radon causes lung cancer by continuing to radioactively decay after being inhaled, and turning into a daughter product (218Po, 214Pb, 214Bi) which may become attached to lung tissue and induce lung cancer due to their continued radioactive decay. *Table 35 - Radon Risk* (EPA, 2017) describes the relative risk to lung cancer that people experience depending on the radon level and their experience with smoking.

The EPA reports that the national average radon concentration of indoor air of homes is about 1.3 pCi/L, and they recommend that homes be fixed if the radon level is 4pCi/L or more. There is however no safe level of radon exposure, so the EPA also recommends to consider fixing a home if the radon level is between 2 pCi/L and 4 pCi/L.

Table 35 - Radon Risk

Radon Level (pCi/L)	If 1,000 people were exposed to this level over a lifetime…*	Risk of cancer from radon exposure compares to…***	Action Threshold
SMOKERS			
20	About 260 people could get lung cancer	250 times the risk of drowning	Fix Structure
10	About 150 people could get lung cancer	200 times the risk of dying in a home fire	
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

Radon Level (pCi/L)	If 1,000 people were exposed to this level over a lifetime...*	Risk of cancer from radon exposure compares to...***	Action Threshold
1.3	About 20 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	About 3 people could get lung cancer	(Average outdoor radon level)	
NON-SMOKERS			
20	About 36 people could get lung cancer	35 times the risk of drowning	Fix Structure
10	About 18 people could get lung cancer	20 times the risk of dying in a home fire	
8	About 15 people could get lung cancer	4 times the risk of dying in a fall	
4	About 7 people could get lung cancer	The risk of dying in a car crash	
2	About 4 people could get lung cancer	The risk of dying from poison	Consider fixing structure between 2 and 4 pCi/L
1.3	About 2 people could get lung cancer	(Average indoor radon level)	Reducing radon levels below 2pCi/L is difficult
0.4	-	(Average outdoor radon level)	
*Note: Risk may be lower for former smokers * Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003). ** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.*			

4.3.10.3 Past Occurrence

In 1984, the Pennsylvania Radon Bureau responded to the newly detected high radon levels with a massive radon monitoring, educational, and remediation effort. As of November 1986, over 18,000 homes had been screened for radon and approximately 59% were found to have radon daughter levels in excess of the 0.020 Working Level (WL) guideline. Radon daughter levels ranged up to 13 WL or 2600 pCi/L or radon gas.

The EPA estimates that the average indoor radon concentration in Pennsylvania basements is about 7.1 pCi/L (3.6 pCi/L on the first floor), well above their estimated national average of 1.3 pCi/L. Data on abundance and distribution of radon as it impacts individual houses in Sullivan County and Pennsylvania at large is incomplete and biased towards higher radon concentrations – most data is based on test results submitted by concerned homeowners who suspect they might be at risk for high radon levels. Results are skewed to over-represent homes that have high radon levels, and under-represent homes with low radon levels. That being said, any homes with high radon levels are problematic, and there are many reported homes in Sullivan County with elevated radon concentrations.

The Pennsylvania Department of Environmental Protection (PA DEP) provides information for homeowners about how to test for radon in their homes, and when they receive a test result over 4 pCi/L, the PA DEP Bureau of Radiation Protection works to help homeowners repair the home and mitigate the hazard. The PA DEP records all the tests they receive and categorize them in a searchable database by zip code. *Table 36 - Radon Level Test Results* shows there are five zip codes in Sullivan County where sufficient tests were reported for the PA DEP to report their findings. The highest radon levels were reported from the 17737 zip code which covers part of Shrewsbury Township with maximum and average readings of 322 and 13.2 pCi/L respectively. Most reporting zip codes in Sullivan County have average basement Radon levels above the suggested EPA action level of 4 pCi/L - The average basement reading for reporting zip codes in the County is 6.8 pCi/L, and the average first floor reading is 3.4 pCi/L.

Table 36 - Radon Level Test Results

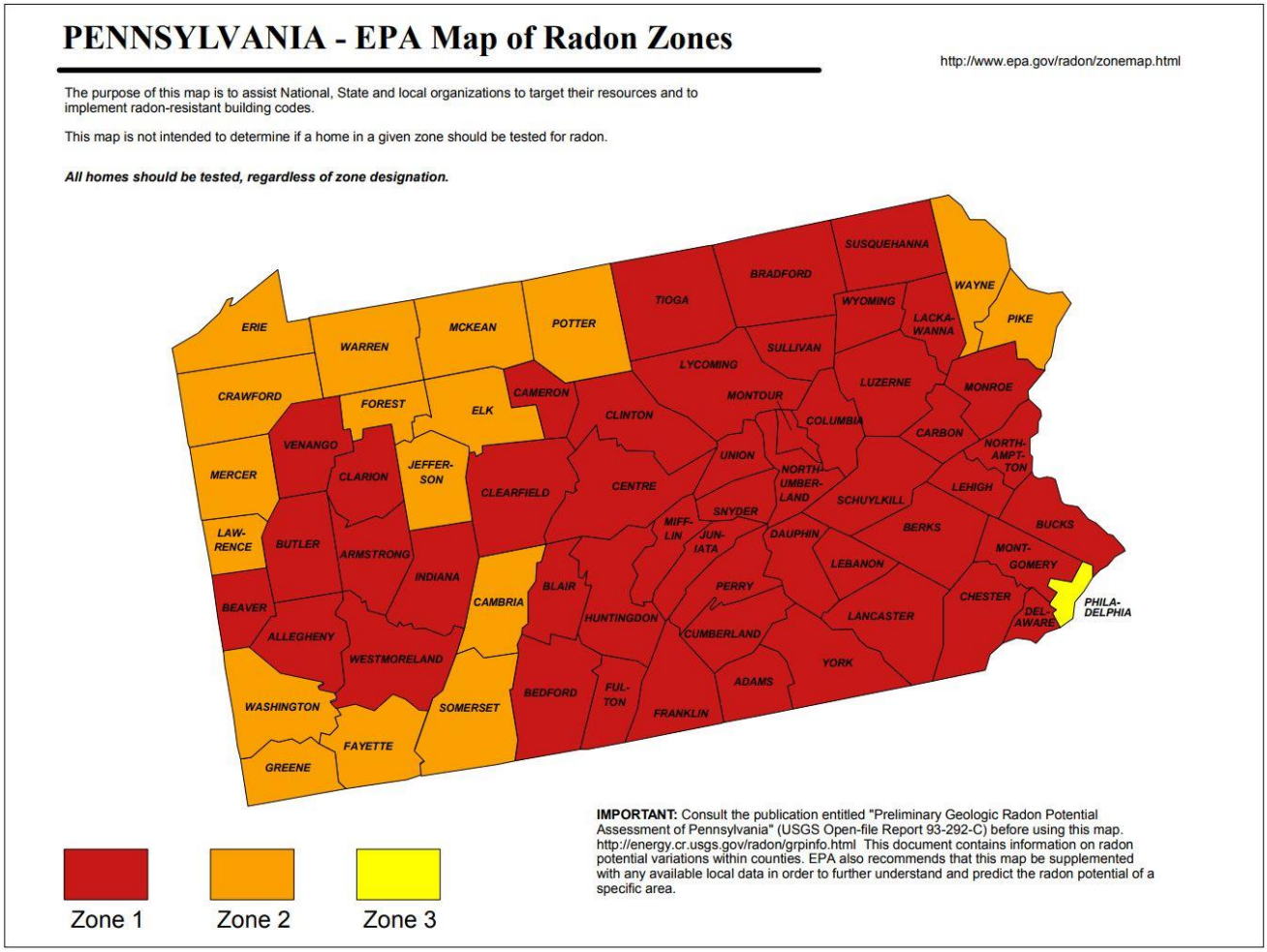
Radon Level Test Results ***(PA DEP, 2018)***					
Zip Code	**Municipalities**	**Location**	**Number of Tests**	**Max Result pCi/L**	**Avg Result pCi/L**
17731	Eagles Mere Borough, Parts of Shrewsbury & Laporte Townships	BASEMENT	86	15.2	3.8
		FIRST FLOOR	32	9.9	2.2
17737	Part of Shrewsbury Township	BASEMENT	409	322	13.2
		FIRST FLOOR	68	52.3	4.6
17758	Parts of Shrewsbury, Davidson & Laporte Townships	BASEMENT	32	65.1	5.6
18614	Parts of Davidson & Colley Townships	BASEMENT	75	36.8	5.7
18626	Laporte Borough & Parts of Laporte & Davidson Townships	BASEMENT	60	33.6	5.7
Averages		**BASEMENT**	**132**	**94.5**	**6.8**
		FIRST FLOOR	**50**	**31.1**	**3.4**

4.3.10.4 Future Occurrence

Radon exposure is inevitable given the geologic and geomorphic conditions in Sullivan County. The EPA and USGS have mapped radon potential in the US to help target resources and assist local governments in determining if radon-resistant features are applicable for new construction. The designations are broken down in three zones and are assigned by county, as shown in *Figure 30 – Radon Zones* (EPA, 2017). Each zone reflects the average short-term measurement of radon that can be expected in a building without radon controls. Sullivan County is located within Zone 1, with a high potential for radon.

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

Figure 30 – Radon Zones (EPA, 2017)

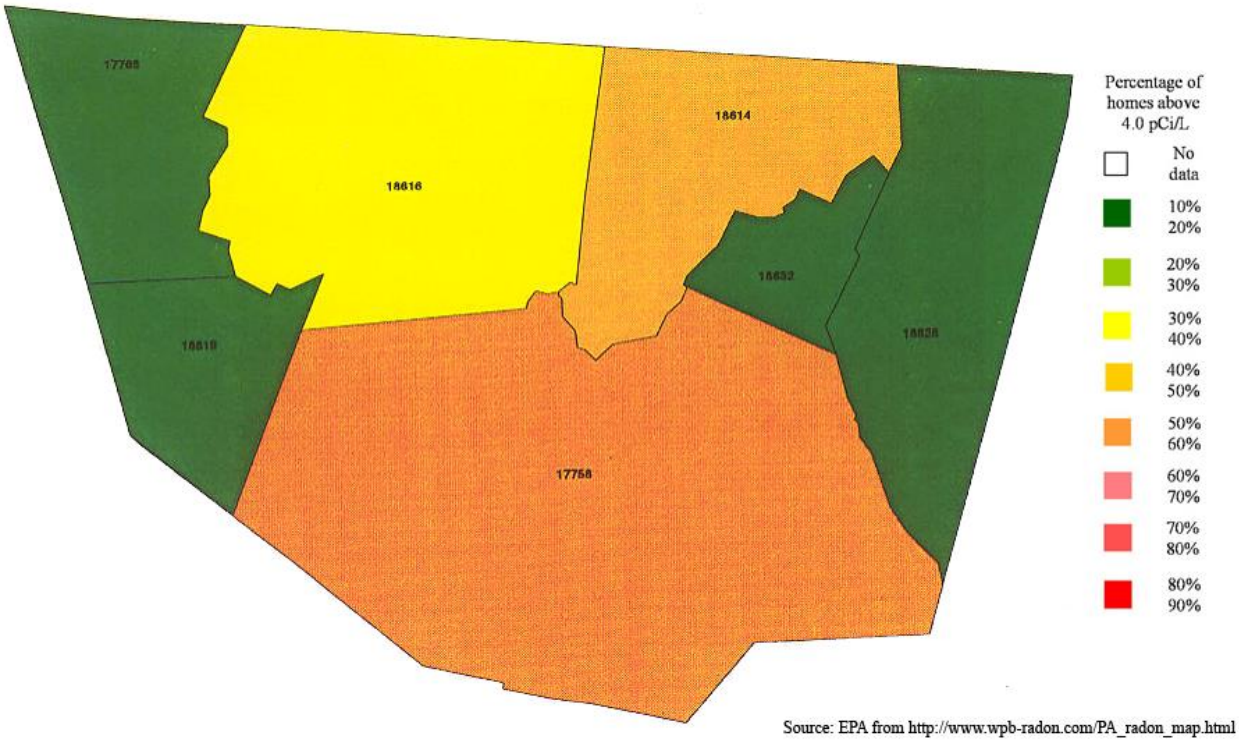


4.3.10.5 Vulnerability Assessment

Sullivan County is in the EPA radon hazard zone 1, meaning there is a high risk of radon exposure. Older homes that have crawl spaces or unfinished basements are more vulnerable to having high radon levels. Average basement radon levels for homes who reported their results to the PA DEP are often found to be above the EPA action level of 4 piC/L. *Figure 30 – Radon Zones (EPA, 2017)* shows the best available data from the EPA about the percentage of homes with radon levels at or above the EPA action level. Homeowners across Sullivan County should test radon levels in their homes in order to determine their level of radon exposure. The EPA estimates that an average radon mitigation

system costs approximately $1,200. The PA DEP Bureau of Radiation Protection provide short- and long-term tests to determine radon levels, as well as information on how to mitigate high levels of radon in a building.

Figure 31 - Radon Vulnerability



Source: EPA from http://www.wpb-radon.com/PA_radon_map.html

4.3.11. Subsidence, Sinkhole

4.3.11.1 Location and Extent

Subsidence refers to gradual caving in, sinking or collapse of an area of land. Many areas of Pennsylvania have bedrock conditions that lend themselves to subsidence events. Carbonate rock like limestone and dolomite is easily eroded and dissolved by water, so if an area has carbonate bedrock, that area is susceptible to subsidence because groundwater may erode and dissolve the carbonate rock, leading to the creation of caves, swales, sinkholes and other forms of subsidence. These types of features are generally referred to as karst topography. Sullivan County does not have bedrock geology that lends itself to karst topography.

Human activity can also increase the risk of subsidence events. Areas with coal or other mineral deposits which have been mined using deep mining techniques may become susceptible to subsidence. Poor engineering practices used at the time of withdrawal or progressive degradation in geological stability can increase the risk of subsidence. Sullivan County has some history of mining activities, mostly in parts of Cherry and Colley Townships (see *Figure 32 - Abandoned Mine Land & Subsidence Vulnerability*).

4.3.11.2 Range and Magnitude

No two subsidence areas or sinkholes are exactly alike. Variations in size and shape, time period under which they occur (i.e. gradually or abruptly), and their proximity to development ultimately determines the magnitude of damage incurred. Events could result in minor elevation changes or deep, gaping holes in the ground surface. Subsidence and sinkhole events can cause severe damage in urban environments, although gradual events can be addressed before significant damage occurs.

Problems related to subsidence include the disruption of utility services and damages to private and public property including buildings, roads, and underground infrastructure. Incidents of subsidence throughout the coal regions over the years have affected houses, garages, and trees that have been swallowed up by subsidence holes. Lengths of local streets and highways, and countless building foundations have been damaged.

The worst-case scenario in Sullivan County would result from long-term subsidence or sinkhole formation from abandoned mined land that were not recognized and mitigation measures were not implemented. In this case fractures or complete collapse of building foundations and roadways may result.

4.3.11.3 Past Occurrence

The DCNR provides an online Sinkhole Inventory Database, which lists a total of 3,619 identified natural sinkholes and over 138,000 reported surface depressions in Pennsylvania as of 2016, none of which occur in Sullivan County (DCNR, 2016). There are several

abandoned mine sites in Sullivan County (see *Figure 32 - Abandoned Mine Land & Subsidence Vulnerability*). On January 12, 2013, a geological emergency was reported to the Knowledge Center due to mine subsidence in Cherry Township.

4.3.11.4 Future Occurrence

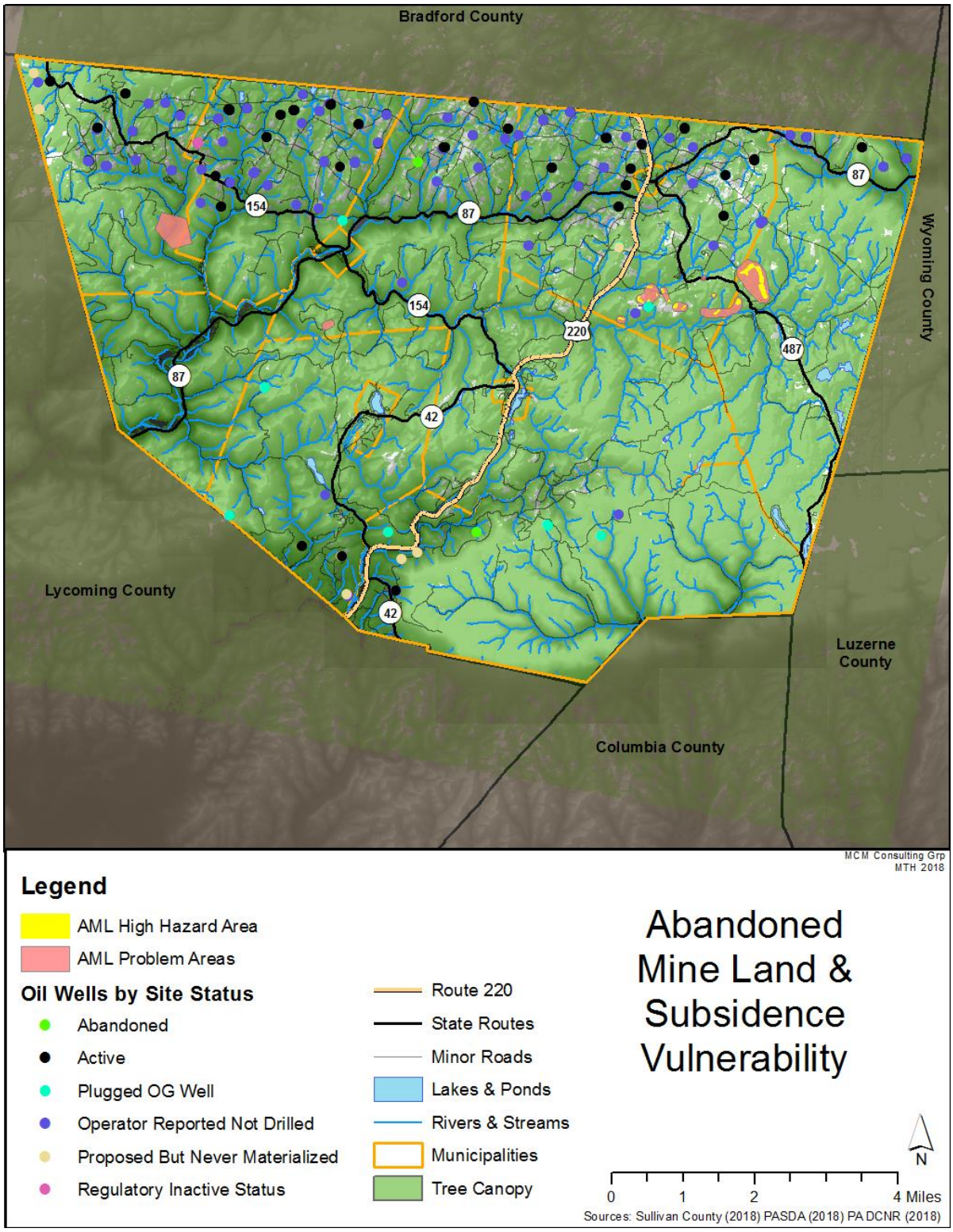
The annual occurrence of subsidence and sinkhole events in Sullivan County is considered unlikely. *Figure 32 - Abandoned Mine Land & Subsidence Vulnerability* shows data as of September 2018 from the PA DEP and the Abandoned Mine Land Inventory System and shed light on the abandoned mines in the county. As abandoned mines age, they are more likely to fail and result in subsidence due to the aging timber supports in the mine shafts, and increasing weight and pressure placed upon them from newly constructed buildings and traffic movement.

4.3.11.5 Vulnerability Assessment

Sullivan County is not vulnerable to subsidence due to karst topography. While the history of mining in Sullivan County is not extensive, abandoned mine sites are susceptible to subsidence events, and there has been some mining activity in Cherry, Colley, Forks, Fox and Elkland Townships. Mine Subsidence Insurance is available through the Pennsylvania Department of Environmental Protection (PA DEP). If citizens are aware that they live in areas that have been mined, the PA DEP Mine Subsidence Insurance department can be contacted at 1-800-922-1678 to have a site-specific request conducted.

There are no critical facilities on top of the abandoned mine land locations, however there are addressable structures that are built on top of abandoned mine land problem areas, including six in Cherry Township, one in Colley Township, and two in Fox Township.

Figure 32 - Abandoned Mine Land & Subsidence Vulnerability



4.3.12. Tornados and Windstorms

4.3.12.1 Location and Extent

Tornados occur in the Commonwealth most frequently during the spring and summer months and are most likely at the warmest times of the day. In the past sixty-seven years, records show that 826 tornados have been reported in all sixty-seven counties in Pennsylvania during the period of 1950 - January 2017 (NOAA NCEI, 2017). The National Weather Service estimates that the Commonwealth will experience ten tornados annually. According to the National Centers for Environmental Information (NCEI), wind speeds in tornados range from values below that of hurricane speeds to more than 300 miles per hour. The NCEI continues by reporting that, "the maximum winds in tornados are often confined to extremely small areas and vary tremendously over short distances." This is the reason that one house will be completely demolished by a tornado and the house next to it might be untouched. The width of tornados can vary greatly, from 100 feet wide to over a mile, and the forward motion of tornados can range from speeds between zero and fifty miles per hour.

Windstorms may be caused by thunderstorms, hurricanes and tornadoes, but the most frequent cause of windstorms in Northeastern Pennsylvania are thunderstorms. Straight-line winds and windstorms are experienced on a more regional scale. While such winds usually also accompany tornados, straight-line winds are caused by the movement of air from areas of high pressure to low pressure. Windstorms are generally defined with sustained wind speeds of 40 mph or greater, lasting for at least one hour, or simply winds of 58 mph or greater for any duration. A microburst is a very-localized column of sinking air, capable of producing damaging opposing and straight-line winds at the surface. A wind shear is usually found when a violent weather front is moving through; wind speeds have been recorded up to 100 mph. Wind shear is defined as a difference in wind speed and direction over a relatively short distance in the atmosphere.

Figure 33 - Microburst

The air moves downward until at ground level. It then spreads outward in all directions.

4.3.12.2 Range of Magnitude

Each year, tornados account for $1.1 billion in damages and cause over eighty deaths nationally. 2011 was the second worst year on record for deadly tornados, the worst being 1936. The number of tornado reports has increased by 14% since 1950. While the extent of tornado damage is usually localized, the vortex of extreme wind associated with a tornado can result in some of the most destructive forces on Earth.

Rotational wind speeds can range from 100 mph to more than 250 mph. In addition, a tornado's 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 tornados 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 tornados 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.

Damages and deaths can be especially significant when tornados move through populated, developed areas. The destruction caused by tornados ranges from light to inconceivable depending on the intensity, size and duration of the storm. Typically, tornados cause the greatest damages to structures of light construction. 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 tornados into six intensity categories, as shown in, based upon the estimated maximum winds occurring within the wind vortex (*Table 37 - Enhanced Fujita Scale*). Since its implementation by the National Weather Service in 2007, the EF-Scale has become the definitive metric for estimating wind speeds within tornados based upon damage to buildings and structures. Previously recorded tornadoes are reported with the older F-Scale values, but *Table 37 - Enhanced Fujita Scale* shows F-Scale categories with corresponding EF-Scale wind speeds.

Figure 19 - Wind Zones in Section 4.3.5 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. Sullivan County falls within Zone III, meaning

shelters and critical facilities should be designed 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. While it is difficult to pinpoint the exact locations at the greatest risk of a tornado, the southeast, southwest and northwest sectors of the Commonwealth are more prone to tornados.

Tornados can have varying secondary effects. The most common is power failure. The severe wind can dismantle power sources and cause significant structural damage. Hazardous material spills can occur if a tornado comes near a holding tank, or the spill stems from a traffic accident caused by high winds.

Windstorms of all types have caused the following problems within Sullivan County:

- Power failures lasting four hours or longer
- Loss of communications networks lasting four hours or more
- Residents requiring evacuation or provision of supplies or temporary shelter
- Severe crop loss and or damage

Table 37 - Enhanced Fujita Scale

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

4.3.12.3 Past Occurrence

Sullivan County has experienced eleven tornados since 1954 (see *Table 38 - Tornado History*). One of the deadliest tornado events in Pennsylvania occurred on May 31 1985, with a total of twenty-one tornados in the Ohio and Northwest Pennsylvania region (none of which tracked through Sullivan County). These tornados resulted in seventy-six deaths, upwards of 1000 injuries, and hundreds of millions of dollars in property damage. Most recently, Sullivan County experienced an EF2 tornado on July 8, 2014 with maximum winds of 120 mph confirmed near Dushore, causing approximately $5,000 in property damage. On August 16, 1997, three tornadoes occurred in Sullivan County, one of which resulted in a fatality in Ricketts Glen State Park when a tree was blown onto someone's tent.

Aside from tornados, Sullivan County has eighty-four severe wind reports from 1950 to October 2018 causing a total of ~$304,900 dollars in property damage (NOAA NCEI, 2018). Most often these are the result of intense thunderstorms, which may fell trees, damaging power lines and cause power outages for upwards of four days in some areas. One strong wind event occurred on July 26, 2012 and resulted in firefighters needing to rescue one man who was injured and trapped when a tree fell onto his tent in Worlds End State Park – fortunately his injuries were not life-threatening (NOAA NCEI, 2018). Detailed information for each severe wind report in Sullivan County can be found in NOAA's Storm Events Database (www.ncdc.noaa.gov/stormevents).

Figure 34 - Tornado History 1950-2018

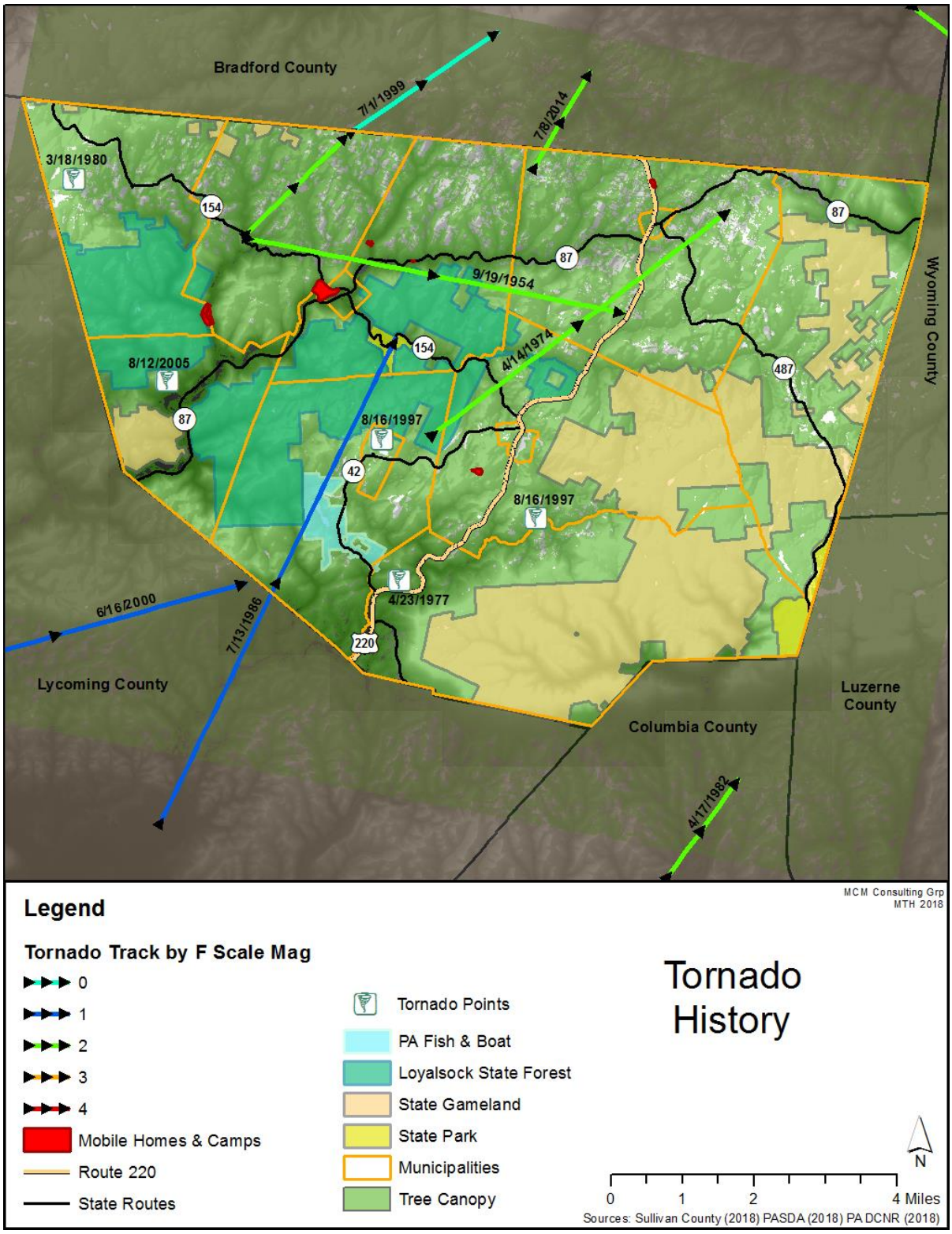


Table 38 - Tornado History

Tornado History *(NCEI, 2018; 2014 HMP)*					
Date	**Mag.**	**Deaths**	**Injuries**	**Property Damage**	**Description**
06/27/1892	F2	0	15	-	
06/11/1922	F3	1	7	-	
09/19/1954	F2	0	0	$25,000	
04/14/1974	F2	0	0	$25,000	
04/23/1977	F1	0	0	$2,500	
07/13/1986	F1	0	0	$2,500	
08/16/1997	F1	0	1	$0	A woman age 45 was injured by falling tree while hiking near High Knob in Wyoming State Forest.
08/16/1997	F1	0	0	$0	A large area of downburst winds struck sections of Sullivan County from Hillsgrove east across Eagles Mere to Laporte and Dushore. While most of the damage was straight line wind, at least two locations in the Eagles Mere area had evidence of rotation indicative of a tornado. The first path with apparent rotation began near High Knob in Wyoming State Forest. The storm moved east taking down trees on an intermittent path for 5 miles into Eagles Mere. The second path with evident rotation crossed Route 42 north of the airport and moved east crossing Laporte Avenue on the south side of the borough of Eagles Mere. Again, although most of the damage was downburst in origin, there were small areas with good indication of rotation in the winds. Eyewitness accounts told of rotating debris, and several remarked of hearing of funnel cloud reports, but no visual witness of a funnel was located. Nearly all of the damage was to trees, although one tree fell and demolished a vehicle at the beach on the north side of Eagles Mere Lake. Fortunately, all boats on the lake had been called in because of the early alerts, and trips on the motor launch that carries passengers around the lake had been suspended for the day because of the threat of severe weather.

Tornado History *(NCEI, 2018; 2014 HMP)*					
Date	**Mag.**	**Deaths**	**Injuries**	**Property Damage**	**Description**
08/16/1997	F1	1	0	$0	The Ricketts Glen tornado was another example of tornadic winds embedded within a wider area of downburst damage. Downburst damage covered an area of about 3 miles wide from Ganoga Lake southeast to Lake Jean. An eyewitness at Ganoga Lake described a cloud of water being lifted off the surface of the lake. Another told of seeing a catamaran being lifted about 30 feet off the lake surface and thrown towards shore. The tornado appeared to cross Lake Jean and end in a campground. A 15-year old youth was fatally injured there when a tree was blown onto his tent. Other campers in tents narrowly missed injury.
07/01/1999	F1	0	0	$200,000	An F1 tornado touched down in Elkland township about two miles northwest of Lincoln Falls on Route 154, then moved northeast through a crossroads near Eldredsville to Hugo corners. Trees were blown down as the storm crossed Route 154. Just west of McCarty Ridge Road a group of campers narrowly missed injury when a stand of trees was blown over near their site. The heaviest damage was along McCarty Ridge Road near the town of Eldredsville. A well-built older home was lifted just slightly on its foundation. The occupants told of seeing a cloud of dust appear as they watched from their basement. A barn nearby was leveled. The roof flew off a sawmill and landed largely intact about 100 feet northwest of the mill. Several other homes had some structural damage and one had shingles removed from a roof. A travel trailer was overturned and an outdoor shed was destroyed. A couple mobile homes were damaged by debris, but were not moved off their foundations. Tree damage was sporadic along the path with a number of trees down in the Hugo Corners area near the end of the path.

Tornado History *(NCEI, 2018; 2014 HMP)*					
Date	**Mag.**	**Deaths**	**Injuries**	**Property Damage**	**Description**
06/16/2000	F0	0	0	$0	This tornado was a continuation of the Farragut tornado from Lycoming County, which produced an intermittent path of damage along a 16-mile path of which about 2 miles was included in Sullivan County in the Rock Run area southwest of Hunters Lake. The tornado began at Farragut north of Montoursville, and moved east across sparsely populated sections of eastern Lycoming County, crossing into Sullivan County about 2 miles north of Glen Mawr before ending about 4 miles southwest of Eagles Mere. Eyewitness accounts indicated the presence of two separate funnels in the Farragut area. The storm probably reached F1 intensity (close to 90 mph) in the Farragut area where it initially touched down near the Loyalsock Creek just southwest of town. Accounts indicate initial touchdown was about 5:45 p.m. EDT. Last damage was probably close to 6:25 p.m. EDT in the forests of Sullivan County. In Farragut, one tree fell on a house, a roof was lifted off of a shed, and a number of trees were downed. A field of new corn was leveled. Further east, damage to trees was sporadic. In addition, 1.25-inch hail was reported in Eagles Mere and trees were downed south of the path in Picture Rocks. Wind gusts at the Lycoming County Office of Emergency Management less than 2 miles southwest of Farragut were recorded at 67 mph.
08/12/2005	F1	0	0	$15,000	A tornado touched down during the afternoon of August 12th just north of the town of Hillsgrove in Sullivan County. A swath of tree damage about 1/2 to 3/4 miles long and about 30 yards wide ran along Mill Creek Road. It was estimated that the tornado was on the ground for 2 minutes. The tornado caused dozens of trees to be knocked down. In addition to the tornado, ambient winds with the thunderstorm produced downed trees throughout the general area of Hillsgrove. One of these trees fell on a vehicle causing major damage and others fell on structures causing minor to moderate roof damage. Winds were estimated at around 75 to 85 mph, making it an F1 on the Fujita Scale. There were no injuries or deaths.

Tornado History *(NCEI, 2018; 2014 HMP)*					
Date	**Mag.**	**Deaths**	**Injuries**	**Property Damage**	**Description**
07/08/2014	EF2	0	0	$150,000	An EF2 tornado with maximum winds of 120 mph was confirmed near Dushore along with a 90- 100mph microburst in Perry County. The tornado produced considerable damage along a path that measured just over 2 miles long, exiting Sullivan County and crossing into the Bradford County (NWS Binghamton, NY CWA). The tornado was on the ground for about 5 minutes with a maximum path width of 400 yards. The tornado touched down in a field and crossed Elys Road, where a roof was blown off of a house and a barn. Some of this debris was thrown over 100 yards. A trailer was thrown 30 yards and demolished. Dozens of trees were downed.

4.3.12.4 Future Occurrence

It is possible for a disastrous tornado to hit Sullivan County. While the chance of being hit by a tornado is somewhat small, the damage that results when the tornado arrives can be devastating. An EF5 tornado with a 0.019 percent annual probability of occurring can carry wind velocities of 200 mph, resulting in a force of more than 100 pounds per square foot of surface area. This is a "wind load" that exceeds the design limits of most buildings.

Based on tornado activity information for Pennsylvania between 1950 and 2002, Sullivan County lies within an area that has experienced twenty to forty tornado events per square mile, which is equivalent to about one to four tornados per square mile every five years (Pennsylvania State Climatology). Additionally, based on historic patterns, tornados are unlikely to remain on the ground for long distances, especially in areas of the county with hilly terrain. However, the high historical number of windstorms with winds over 50 knots indicates that annual chance of a windstorm is higher.

According to FEMA (See Section 4.3.5 *Table 27 - Annual Probability of Wind Speeds)*, there is high probability (~92%) each year that Sullivan County will experience winds of 45-77 mph, however there is under a 10% chance of winds of 78-118 mph.

4.3.12.5 Vulnerability Assessment

Tornados can occur at any time of the year, though they're more likely during peak months, which are during the summer for the northern part of the United States. Tornados are most likely to occur between 3 P.M and 9 P.M. but have been known to occur at all hours of the day or night. Factors that impact the amount of damage caused by a tornado are the strength of the tornado, the time of day and the area of impact. Usually

such distinct funnel clouds are localized phenomena impacting a small area, however, the high winds of tornados make them one of the most destructive natural hazards. There can be many secondary impacts of tornados and windstorms, including transportation accidents, hazardous material spills, flooding, and power outages. A proper warning system is vital for the public to be informed of what to do and where to go.

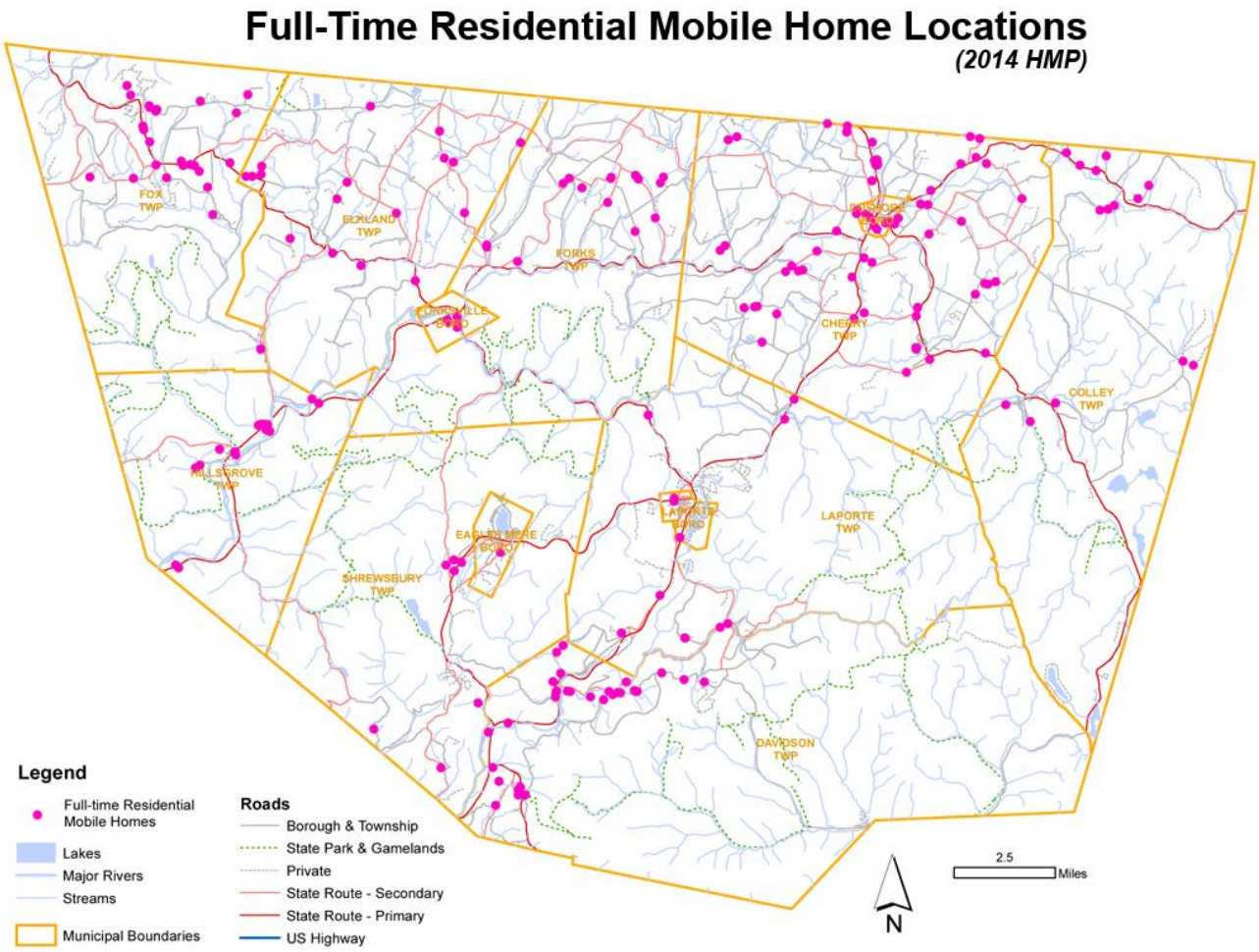
Dangers that accompany thunderstorms which can produce tornados:

- Flash floods – with 146 deaths annually nationwide
- Lightning – 75 to 100 deaths annually nationwide
- Damaging straight-line winds – reaching 140 mph wind speed
- Large hail – can reach the size of a grapefruit and causes several hundred million dollars in damages annually to property and crops.

Critical facilities are highly vulnerable to high wind storms. While many severe storms can cause exterior damage to structures, tornados can also completely destroy structures, along with their surrounding infrastructure, abruptly halting operations. Severe storms and their secondary effects often accompanying tornados and can be just as threatening to the critical facilities within the county. Many critical facilities are particularly vulnerable to power outages which can leave facilities functionless, potentially crippling infrastructure supporting the population of the county. With a storm's ability to destroy structures, citizens and their possessions are often left at the will of the storm. The elderly and disabled people are vitally at risk when faced with tornados. Without assistance to evacuate, they may be unable to prepare themselves or their homes and other possessions to safely weather the storm. Campgrounds and mobile homes are also particularly vulnerable to tornados and windstorms, and locations of some mobile home parks and campgrounds in Sullivan County can be found in *Figure 34 - Tornado History 1950-2018*, however this is not a comprehensive list. Full-time residential mobile home locations can be found in *Figure 35 - Full-Time Residential Mobile Home Locations*. It should also be noted that the State Parks and State Forests in Sullivan County have designated camping locations where visitors often pitch tents and can be vulnerable to severe wind storms.

The local economy can also be crippled by tornados and windstorms and their secondary effects when buildings and supporting infrastructure are destroyed in the storm. Power outages can create work stoppages while transportation accidents and road closings can limit the transportation of goods and services. Additionally, flooding cannot be discounted as it can destroy the physical structures, merchandise and equipment essential for business operation. In the case of hazardous material spills caused by windstorms, the local environment can also be negatively impacted, requiring extensive clean-up and mitigation efforts.

Figure 35 - Full-Time Residential Mobile Home Locations



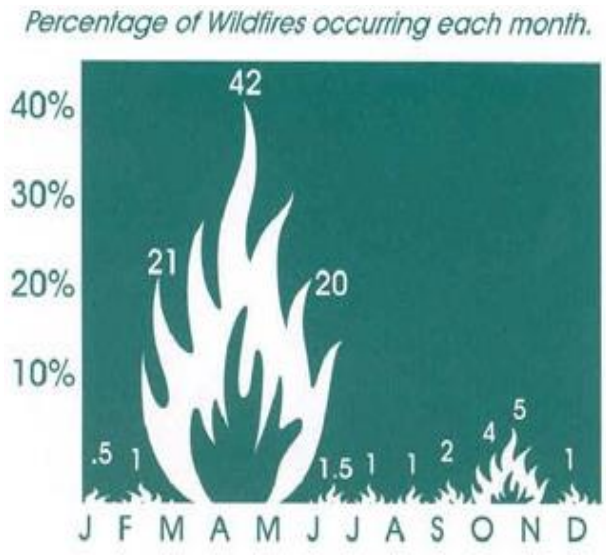
4.3.13. Wildfire

4.3.13.1 Location and Extent

The most prevalent causes of devastating wildfires are droughts, lightning strikes, arson, human carelessness, and in rare circumstances, spontaneous combustion. Most fires in Pennsylvania are caused by anthropogenic fires such as debris burns that get out of control. A fire, started in somebody's backyard, could travel through dead grasses and weeds into bordering woodlands starting a wildfire. Major urban fires can cause significant property damage, loss of life, and residential or business displacement. While wildfires are a natural and essential part of many native Pennsylvania ecosystems (e.g. pitch pine – scrub oak woodlands), wildfires can also cause devastating damage if they are

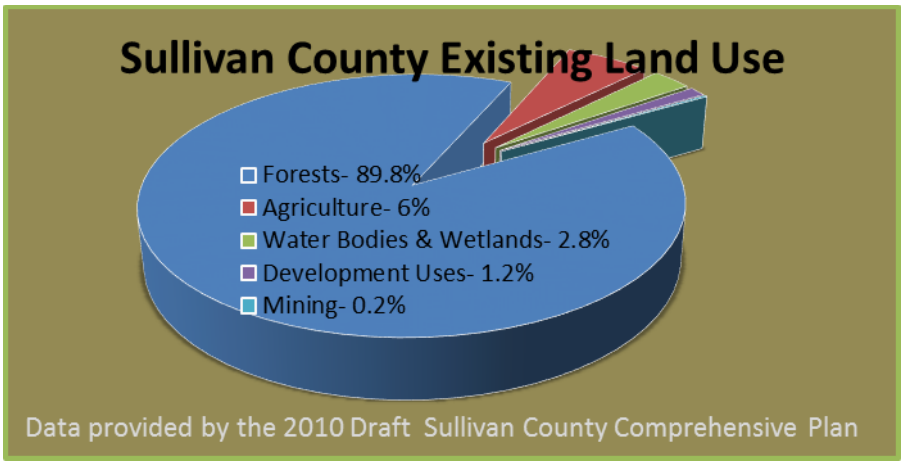
undetected and allowed to propagate unfettered. Wildfires most often occur in less developed areas such as open fields, grass, dense brush or forests where they can spread rapidly by feeding off of vegetative fuels. Wildfires are most prevalent under prolonged dry and hot spells, or generally drought conditions. The greatest potential for wildfires (83% of all Pennsylvania wildfires) occur in the spring months of March, April, and May, and the autumn months of October and November. In the spring, bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris and increasing wildfire vulnerability. In the fall, the surplus of dried leaves are fuel for fires. *Figure 36 - Seasonal Wildfire Percentage* shows the wildfire percentage occurrence during each month occurring in Pennsylvania.

Figure 36 - Seasonal Wildfire Percentage



Sullivan County is located in the Loyalsock District (District 20) and has significant expanses of natural forests which cover nearly 90% of the county (see *Figure 37 - Sullivan Land Use*), including much of the Loyalsock State Forest, Worlds End State Park, part of Ricketts Glen State Park, as well as several State Game Lands (Numbers 12, 13, 66 & 134).

Figure 37 - Sullivan Land Use



4.3.13.2 Range of Magnitude

Forested areas, croplands and properties that are at the interface between wild lands and human development are most at risk for being impacted by and causing wildfires. If an urban fire or wildfire is not contained, secondary impacts such as power outages may

result. Other negative impacts of wildfires include killing people, livestock, fish and wildlife, destroying valuable property, timber, forage, recreational and scenic values. Wildfires can also cause severe erosion, silting of stream beds and reservoirs, and flooding due to a loss of ground cover.

The United States Forest Service utilizes the Forest Fire Assessment System to classify the dangers of wildfire. *Table 39 - Wildland Fire Assessment System* identifies each threat classification and provides a description of the level.

Table 39 - Wildland Fire Assessment System

Wildland Fire Assessment System ***(U.S. Forest Service)***	
Rank	**Description**
Low (L)	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
Moderate (M)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (H)	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH)	Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E)	Fires start quickly, spread furiously and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

4.3.13.3 Past Occurrences

There were eight fire events reported to the Knowledge Center between 2013 and October 2018. It should be noted that wildfires in natural lands may be reported less frequently

to the Knowledge Center and thus could be under-represented in *Table 40 - Fire Occurrences*. This list should be treated as a sample of fire history in Sullivan County and not an all-inclusive database.

Table 40 - Fire Occurrences

Fire Occurrences ***(Knowledge Center, 2018)***		
Date	**Location**	**Description**
04/08/13	Forks Township	BRUSH FIRE
03/24/16	Colley Township	PGC-Controlled Burn-Sullivan, Colley Township
03/30/16	Colley Township	PGC Controlled Burn, SGL66, Colley Township

Table 41 - Wildfires in the Loyalsock District

Wildfires in the Loyalsock District 2003-2011 ***(2014 HMP)***				
Year	**Fires**	**% of Statewide**	**Acres**	**% of Statewide**
2003	21	5.1%	125.4	6.2%
2004	13	6.3%	2378.2	85.6%
2005	44	5.4%	552.7	12.9%
2006	4	0.4%	12.6	0.2%
2007	4	0.7%	0.5	0.0%
2008	10	1.5%	17.4	0.2%
2009	46	7.4%	192.8	3.2%
2010	34	6.0%	197.4	5.8%
2011	3	1.5%	0.5	0.1%

In recent years, the number of prescribed burns in Pennsylvania have been increasing. This corresponds to an embrace of the need for fire in many natural ecosystems and management strategies for reducing vulnerability to wildfires. *Table 40 - Fire Occurrences* lists two prescribed burns conducted by the PA Game Commission. In addition, in 2018 there was a prescribed burn of 403 acres in the northern portion of State Game Lands 13 (PA Prescribed Fire Council, 2018). *Table 42 - Pennsylvania Prescribed Burns* shows prescribed burn data for Pennsylvania from 2010 to 2015. Statewide data for prescribed burns was not available after 2015.

Table 42 - Pennsylvania Prescribed Burns

Pennsylvania Prescribed Burns *(PA DCNR, 2018)*				
Year	**All Agencies and Organizations - Number of Prescribed Fires**	**All Agencies and Organizations - Number of Prescribed Fire Acres**	**DCNR - Number of Prescribed Fires**	**DCNR - Number of Prescribed Fire Acres**
2010	56	2737	12	186
2011	70	6301	11	189
2012	96	4133	10	208
2013	142	8058	35	866
2014	161	7094	26	338
2015	244	14553	47	1317

4.3.13.4 Future Occurrence

Annual occurrences of urban and wildfires in Sullivan County are expected. Urban fires are most often a result of human errors, outdated wiring or occasionally malintent (arson). The occurrence of large scale and intensity wildfires is somewhat unpredictable and highly dependent on environmental conditions and human response. Weather conditions play a major role in the occurrence of wildfires, so in the event of dry drought conditions, wildfire caution should be heightened. 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 Sullivan County Emergency Management Agency coordinates countywide burn bans when the conditions are ideal for wildfires. Public information and press releases are issued to help decrease the risk of a major fire thus reducing the possibility of future occurrences. Sullivan County Department of Emergency Services disseminates all red flag warnings.

4.3.13.5 Vulnerability Assessment

The size and impact of a wildfire depends on its location, climate conditions and the response of firefighters. If the right conditions exist, these factors may often mitigate the effects of wildfires, however during a drought, wildfires can be devastating. The highest risk for wildfires in Pennsylvania occurs during the spring (March–May) and fall (October–November) months. Firefighters and other first responders can encounter life threatening situations due to forest fires. Traffic accidents during a response and then the impacts of fighting the fire once on scene are examples of the first responder vulnerabilities.

The Wildland Urban Interface (WUI) was nationally mapped by a United States Department of Agriculture Forest Service effort in 2015 that used data from 1990-2010 to develop a robust dataset that relates housing density and vegetative density. The dataset provides a way to help identify locations where larger numbers of humans are living in or near natural areas that could be at risk in the event of a wildfire. The WUI defines two

types of communities – interface and intermix: intermix WUI refers to areas where housing and wildland vegetation intermingle, and interface WUI refers to areas where housing is in the vicinity of a large area of dense wildland vegetation (Martinuzzi et al., 2015). Pennsylvania is among the states with the largest area of WUI and the most housing units in a WUI designated area. There are several locations within Sullivan County that are identified as interface or intermix - these regions represent the areas where human lives are most vulnerable to wildfires and can be seen in *Figure 39 - Wild Urban Interface Locations*. As a compliment to these locations, *Figure 38 – Wildfire Vulnerable Locations* shows the locations of fire departments as well as state owned natural areas which represent vast swatches of forests in the county.

Table 43 - Buildings in High Wildfire Hazard Areas shows the total addressable structures and critical facilities that are located in state game lands, state parks and locations designated by the Wildland Urban Interface. Wildfire hazard is defined based on conditions that affect wildfire ignition and/or behavior such as fuel, topography and local weather. Cells that have no entry had zero vulnerable addressable structures or critical facilities according to this analysis.

Table 43 - Buildings in High Wildfire Hazard Areas

Buildings in High Wildfire Hazard Areas *(Sullivan Co. GIS, 2018; Radeloff et al. 2016)*				
Municipalities	**Wild Urban Interface & Intermix**		**State Forests, Parks & Game Lands**	
	Addressable Structures	**Critical Facilities**	**Addressable Structures**	**Critical Facilities**
Cherry Township	941	0	0	0
Colley Township	460	0	6	1
Davidson Township	454	0	5	0
Dushore Borough	312	4	0	0
Eagles Mere Borough	401	1	0	0
Elkland Township	305	0	1	0
Forks Township	258	0	33	1
Forksville Borough	88	1	0	0
Fox Township	543	1	19	0
Hillsgrove Township	302	1	9	1
Laporte Borough	268	4	0	0
Laporte Township	304	2	8	1
Shrewsbury Township	167	0	20	0
Total	**4803**	**14**	**101**	**4**

There are nine fire departments that cover Sullivan County which can be seen in *Table 44 - Fire Departments*. Each fire department conducts its own schedule of in-house training sessions for their members.

Table 44 - Fire Departments

Fire Departments ***(Sullivan County GIS, 2018)***				
Station Name	**Station Number**	**Address**	**Municipality**	**Ambulances**
Laporte Borough Vol Fire Company	50	114 Maple St	Laporte Borough	1
Muncy Valley Area Vol Fire Co #1, Inc	52	11997 Route 42	Davidson Township	1
Eagles Mere Fire Company	51	49 Fern Ln	Eagles Mere Borough	1
Hillsgrove Volunteer Fire Co	54	2232 Route 87	Hillsgrove Township	1
Forksville Fire Co	53	158 Main St	Forksville Borough	0
Endless Winds Fire Co	55	9721 Route 154	Fox Township	1
Eldredsville Fire Company	56	402 Route 4007	Elkland Township	0
Mildred Fire Company	58	113 School Rd	Cherry Township	1
Dushore Fire Company	57	212 Julia St	Dushore Borough	1

Figure 38 – Wildfire Vulnerable Locations

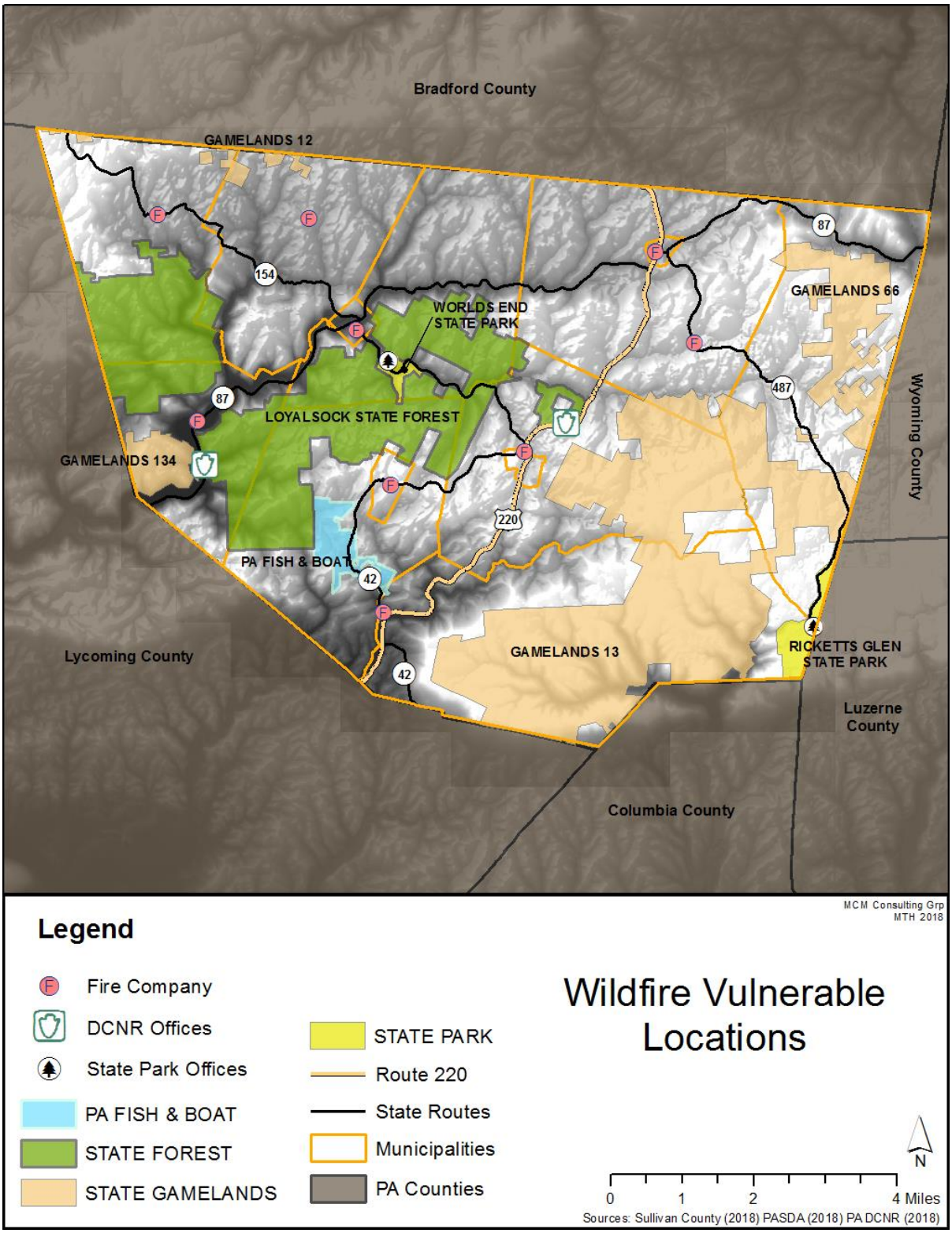
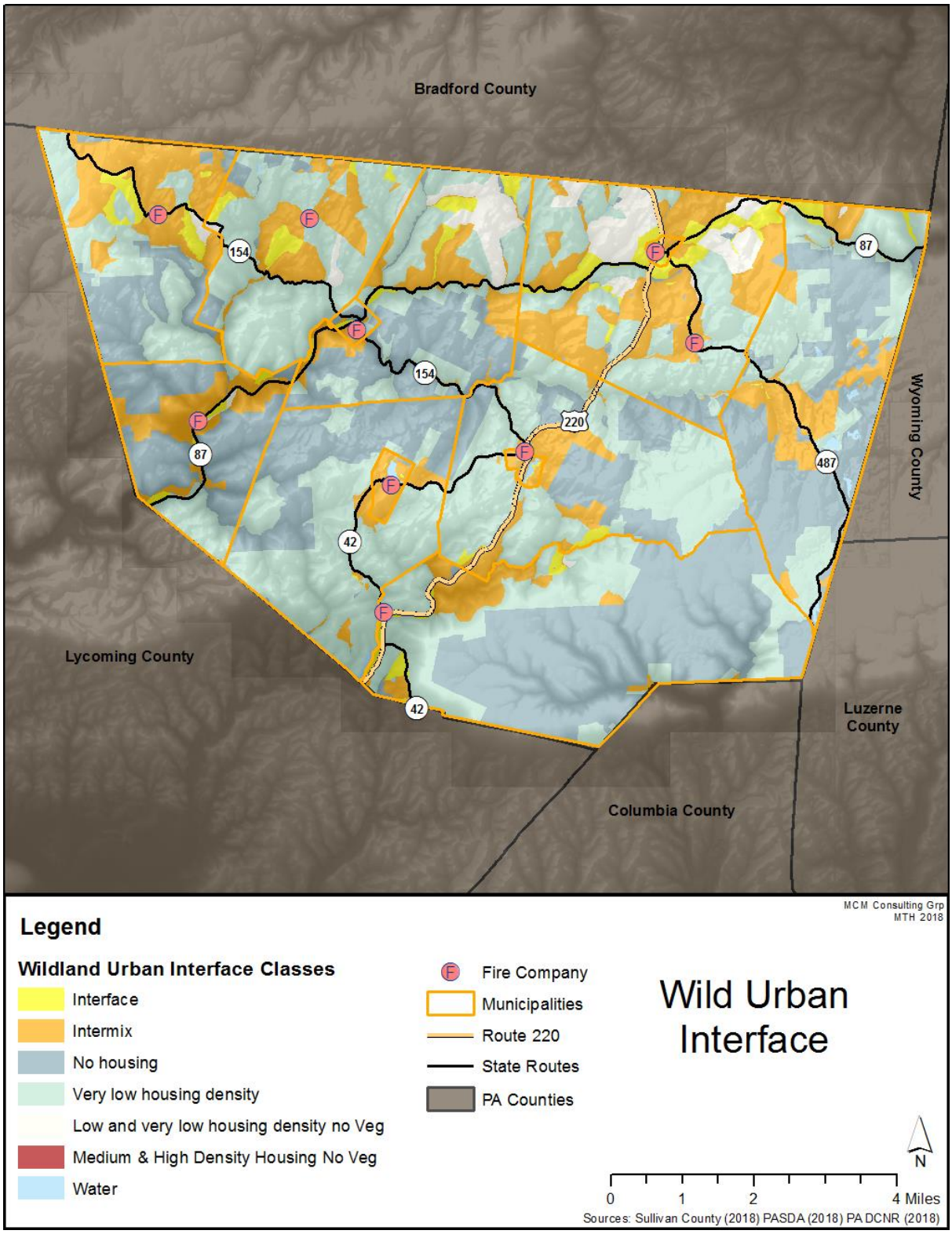


Figure 39 - Wild Urban Interface Locations



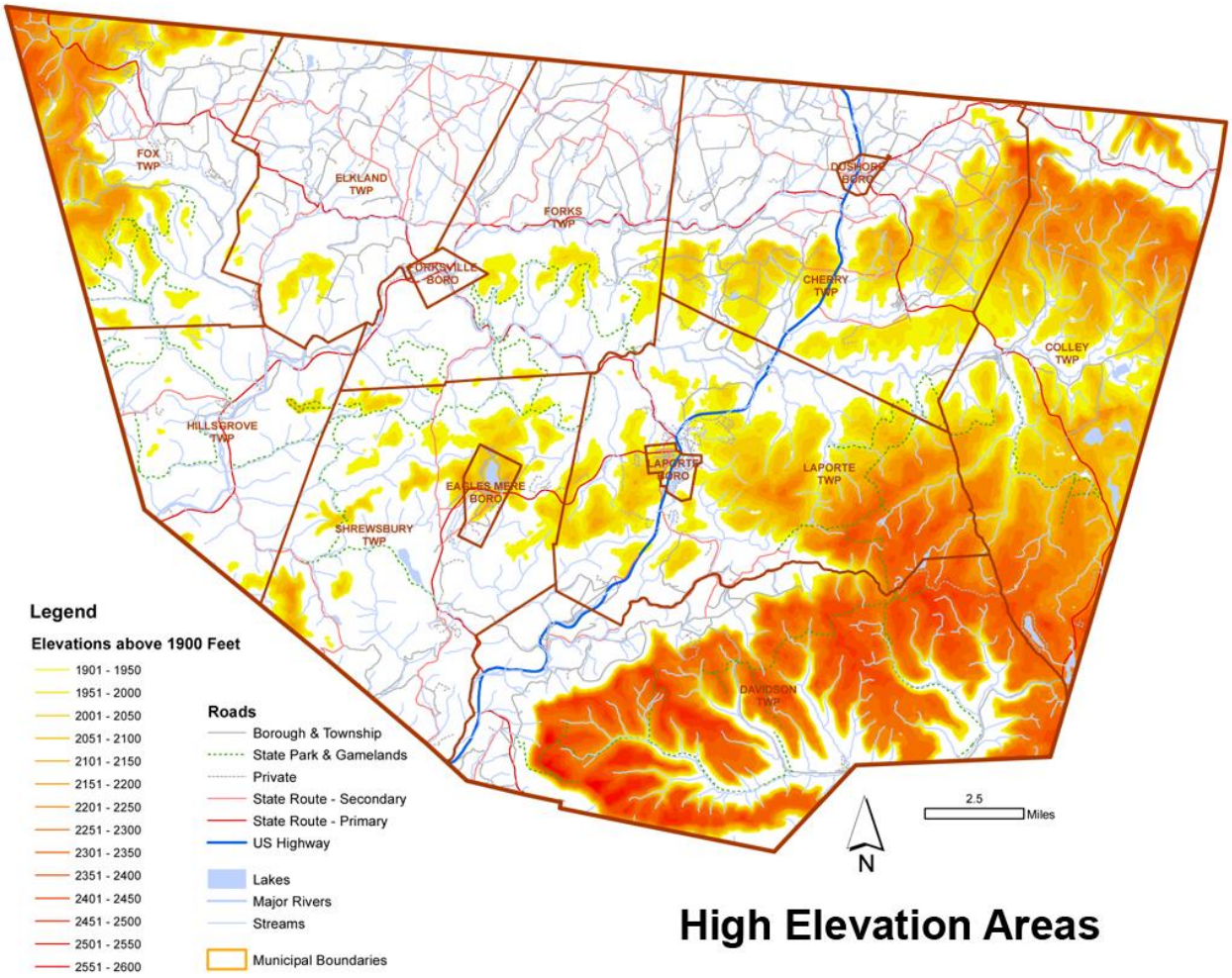
4.3.14. Winter Storms

4.3.14.1 Location and Extent

There is an average of thirty-five winter weather events that impact Pennsylvania each year. Such winter storms are regional events, so each county in Pennsylvania shares these hazards, however, the northern tier, western counties and mountainous regions generally experience storms more frequently and with a greater severity due to lake effects and geographic influence. Within Sullivan County there are variations in the average amount of snowfall that is received throughout the county because of differences in terrain; higher elevations experience greater snowfalls than lower-lying areas (See *Figure 40 - High Elevation Areas*)

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

Figure 40 - High Elevation Areas



4.3.14.2 Range of Magnitude

Winter storms consist of cold temperatures, heavy snow or ice and sometimes strong winds. Descriptions of types of winter storms can be found in *Table 45 - Winter Weather Events*. In severe cases, secondary effects of winter storms involve flooding, disruption to traffic, EMS response capabilities, communications, electric power and other utilities. Power outages can be caused by large amounts of snow or ice weighing on and breaking power lines. Especially in rural areas, loss of electric power can result in a loss of heat for residential customers, potentially posing a threat to human life.

Long cold spells can cause rivers and lakes to freeze over. A subsequent thaw and rise in the water level then break the ice into large chunks and can result in ice jams when the ice begins to flow. The ice jams can act as a dam and result in flooding. 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. While

gradual melting of snow and ice provides excellent groundwater recharge, high temperatures following a heavy snowfall can cause rapid surface water runoff and severe flooding. *Figure 41 - Pennsylvania Annual Snowfall 1981-2010* shows mean annual snowfall in Sullivan County to be between thirty-one and fifty inches. *Table 46 - Recent Annual Snowfall by Snow Station* summarizes annual snowfall accumulation for recent years not covered in *Figure 41 - Pennsylvania Annual Snowfall 1981-2010* as recorded in the weather stations in Laporte and Dushore.

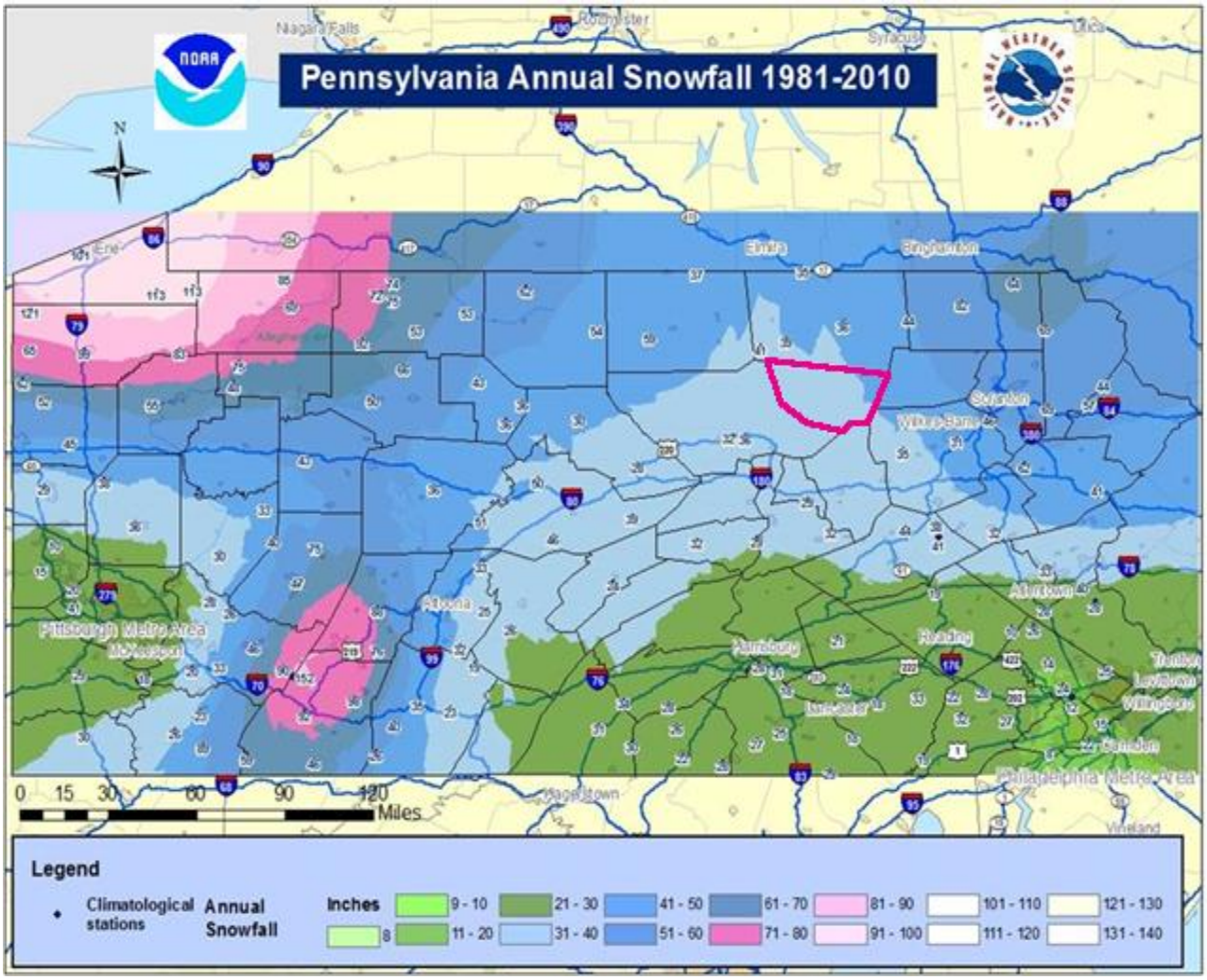
Table 45 - Winter Weather Events

Winter Weather Events	
Weather Event	**Classification**
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.

Table 46 - Recent Annual Snowfall by Snow Station

Recent Annual Snowfall by Snow Station *(NOAA, 2018)*		
Winter Season	**Laporte**	**Dushore**
2010-2011	97.8”	62.5”
2011-2012	48.8”	32.8”
2012-2013	59.7”	34.5”
2013-2014	79.8”	57.6”
2014-2015	96.3”	51.3”
2015-2016	15.1”	12.7”
2016-2017	67.3”	57.4”
2017-2018	58.0”	50.5”

Figure 41 - Pennsylvania Annual Snowfall 1981-2010



4.3.14.3 Past Occurrence

Historically, winter storms have occurred on the average of five times a year in Sullivan County. One of the most severe winter events in the county's history was in the winter of 1993–1994 when the state was hit by a series of protracted winter storms. The severity and nature of these storms combined with accompanying record-breaking frigid temperatures posed a major threat to the lives, safety and well-being of Commonwealth residents and caused major disruptions to the activities of schools, businesses, hospitals, and nursing homes. One of these devastating winter storms occurred in early January 1994 with record snowfall depths in many areas of the Commonwealth, strong winds and sleet/freezing rains. Numerous storm-related power outages were reported and as many as 600,000 residents were without electricity, in some cases for several days at a time. A ravaging ice storm followed which closed major arterial roads and downed many

trees and power lines. Utility crews from a five-state area were called to assist in power restoration repairs. 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 and sporadic power supply outages continued through mid-January in many locations due to record cold temperatures. The entire Pennsylvania-New Jersey-Maryland grid and its partners in the District of Columbia, New York and Virginia experienced 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 (with temperatures as low as -31˚F) resulted in numerous water-main breaks and interruptions of service to thousands of municipal and city water customers throughout the Commonwealth. The extreme cold in conjunction with accumulations of frozen precipitation resulted in acute shortages of road salt. Trucks were dispatched to haul salt from New York to expedite deliveries to Pennsylvania Department of Transportation storage sites.

All recorded winter weather events in Sullivan County from 1996-October 2018 are summarized in *Table 47 - Winter Storm History*. No direct deaths or injuries were reported for the following winter weather events in Sullivan, and the only property damage reported occurred on March 4, 2001 and October 28, 2008, with the heavy snows causing $4,000 and $2,000 in property damage respectively. Detailed reports of each event can be found on NOAA's Storm Events Database (www.ncdc.noaa.gov/stormevents). The snowstorm on October 28, 2008 was unseasonably early and severe with seven inches of snow falling in Sullivan County, resulting in 1,200 Penelec customers without power at the height of the storm. Numerous motor vehicle accidents were reported in Sullivan County, although none were serious according to state police in Laporte. Sections of U.S. Route 220 were temporarily closed due to a jackknifed tractor trailer and other trucks that were stuck in the road (NOAA NCEI, 2018).

Table 47 - Winter Storm History

Winter Storm History ***(NOAA NCEI, 2018)***			
Date	**Type**	**Date**	**Type**
01/02/1996	Heavy Snow	01/07/1996	Blizzard
01/12/1996	Heavy Snow	03/07/1996	Heavy Snow
01/15/1997	Heavy Snow	01/27/1997	Heavy Snow
02/13/1997	Winter Storm	03/14/1997	Ice Storm
03/31/1997	Heavy Snow	11/14/1997	Heavy Snow
12/10/1997	Heavy Snow	12/29/1997	Heavy Snow
01/15/1998	Ice Storm	01/22/1998	Ice Storm
02/23/1998	Heavy Snow	01/02/1999	Winter Storm
01/08/1999	Winter Storm	01/14/1999	Winter Storm

Winter Storm History *(NOAA NCEI, 2018)*			
Date	**Type**	**Date**	**Type**
02/07/1999	Heavy Snow	03/06/1999	Heavy Snow
03/21/1999	Heavy Snow	01/25/2000	Heavy Snow
01/30/2000	Heavy Snow	02/13/2000	Ice Storm
02/18/2000	Winter Storm	04/08/2000	Heavy Snow
12/13/2000	Winter Storm	12/19/2000	Heavy Snow
01/20/2001	Heavy Snow	03/04/2001	Heavy Snow
03/21/2001	Heavy Snow	01/06/2002	Heavy Snow
01/19/2002	Heavy Snow	12/05/2002	Heavy Snow
12/10/2002	Ice Storm	12/25/2002	Heavy Snow
01/01/2003	Ice Storm	01/02/2003	Heavy Snow
02/16/2003	Heavy Snow	03/30/2003	Heavy Snow
12/14/2003	Heavy Snow	01/27/2004	Heavy Snow
02/03/2004	Heavy Snow	02/06/2004	Ice Storm
03/16/2004	Heavy Snow	12/20/2004	Cold/Wind Chill
01/05/2005	Winter Storm	01/08/2005	Ice Storm
01/22/2005	Winter Storm	02/21/2005	Winter Storm
03/01/2005	Heavy Snow	03/23/2005	Winter Storm
10/25/2005	Heavy Snow	12/09/2005	Heavy Snow
12/16/2005	Winter Storm	01/03/2006	Winter Storm
01/28/2007	Heavy Snow	02/03/2007	Extreme Cold/Wind Chill
02/13/2007	Heavy Snow	02/16/2007	Extreme Cold/Wind Chill
03/06/2007	Extreme Cold/Wind Chill	03/16/2007	Heavy Snow
04/15/2007	Heavy Snow	11/18/2007	Heavy Snow
12/02/2007	Ice Storm	12/09/2007	Ice Storm
02/01/2008	Winter Storm	02/10/2008	Extreme Cold/Wind Chill
10/28/2008	Heavy Snow	12/11/2008	Winter Storm
12/19/2008	Winter Storm	12/21/2008	Extreme Cold/Wind Chill
12/23/2008	Ice Storm	01/06/2009	Ice Storm
01/10/2009	Winter Storm	01/15/2009	Extreme Cold/Wind Chill
01/27/2009	Winter Storm	03/02/2009	Extreme Cold/Wind Chill
10/15/2009	Winter Storm	02/09/2010	Winter Storm
02/25/2010	Winter Storm	02/01/2011	Winter Storm
02/20/2011	Heavy Snow	03/06/2011	Heavy Snow
03/23/2011	Winter Storm	10/29/2011	Heavy Snow
12/26/2012	Winter Storm	12/14/2013	Heavy Snow
01/06/2014	Extreme Cold/Wind Chill	02/04/2014	Winter Storm
02/13/2014	Heavy Snow	11/25/2014	Heavy Snow
02/01/2015	Winter Storm	02/12/2015	Extreme Cold/Wind Chill
02/15/2015	Extreme Cold/Wind Chill	02/19/2015	Extreme Cold/Wind Chill
02/23/2015	Extreme Cold/Wind Chill	02/13/2016	Extreme Cold/Wind Chill
01/23/2017	Winter Storm	02/08/2017	Winter Storm
03/13/2017	Winter Storm	01/05/2018	Extreme Cold/Wind Chill
02/04/2018	Winter Storm		

4.3.14.4 Future Occurrence

The prospect of climate change brings the future of the climate into uncertainty; however, climate scientists believe that extreme winter storms are expected to occur more frequently – there have been about twice as many extreme snow events in the United States in the latter half of the 20th century as occurred in the first half (NOAA, 2018). This uptick is caused in part by higher than normal ocean surface temperatures that result in an increased source of moisture for storms that develop over the Atlantic Ocean. Conditions for severe winter storms are particularly heightened in the eastern United States due to changes in atmospheric circulation patterns caused by higher temperatures and melting Arctic sea ice (Francis & Vavrus, 2012). Winters in 2000 and 2001 were mild in Pennsylvania and led to spring-like thunderstorms during the winter months rather than snow storms. Such thunderstorms can be followed by cold fronts and winter storms resulting in temperature drops of 50˚F in a few short hours.

Winter storms are a regular, annual occurrence in Sullivan County and should be considered highly likely. Approximately thirty-five winter storm events occur across Pennsylvania annually and about five of which are estimated to significantly impact Sullivan County each year.

4.3.14.5 Vulnerability Assessment

Winter storms are a frequent event in the county. Detrimental impacts of severe winter storms are mitigated by salting, plowing and snow removal by PennDOT and local municipalities. Icy and snow-covered roads often result in increases in traffic incidents. Swift response to utility outages during winter storms is another significant way to mitigate damages. Residents of the mountainous and more rural areas of the county may be more susceptible during severe storms, especially when emergency medical assistance is required due to the location's potential for isolation. There are rural areas which are susceptible to isolation due to winter storms. Residents in outlying areas often find it beneficial to keep an emergency food and fuel stock in the event of isolation or utility interruption during a winter storm. Residents in the northwestern sector of Sullivan County are subject to isolation when winter storms strike. The economic impacts from snow removal, road and infrastructure repair and other secondary effects impart a great strain on the budgets and material resources of local municipalities.

Even for communities that are prepared to respond to winter storms, severe events involving snow accumulations that exceed six or more inches in a twelve-hour period can cause a large number of traffic accidents, strand motorists due to snow drifts, interrupt power supply and communications, and cause the failure of inadequately designed and/or maintained roof systems. State Routes US 220, SR 42 and SR 87 may have stranded motorists requiring emergency transportation. Similar to the vulnerability assessment discussion for tornados and severe wind, vulnerability to the effects of winter storms on buildings is dependent on the age of the building, construction material used

and condition of the structure. Unfortunately, no comprehensive database of these variables could be identified for Sullivan County.

4.3.15. Civil Disturbance

4.3.15.1 - Location and Extent

Riots have not been frequent occurrences throughout the history of the Commonwealth, however when they occur, they can cause significant property damage, injury and even loss of life. The scale and scope of civil disturbance events varies widely. Government facilities, local landmarks, prisons, and universities are common sites where crowds and mobs may gather.

4.3.15.2 - Range of Magnitude

Civil disturbances can take the form of small gatherings or large groups blocking or impeding access to a building or disrupting normal activities by generating noise and intimidating people. They can range from a peaceful sit-in to a full-scale riot, in which a mob burns or otherwise destroys property and terrorizes individuals. Even in its more passive forms, a group that blocks roadways, sidewalks, or buildings interferes with public order. There are two types of large gatherings typically associated with civil disturbances: a crowd and a mob. A crowd may be defined as a casual, temporary collection of people without a strong, cohesive relationship. Crowds can be classified into four categories:

- **Casual Crowd**: A casual crowd is merely a group of people who happen to be in the same place at the same time. Violent conduct does not occur.
- **Cohesive Crowd**: A cohesive crowd consists of members who are involved in some type of unified behavior. Members of this group are involved in some type of common activity, such as worshipping, dancing, or watching a sporting event. Although they may have intense internal discipline, they require substantial provocation to arouse to action.
- **Expressive Crowd**: An expressive crowd is one held together by a common commitment or purpose. Although they may not be formally organized, they are assembled as an expression of common sentiment or frustration. Members wish to be seen as a formidable influence. One of the best examples of this type is a group assembled to protest.
- **Aggressive Crowd**: An aggressive crowd is comprised of individuals who have assembled for a specific purpose. This crowd often has leaders who attempt to arouse the members or motivate them to action. Members are noisy and threatening and will taunt authorities. They may be more impulsive and emotional, and require only minimal stimulation to arouse violence. Examples of this type of crowd could include demonstrators and strikers, though not all demonstrators and strikers are aggressive.

A mob can be defined as a large disorderly crowd or throng. Mobs are usually emotional, loud, tumultuous, violent and lawless. Similar to crowds, mobs have different levels of commitment and can be classified into four categories:

- **Aggressive Mob**: An aggressive mob is one that attacks, riots and terrorizes. The object of violence may be a person, property, or both. An aggressive mob is distinguished from an aggressive crowd only by lawless activity. Examples of aggressive mobs are the inmate mobs in prisons and jails, mobs that act out their frustrations after political defeat, or violent mobs at political protests or rallies.
- **Escape Mob**: An escape mob is attempting to flee from something such as a fire, bomb, flood, or other catastrophe. Members of escape mobs are generally difficult to control can be characterized by unreasonable terror.
- **Acquisitive Mob**: An acquisitive mob is one motivated by a desire to acquire something. Riots caused by other factors often turn into looting sprees. This mob exploits a lack of control by authorities in safeguarding property.
- **Expressive Mob**: An expressive mob is one that expresses fervor or revelry following some sporting event, religious activity, or celebration. Members experience a release of pent up emotions in highly charged situations.

In the event of a significant civil disorder event, local government operations and the delivery of services in the community may experience short-term disruptions. The greatest secondary effect is the impact on the economic and financial conditions of the affected community, particularly in relation to the property, facilities, and infrastructure damaged as a result of the disturbance. More serious acts of vandalism may result in limited power failure or hazardous material spills, leading to a possible public health emergency. Altered traffic patterns may increase the probability of a transportation accident.

Sullivan County's greatest threat to civil disorder is in Colley Township, home of the Red Rock Job Corps Center. Red Rock Job Corps Center is a no-cost education and career training program administered by the U.S. Department of Labor that helps young people ages sixteen to twenty-four to improve the quality of their lives through career, technical and academic training. Citizens, property, and infrastructure in and around the Colley Township area could be affected in the event of a large-scale disturbance at the center.

4.3.15.3 - Past Occurrence

There have not been many major civil disorders and riots in Sullivan County, though there was one notable disturbance at the Red Rock Job Corps Center on April 30, 2012. Twenty students were rioting at the facility and assaulting teachers. Dozens of State Police and local police were summoned to the location, and parts of Route 487 had to be shut down during the incident. Several minor injuries were reported.

4.3.15.4 - Future Occurrence

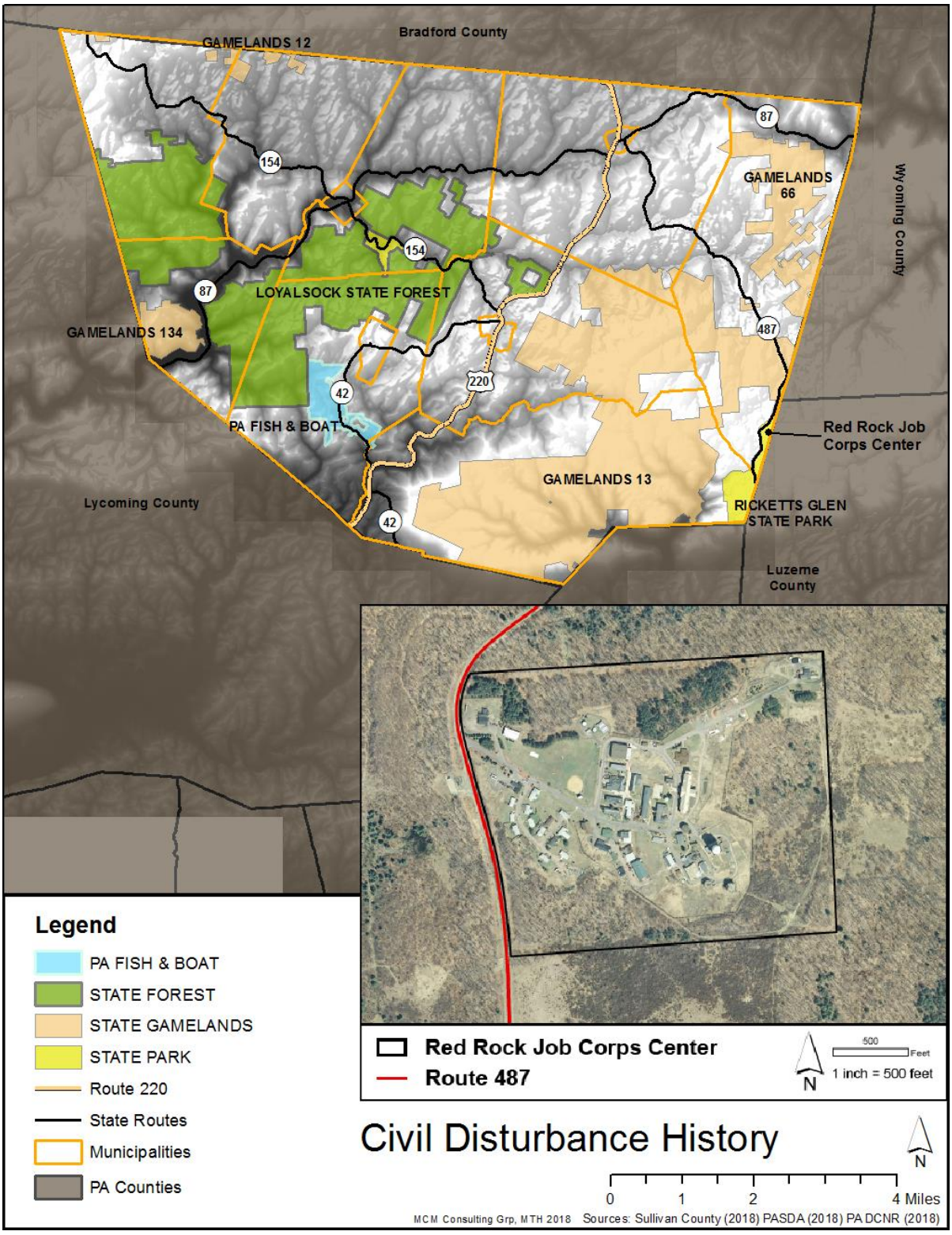
While unlikely, civil disturbances may occur in Sullivan County, and it is difficult to accurately predict the probability of future occurrence for civil disturbance events over

the long-term. It is estimated that a civil disturbance event could occur every thirty years or less in Sullivan County.

4.3.15.5 - Vulnerability Assessment

All municipalities in Sullivan County can be vulnerable to civil disturbance, however the anticipated impact from such events is minimal. These events may be sparked for varying reasons and the seriousness of the event may well be exacerbated by how authorities handle the crowd. The map below shows the location of the Red Rock Job Corps Center in Colley Township. Some critical facilities are important to be aware of as both potential locations for civil disturbance events, and important locations during civil disturbance response.

Figure 42 - Civil Disturbance History



4.3.16. Dam Failure

See Appendix I for the Dam Failure profile.

4.3.17. Disorientation

4.3.17.1 Location and Extent

Large numbers of people are attracted to Pennsylvania's rural areas for recreational purposes such as hiking, camping, hunting, and fishing. As a result, people can become lost or trapped in remote and rugged wilderness areas. Sullivan County attracts environmental tourists due to the natural beauty of the county and the expanses of forested area, both state land and otherwise. Sullivan is home to the Loyalsock State Forest, Worlds End State Park, part of Ricketts Glen State Park, and several state game lands. In the event of disorientation, search and rescue may be required for people who suffer from medical problems or injuries and those who become accidentally or intentionally disoriented. Search and rescue efforts are often focused in and around state forest and state park lands as they contain numerous miles of hiking and biking trails.

4.3.17.2 Range of Magnitude

Approximately 90% of Sullivan County is forested (Comprehensive Plan, 2010). A wide variety of factors can contribute to the outcome of a search and rescue mission but the most common dangers associated with disorientation are lack of food, water and shelter. Sullivan County generally has an abundance of water, and during the warmer summer months shelter is less of a necessity than during winter months when extreme temperatures can pose a threat. Age, physical fitness, and familiarity with the area can also have a bearing on the outcome.

Initial search and rescue efforts are often made with teams of dogs, people on horseback, and or volunteers from fire departments, and for longer term incidents, drones may be employed.

4.3.17.3 Past Occurrence

Wilderness search and rescue has required considerable resources, sometimes resulting in the expenditure of hundreds of man-hours. *Table 48 - Disorientation Events* identifies the disoriented and missing person incidents in Sullivan County through October 2018 where emergency service personnel assistance was required.

One of the most significant search and rescue operations in Sullivan County happened in early October 2018, when a hunter went missing in State Game Lands 66 in Colley Township. The hunter embarked into the woods on October 2, encountered inclement weather and did not return that night. The first searches were deployed on October 3, with a full search and rescue operation mounted by October 4. The DCNR, Game Commission, and other PEMA recognized search and rescue groups were involved in the

multi-day search. Most search and rescues typically last around one day, and the length of this search ended up employing more resources than many other search and rescue efforts often use. The search concluded on Monday October 8 when they found the hunter deceased.

Table 48 - Disorientation Events

Disorientation Incidents ***(Knowledge Center, 2018; 2014 HMP)***			
Description	**Category**	**Location**	**Date and Duration**
Missing Hunter Search, found deceased hunter after six days of searching.	Search & Rescue	State Game Lands 66 in Colley Township	10/3/2018 to 10/8/2018
Personal Care Home Evacuation	Search & Rescue	Hillsgrove Township	10/21/2016 04:59 to 10/24/2016 07:33
Missing Hiker	Search & Rescue	Davidson Township	11/16/2014 18:35 to 12/01/2014 09:57
Missing Person	Exercise	Forks Township	11/05/2014 18:07 to 11/05/2014 20:50
Missing Person	Search & Rescue	Forks Township	09/27/2013 20:00 to 09/28/2013 08:32
ATV Accident	Search & Rescue	Laporte Township	11/15/2012 16:02 to 11/16/2012 09:02
Missing Hunter. Did not survive.	Search & Rescue	Camp Brule Area, Elkland Township	11/27/2007 to 11/30/2007
Missing 4-year old child	Search & Rescue	Fox Township	03/27/2007 11:33 P.M. to 4:06 P.M.
Suicidal female, was found	Search & Rescue	Lake Mokoma, Davidson Township	09/12/2006 to 09/16/2006
Missing ice-fisherman. Fire personnel and divers were dispatched for a drowning. Unknown outcome.	Search & Rescue	Hunters Lake, Shrewsbury Township	03/10/2006 to 3/11/2006
2 Missing Hikers. Both found in good condition	Search & Rescue	Camp Brule, Elkland Township	07/31/2004 12:24 P.M. to 5:44 P.M.

4.3.17.4 Future Occurrence

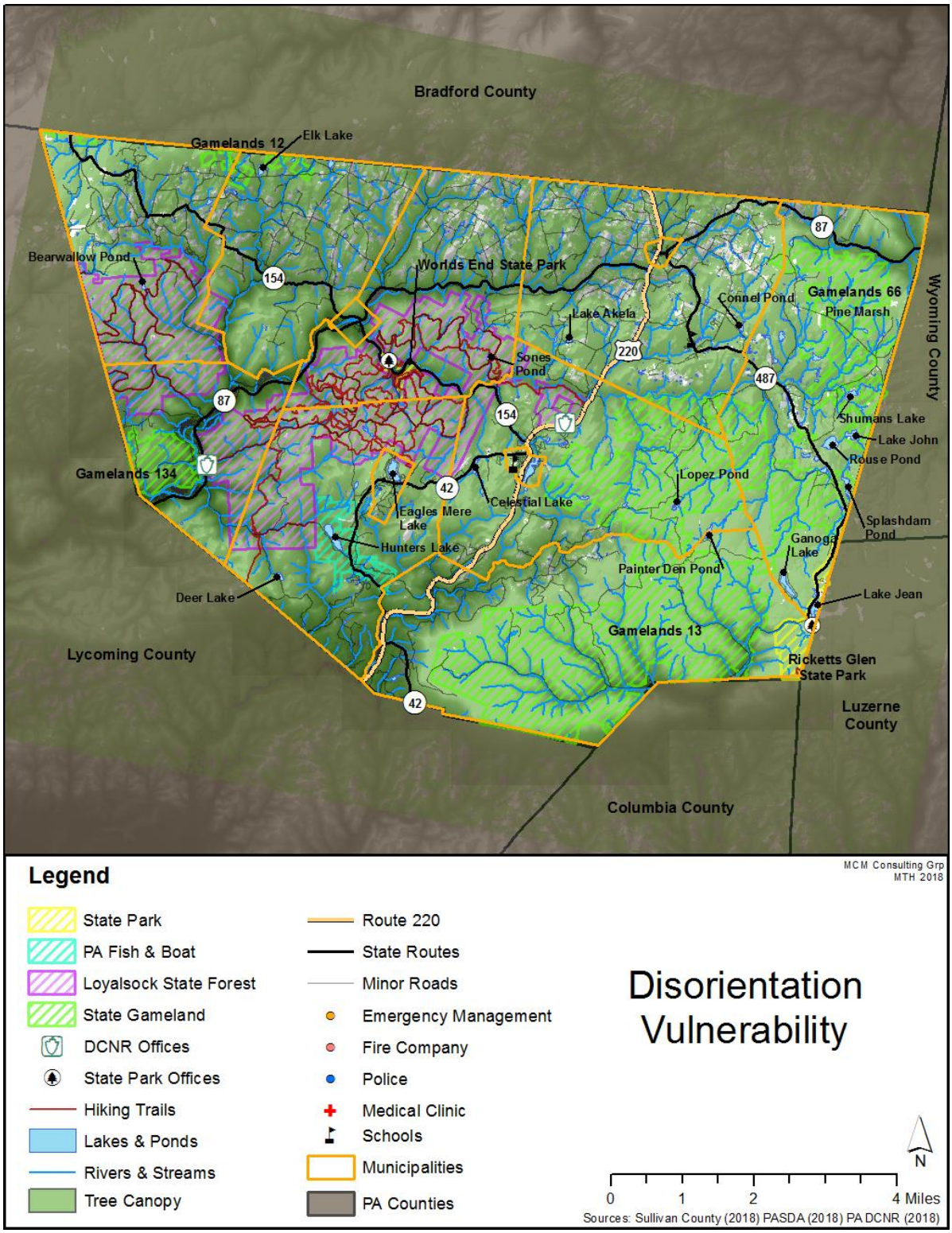
During the warm summer months, as activities such as hiking, biking and camping increase, so does the likelihood of individuals becoming disoriented. November also has many most search and rescue events because of hunters getting lost during hunting season. Disorientations are most likely in state parks and state forests where outdoor recreation is most abundant and the forest is most dense. Medical emergencies occur regularly in the county, especially in the elderly that could result in disorientation.

4.3.17.5 Vulnerability Assessment

Individuals are most likely to become disorientated in areas of vast, open wilderness. Children and the elderly are more vulnerable to the exposure of elements. The elderly tend to be more vulnerable to disorientation due to medical related issues. Many times, a dementia or Alzheimer individual will become disoriented in wilderness or residential areas.

The most dangerous period to become lost outdoors is during the winter months when heat and shelter are vital. Sullivan County regularly experiences winter storms and temperatures below freezing, so persons participating in outdoor recreational activities in the winter are at a higher risk in the event of disorientation. A majority of the county is forested and relatively rural, and *Figure 43 - Disorientation Vulnerability* identifies areas within the county that are most vulnerable to disorientation such as State Parks, State Forests, and State Game Lands as they attract many visitors. Due to hunting seasons and the number of hunters taking to the woods, November is often also a high-volume time for search and rescue events, especially in State Game Lands and the surrounding areas. The map also details the most active trails in those regions, giving a good idea of where people could start when they lose their way.

Figure 43 - Disorientation Vulnerability



4.3.18. Drowning

4.3.18.1 Location and Extent

Drowning can be a significant hazard in communities with numerous water bodies (e.g. ponds, lakes, rivers, etc.) and extensive outdoor recreational activity. This profile focuses on the threat of drowning in natural bodies of water, not swimming pools or other commercial/residential settings.

Sullivan County has been and continues to grow in popularity as a tourist destination. Water related recreational opportunities such as swimming, boating, fishing, and ice fishing are popular among visitors and locals. The Loyalsock Creek runs through the county, and hosts numerous swimming holes along its course. A small dam on the creek forms a swimming area in Worlds End State Park open from Memorial Day weekend through Labor Day where visitors can enjoy cold mountain stream water. Another swimming hole on the Loyalsock Creek is known as the "Haystacks" and features unique sandstone formations and requires over a mile hike to reach. The Bend is another location for swimming on the Loyalsock Creek, located between Forksville and Worlds End State Park, on Route 154 across from the Sullivan County Fairgrounds. Loyalsock Creek even hosts whitewater rafters, March and May being the best time for rafting in the area.

Many lakes and creeks are stocked with trout in Sullivan County, including Loyalsock Creek, Sones and Bear Wallow Ponds in Loyalsock State Forest, Lake Jean in Ricketts Glen State Park, and Hunters Lake in PA Fish & Boat Commission land. Ice fishing is also popular in many locations in Sullivan County, including all of the previously mentioned lakes and ponds.

These water-related recreation activities draw people to remote areas and possibly deep waters where drowning is a realistic threat and response can take time due to the remoteness of some locations. Other than those mentioned, there are numerous other rivers, lakes and ponds where such recreation takes place throughout the county.

4.3.18.2 Range of Magnitude

According to the Center for Disease Control (CDC), drowning is the third leading cause of death from unintentional injury worldwide. In the United States, children under the age of five and adults over the age of eighty-five had the highest risk to drowning. As surveyed above, there are many streams, lakes and ponds in Sullivan County where various water recreation activities are common, and it follows that there are many places and times in Sullivan County when drownings could occur. *Table 49 - Sullivan County Water Features* lists many prominent locations where water recreation can occur in the county.

A secondary hazard from a drowning is the potential for a rescuer to lose their life in their effort of rescuing a drowning person, or recovering a drowned person's body. There is also a hazard of droning during flash flooding. The National Weather Service has adopted the "Turn Around, Don't Drown" slogan to inform the public of the hazards of traveling through or near flood waters. People often underestimate the force and power of water, especially flood water. Many of the deaths occur in automobiles as they are swept downstream. The next highest percentage of flood-related deaths is due to walking into or near flood waters. A mere six inches of fast-moving water can knock over an adult, and it takes only two feet of rushing water to carry away most vehicles, including sizable pickup trucks and SUVs.

Table 49 - Sullivan County Water Features

Sullivan County Water Features					
Name	**Type**	**Name**	**Type**	**Name**	**Type**
Barkshed Run	Stream	Bear Run	Stream	Bear Swamp Run	Stream
Bearwallow Pond	Lake	Bearwallow Run	Stream	Beaver Pond	Lake
Big Bottom Run	Stream	Big Run	Stream	Birch Creek	Stream
Black Creek	Stream	Blackwater Run	Stream	Bloody Run	Stream
Brunnerdale Run	Stream	Bully Run	Stream	Cabin Run	Stream
Cape Run	Stream	Celestial Lake	Lake	Cherry Run	Stream
Coal Run	Stream	Cold Run	Stream	Conklin Run	Stream
Crystal Lake	Lake	Deep Hollow Run	Stream	Deer Lake	Lake
Double Run	Stream	Dry Run	Stream	Dutchman Run	Stream
Eagles Mere Lake	Lake	East Branch Mill Creek	Stream	Elk Creek	Stream
Elk Lake	Lake	Elk Run	Stream	Elklick Run	Stream
Ellis Creek	Stream	Fall Run	Stream	Falls Run	Stream
Flag Marsh Run	Stream	Floodwood Creek	Stream	Gallows Run	Stream
Ganoga Lake	Lake	Glass Creek	Stream	Glass Creek Pond	Lake
Hemlock Run	Stream	High Rock Run	Stream	Hoagland Branch	Stream
Hog Run	Stream	Huckle Run	Stream	Hunters Lake	Lake
Joes Run	Stream	Ketchum Run	Stream	Kettle Creek	Stream
Kings Creek	Stream	Lake Akela	Lake	Lake John	Lake
Lake Run	Stream	Laurel Run	Stream	Lick Creek	Stream

Sullivan County Water Features					
Name	**Type**	**Name**	**Type**	**Name**	**Type**
Lick Run	Stream	Little Loyalsock Creek	Stream	Little Swamp Run	Stream
Long Brook	Stream	Long Run	Stream	Lopez Creek	Stream
Lopez Pond	Lake	Lopez Pond Branch	Stream	Mackeys Run	Stream
Marsh Run	Stream	Meeker Run	Stream	Middle Branch Mill Creek	Stream
Mill Creek	Stream	Mill Run	Stream	Mosey Run	Stream
Mud Lake	Lake	Noon Run	Stream	Ogdonia Creek	Stream
Open Run	Stream	Oxhorn Run	Stream	Painter Den Creek	Stream
Painter Run	Stream	Payne Run	Stream	Peterman Run	Stream
Peters Creek	Stream	Pigeon Creek	Stream	Pine Marsh	Lake
Pine Marsh Creek	Stream	Pole Bridge Run	Stream	Porter Creek	Stream
Rainbow Lake	Lake	Rock Run	Stream	Rocky Run	Stream
Rough Run	Stream	Rouse Pond	Lake	Rusty Run	Stream
Ryman Pond	Lake	Sand Run	Stream	Santee Creek	Stream
Scar Run	Stream	Shanerburg Run	Stream	Sherman Run	Stream
Shingle Mill Run	Stream	Shumans Lake	Lake	Slab Run	Stream
Slip Run	Stream	Smith Cabin Run	Stream	South Branch Rock Run	Stream
Spring Brook	Stream	Spring Run	Stream	Stoney Run	Stream
Streby Run	Stream	Swamp Run	Stream	Swanks Run	Stream
Tamarack Run	Stream	The Outlet	Stream	Trout Run	Stream
Tublick Run	Stream	Wampole Run	Stream	Weed Creek	Stream
Williams Lake	Lake	Wolf Run	Stream	Yellow Run	Stream

4.3.18.3 Past Occurrence

There is only one available record of a drowning that happened in Sullivan County. It occurred on March 10, 2006, and there was a search and rescue at Hunters Lake - a water rescue was executed by fire personnel and divers at nearly 2:00 a.m. when a man fell into the water while ice fishing.

4.3.18.4 Future Occurrence

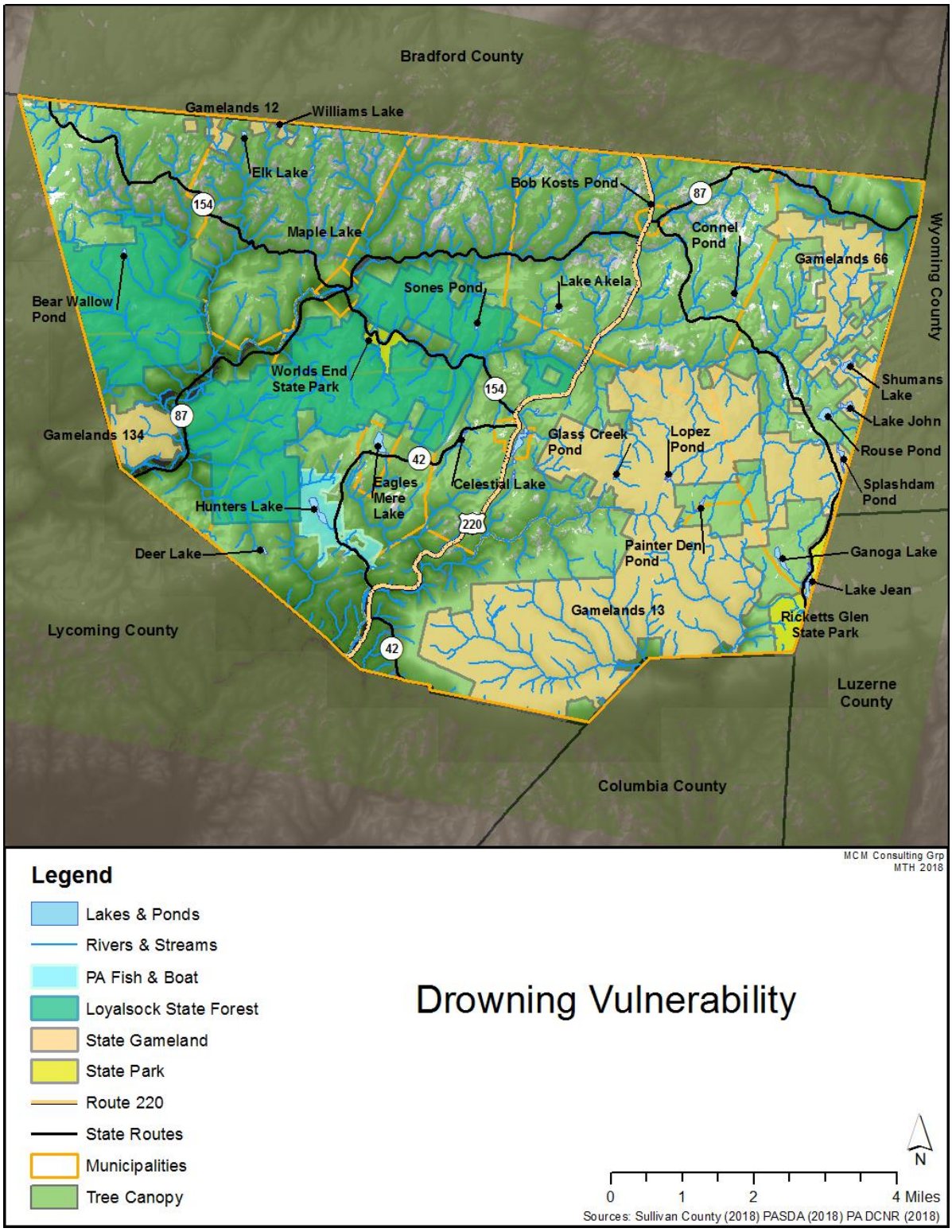
It is difficult to predict when occur, however knowledge of water based recreational activities in Sullivan County will give a better idea of where and when future drowning may occur. In the winter months, the county should be away of popular ice fishing locations.

Whitewater rafting on the Loyalsock Creek is most prevalent in March through May. During the warm summer months, as activities such as swimming, boating and fishing increase so does the likelihood of drowning in popular destinations for these activities. There is a consistent possibility for drowning occurrences in Sullivan County based on the many enjoyable water recreational opportunities in the County.

4.3.18.5 Vulnerability Assessment

With the 120 lakes, ponds and streams listed above as well as the numerous unnamed ponds, the potential for drowning is great. Natural water sources like the rivers, streams, lakes and ponds mentioned in 4.3.18.1 above are identified as particularly prominent destinations and vulnerable locations. As tourism continues to increase in the county and number of visitors grows, drowning is likely to continue without mitigation actions in place. Children and the elderly are at a higher vulnerability than all other age groups, however anybody partaking in water recreational activities can be vulnerable. The following map shows locations of popular water recreation locations as well as many of the other water features discussed above.

Figure 44 - Drowning Vulnerability Map



4.3.19. Emergency Services Response

4.3.19.1 Location and Extent

Emergency medical services (EMS) and the fire services in Sullivan County play a crucial role in the emergency response system, providing services ranging from emergency and medical transport for the sick and injured each year as well as fire and rescue responses. As stated in the Senate of Pennsylvania House of Representatives Final Senate Resolution 6 (SR6) Report, both EMS and fires services are in crisis due to the lack of funding and number of volunteers available to assume critical roles.

The citizens and visitors of the Commonwealth of Pennsylvania benefit daily from the services, knowledge and skills of the emergency services providers described below. Prehospital EMS encompasses a range of related activities, including 911 dispatch, response to the scene by ambulance, treatment and triage by EMS personnel, and transport to a care facility via ground and/or air ambulance. Importantly, it also includes medical direction provided through preestablished medical protocols or a direct link to a hospital or physician. EMS may encompass multiple levels of medical response, depending on how the system is configured in the community. EMS represents the first stage in a full continuum of emergency care that also includes hospital emergency departments (EDs), trauma systems/centers, inpatient critical care services, and interfacility transport.

Rural EMS and fire services often travel longer distances per incident due to the larger service areas and lower population density in rural areas. This results in higher average costs per trip for the agency as compared to their urban counterparts that more often accrue costs due to a higher number of trips.

The EMS system has a number of notable strengths. Prehospital EMS is far more sophisticated and far more capable than it was forty years ago. The 9-1-1 emergency notification system is available to virtually all Pennsylvanians and is regarded as highly responsive and reliable. The system enables rapid response to medical emergencies and facilitates crucial lifesaving care. In addition, the broad availability of cell phones has expanded 9-1-1 access to emergency and trauma scenes where no help was available before. The development of automatic crash notification technology has also become more widely available, further improving emergency response. This innovation provides immediate and increasingly detailed crash information to dispatchers automatically, even before anyone on scene places a call.

In general, Pennsylvanians have access to rapid services in emergency situations. While there are many glaring exceptions, first responders in urban and suburban areas are generally able to arrive on scene within minutes of notification, with ambulance and fire service crews close behind. Moreover, with greater emphasis now being placed on bystander care and prearrival instructions provided by dispatchers, care to patients can be initiated even more rapidly.

Emergency Services personnel form the backbone of the prehospital care and fire services system despite working under conditions that are stressful and at times dangerous. Many of them provide their services on a volunteer basis. The sophisticated equipment now at the disposal of many emergency services providers, such as automated external defibrillators (AEDs) and 12-lead electrocardiographs (ECGs), as well as more effective medications, fire equipment and apparatus allow them to provide a much broader array of services than was available in years past.

Response times vary widely depending on the location where an incident occurs. Across the large, sparsely populated terrain of rural areas, emergency services response times are significantly increased compared with those in urban areas. These prolonged response times occur at each step in the activation and response, including time to notification, time from notification to arrival at the scene, and time from arrival on the scene to hospital arrival.

4.3.19.2 Range of Magnitude

Finances, changing political climates, poor leadership, or a significant high-profile event can all trigger a system to be declared as "failed." In some cases, a combination of these factors can create a perfect storm. Unfortunately, many "failed" systems are measured by recent events, no matter how successful they may have been in the past. Although finance troubles are often blamed on poor leadership, they actually have many root causes. Labor rates, benefits, poor productivity, operational design, insurance reimbursements and market regulation all have a significant direct impact on the financial viability of an organization. EMS is often underfunded and poorly reimbursed, and the lack of dedicated and stable funding sources will continue to challenge EMS systems.

Two fundamental yet misunderstood topics are the finances and economic variables that drive emergency service systems. These systems typically generate revenue through billing insurance, tax subsidies, memberships, direct sales, diversification into other lines of business or grants or fundraising. They spend a majority of these revenues on direct and indirect labor and benefits, with the remaining dollars going to infrastructure, fuel, medical supplies, fleet maintenance, dispatch, billing and other essential items with hopefully some left over for recapitalization and profit or fund balance development.

Private insurance typically pays based on negotiated rates or will pay full charges to a point, occasionally by sending the payment directly to the patient, thus making it difficult for the provider to collect. This is done as a way to strong-arm the provider into a lower negotiated rate.

More important to understand is that governmental and commercial EMS reimbursement rates aren't tied to local EMS market conditions, competition, regulations or EMS operational system design, and therefore have a set cost assumption. Demand for EMS services within a particular market place (a county for example) doesn't flow based on price and availability of EMS service, as a normal market would, but rather is influenced

by uncontrollable things like population demographics and size, socioeconomics, population health, education and outside influences such as seasonality or things like influenza.

Given this, there's essentially a set amount of dollars that are available in the marketplace, and how these dollars are spent or divided among competitive providers can affect long-term financial stability. Marketplaces where more than one EMS provider exists yields a diseconomy of scale; things like dispatch, administrative, billing, fleet and other EMS functions are duplicated, thus driving up costs without an equal rise in dollars available to meet these expenses. In addition, competition often drives prices down in things like facility-paid, nonemergency work or loss-leader wheelchair work in order to move market share from one provider's pocket to another, thus shrinking the pool of dollars available toward the lower band in the marketplace.

4.3.19.3 Past Occurrence

Most EMS agencies are private organizations that lack local funding and exist based on reimbursements received from insurance companies and self-pay users of the system. Due to the decreased reimbursements as described previously and the decrease in call volumes and the increase in number of treat-no transport call responses EMS agencies are failing. If left unattended the effect may have devastating effects on communities.

Legislative attempts to advancing an amended bill to enable reimbursements for patients that are treated but not transported to advance through the State House of Representatives. This will only solve one part of the ongoing issue. Without financial support from the communities, EMS services may not be able to remain in operation to serve the same communities they have served for decades.

4.3.19.4 Future Occurrence

Volunteerism has been a significant component of the fire services. Most if not all members of our community fire departments are volunteers. Front and center, it is commonly a problem retaining and recruiting volunteers to staff both fire and emergency medical services. Sullivan County has publicly acknowledged the decline in volunteerism due to the required training requirements for firefighters and emergency medical technicians (EMT's).

According to an article published in the NY Times, *The Disappearing Volunteer Firefighter* (August 16, 2014) there are twice the number of volunteers compared to career firefighters. Most notably though is the number of volunteers that continue to drop by around eleven percent since the 1980's. With that trend it is suggested that the number of paid firefighters continues to grow.

Fast forwarding to present day, it is difficult for small communities to have a paid service therefore requiring the use of volunteers. The trend has devastating effects. With a decreased number of volunteers to not only perform the tasks associated with fires and

rescue operations it is imperative to facilitate fundraising. If there is a decreased number of volunteers to raise funds then the operational needs are impacted as well. Without fundraising and community support these fire departments will experience broader challenges.

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

Fire departments perform many tasks, just not fighting fires. It would perhaps be more appropriate to call these departments "All Hazards Departments" as they respond to various hazards such as vehicle accidents, commercial accidents, flooded basements, wires down, trees down, trench rescues, hazardous material spills, traffic control and sometimes even standbys to support other agencies or events to name only a few.

4.3.19.5 Vulnerability Assessment

The likelihood that EMS agencies and fire services will fail is a real threat to our communities. Many communities have already experienced the unfortunate fact that that ambulance services have failed. It is recommended that each municipality assess their own vulnerabilities by maintaining and building a relationship with their local providers to make the determination and begin to plan accordingly if a local service was to shut down the operation. The statistics, response times and all times associated with all units dispatched are easily obtainable from the local 911 centers.

It is typical for fire services to have greater response times during the day or during most business hours. Most 911 centers have orders from various departments to dispatch additional services during the day due to the known phenomenon that there are fewer volunteers available during the day, resulting in longer response times.

Table 50 - Sullivan County Emergency Responders

Sullivan County Emergency Responders	
Dushore Fire Company	Station 57
Eldredsville Fire Company	Station 56
Eagles Mere Fire Company	Station 51
Endless Winds Fire Company	Station 55
Forksville Fire Company	Station 53
Hillsgrove Fire Company	Station 54
Laporte Volunteer Fire Company	Station 50
Mildred Fire Department	Station 58
Muncy Valley Area Volunteer Fire Company	Station 52

The time is now to support these departments to create and or discover new ways to not only recruit but to also retain volunteers. If left unattended the issues will continue and the lack of responses will grow leaving the community more vulnerable to loss of life and loss of property.

It is recommended that the entire community be educated on the perpetual needs associated with providing these services. In addition, continued support and efforts to inform legislatures could all prove to be paramount in assuring these services remain in operation into the future. It is recommended that each municipality assess their own vulnerabilities by maintaining and building a relationship with your local providers to make the determination and begin to plan accordingly for the future.

4.3.20. Environmental Hazards

4.3.20.1 Location and Extent

Chemicals for industrial use and petroleum products can pose an environmental hazard when such materials are manufactured, extracted, used, stored or transported. Most hazardous materials incidents are unintentional, however hazardous materials could also be released in a criminal or terrorist act. A release can result in injury or death and may contaminate air, water and/or soils. Hazardous materials incidents can be generally broken down into the subcategories of transportation and fixed facility.

Tanker trucks, tractor trailers and rail cars often are used to transport hazardous materials. When there are transportation incidents involving these type of vehicles, hazardous materials can be released in significant quantities. *Figure 45 - Hazardous Material Locations* includes the major transportation routes through Sullivan County, including US Route 220 as well as State Routes 42, 89, 154 and 487.

Natural gas pipelines are often at higher capacity during cold winter months when people are utilizing natural gas more. There are three pipeline groups that run through Sullivan County who primarily deal with natural gas products:

Energy Transfer: Energy Transfer is involved mainly in the transportation, storage, gathering, processing, compression and treating of natural gas and the transportation fractionation and storage of natural gas liquids (NGL). This small intrastate natural gas pipeline company is based in Texas. For more information contact Energy Transfer at 1300 Main Street, Houston Tx 77002 or at their website: www.energytransfer.com.

Stagecoach Gas Services LLC: Stagecoach Gas Services owns and operates plant facilities in Owego, NY, where natural gas is stored underground. The underground storage wells are connected to pipelines that transport the natural gas to or from other interconnecting pipeline companies for delivery to end users. For more information contact Stagecoach Gas Services LLC at 801 Cherry Street, Suite 3800, Fort Worth, TX 76102 or at their website: www.stagecoachgs.com.

Williams Company, Inc: In 2014, Williams acquired Access Midstream. Work continues to replace pipeline marker signs, however, you may encounter signage that includes the Access Midstream logo. Williams can be contacted at the Williams Public Awareness Department, P.O. Box 18355 Oklahoma City, OK 73154, emergency contact 1-855-427-2875, or at by email at PipelineSafety@Williams.com.

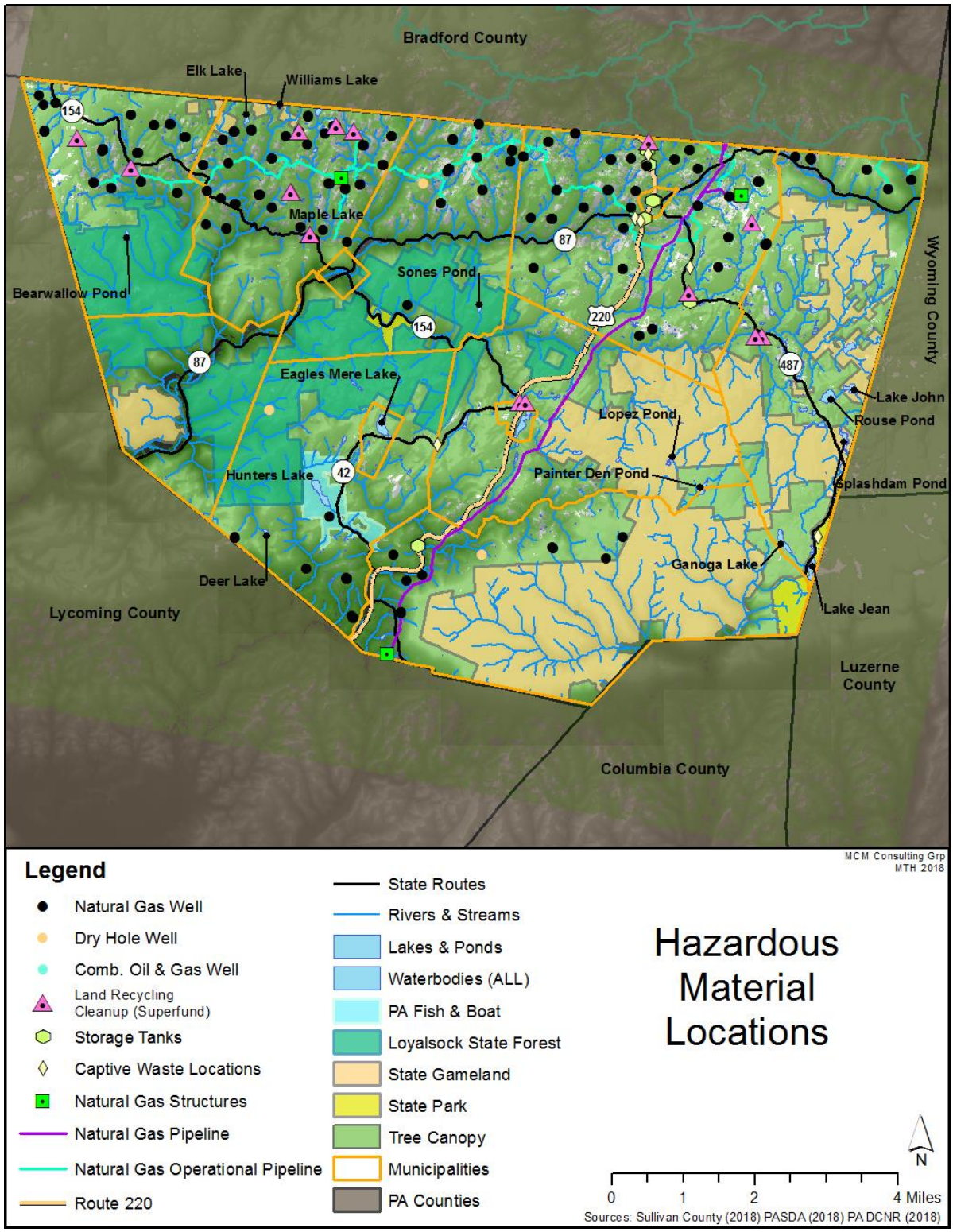
In Pennsylvania, facilities that use, manufacture, or store hazardous materials must comply with Title III of the federal Superfund Amendments and Reauthorization Act (SARA), and the Commonwealth's reporting requirements under the Hazardous Materials Emergency Planning and Response Act (1990-165), as amended. Information on SARA Title III facilities in Sullivan County was unavailable at the time of this report, though it is important to recognize that these facilities are not an exhaustive and comprehensive list of all locations where hazardous material resides in the county.

Fixed facilities are also monitored by the Environmental Protection Agency (EPA). The EPA has identified hazardous materials sites, not regulated by SARA Title III, and are known as Toxic Release Inventory (TRI) sites. Facilities which employ ten or more full-time employees and which manufacture or process more than 25,000 pounds (or use more than 10,000 pounds) of any SARA Section 313-listed toxic chemical in the course of a calendar year are required to report TRI information to the EPA, the federal enforcement agency for SARA Title III and PEMA. As of October 2018, there are no TRI facilities in Sullivan County.

Figure 45 - Hazardous Material Locations identifies locations that consume, store or release potentially hazardous materials and wastes. The map also shows land recycling cleanup locations, which are locations that fall into the jurisdiction of the Hazardous Sites Cleanup Act (HSCA) and are locations where the Department of Environmental Protection (DEP) provides funding and the authority to conduct cleanup actions because of hazardous substances have been released. The DEP also has the authority to force the persons responsible for the release to conduct cleanup actions or to repay public funds spent on a DEP funded cleanup action.

Oil and gas extraction facilities can also be sources of hazardous material release. *Figure 45 - Hazardous Material Locations* shows the location of all oil and gas wells in the county along with their proximity to surface waters.

Figure 45 - Hazardous Material Locations



4.3.20.2 Range of Magnitude

Hazardous material releases can contaminate air, water and soil, and can possibly cause injuries, poisonings, or deaths. Hazardous materials fall into nine hazard classes:

Class 1 - Explosives
Class 2 - Gases (flammable, non-flammable, non-toxic, and toxic)
Class 3 - Flammable and combustible liquids
Class 4 - Flammable solids (spontaneously combustible materials, and dangerous when wet materials/water-reactive substances)
Class 5 - Oxidizing substance and organic peroxides
Class 6 - Toxic substances and infectious substances
Class 7 - Radioactive materials
Class 8 - Corrosive substances
Class 9 - Miscellaneous hazardous materials/products, substances or organisms.

All nine hazard classes can be found being transported and stored at fixed facilities. Certain conditions can exacerbate release incidents:

- Weather conditions affect how the hazard occurs (e.g. transportation accidents) and develops (dispersion can take place rapidly when transported by water and/ or wind). Release can be a secondary impact of natural hazards such as tornadoes or flooding.
- Micro-meteorological effects of buildings and terrain: alters dispersion of hazardous materials
- Proximity to surface and ground water sources
- Compliance with applicable codes (e.g. building or fire codes) and maintenance failures (e.g. fire protection and containment features) can substantially increase the damage to the facility itself and to surrounding buildings

The type of material released, distance and related response time of emergency responders also significantly impact the severity and scope of hazardous material releases and clean-up efforts. Areas most proximal to the release are usually at greatest risk, but depending on the material, a release can travel great distances or remain present in the environment for long periods of time (e.g. centuries or millennia for some radioactive materials) resulting in chronic and extensive impacts on people and the environment.

In recent years, Sullivan County has experienced an expansion of natural gas exploration in the county. Oil and gas well drilling can have a variety of detrimental effects on the environment. Surface waters and soil are sometimes polluted by a salty wastewater product of oil and gas well drilling (brine) 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, making water safety an important factor in oil and gas extraction (Gregory et al., 2011). In some cases, associated with hydraulic fracturing (fracking), methane has been found contaminating drinking water in surrounding areas (Osborn et al., 2011).

Abandoned oil, gas, coal and other types of wells and mines can contaminate groundwater and consequently drinking water wells when not properly plugged or remediated. Acid Mine Drainage (or AMD) is a term referring to the acidic and environmentally hazardous run-off that comes from abandoned mines. Sullivan County has some underground coal mines that are not mapped, and these can cause AMD.

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

4.3.20.3 Past Occurrence

As of October 2018, Sullivan County has a reported 156 active oil and gas wells with 253 more that are either abandoned, inactive, or proposed and have not been drilled yet (PA DEP, 2018). These are largely from Marcellus shale natural gas extraction (PA DEP, 2018). The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration holds detailed accounts of hazardous material incident records. The Pipeline and Hazardous Materials Safety Administration (PHMSA) has only one hazardous materials release incident recorded occurring in Sullivan County between 1972 and October 2018: on April 2, 1975 a vehicle crash in Dushore resulted in 35 LGA of gasoline to be spilled. There were no injuries or fatalities from the incident and it was not classified as a major incident.

The National Response Center lists sixteen hazardous material instances occurring in Sullivan County between October 1990 and July 2013. The Commonwealth as a whole experienced 914 spills in 2012. Most hazardous spills occur on highways. According to the Bureau of Transportation Statistics, in the year 2000 there were 1,115 spills across Pennsylvania, and 1,065 of them occurred on highways. These spills cost the Commonwealth approximately $2.5 million.

Between 2013 and October 2018 there were thirty-four Hazardous Material Incidents reported to the Knowledge Center. *Table 51 - Environmental Hazard Knowledge Center* Incidents reports the full list of Knowledge Center incidents, which comprises of many natural gas well flares, pipeline blowdowns, and fuel leaks. One uncommon event occurred on March 20, 2014 when there was an iridium 192 exposure in Elkland Township.

As of October 2018, the PA DEP identifies sixteen Land Recycling Cleanup Locations in Sullivan County. Each appears on *Figure 45 - Hazardous Material Locations*, and details about each can be found in *Table 52 - Land Recycling Cleanup Locations*.

Table 51 - Environmental Hazard Knowledge Center Incidents

Environmental Hazard Knowledge Center Incidents ***(Knowledge Center, 2018)***			
Title	**Category**	**Jurisdiction**	**Date**
Test	Hazardous Materials	Sullivan County	02/11/13
Well Flare	Hazardous Materials	Sullivan County	02/26/13
Methane Alarm. - Residence	Hazardous Materials	Forks Township	03/09/13
Well Flare	Hazardous Materials	Elkland Township	04/04/13
Well Flare	Hazardous Materials	Cherry Township	04/14/13
Well Flare	Hazardous Materials	Cherry Township	04/30/13
Well Flare	Hazardous Materials	Cherry Township	05/06/13
Well Flare Elkland Twp	Hazardous Materials	Elkland Township	06/06/13
Fluid Spill On Roadway	Hazardous Materials	Cherry Township	06/25/13
Well Flare	Hazardous Materials	Cherry Township	06/30/13
Planned Well Flaring	Hazardous Materials	Cherry Township	07/01/13
Well Flare	Hazardous Materials	Elkland Township	08/03/13
Hydraulic Fluid Spill	Hazardous Materials	Cherry Township	08/08/13
Well Flare	Hazardous Materials	Cherry Township	08/14/13
Well Flare	Hazardous Materials	Sullivan County	08/19/13
Aerial Patrol - Pipeline	Agricultural/Animal Emergency	Sullivan County	11/08/13
Pipeline Blowdown	Hazardous Materials	Forks Township	11/27/13
Pipeline Blowdown-Roundtop PAD to Sick Rd	Hazardous Materials	Colley Township	01/24/14
Pipeline Blowdown Lambert farm well pad	Hazardous Materials	Sullivan County	01/30/14
Well Flare-Marquardt well, Davidson Township	Hazardous Materials	Davidson Township	02/14/14
iridium192 exposure-Sullivan-Elkland Township	Nuclear/Radiological	Elkland Township	03/20/14
Pipeline Blowdown	Hazardous Materials	Elkland Township	03/25/14
Pipeline Blowdown	Hazardous Materials	Elkland Township	03/28/14
Control Blowdown of pipeline	Hazardous Materials	Sullivan County	04/04/14
Pipe Line Blow Down	Hazardous Materials	Sullivan County	04/09/14
Pipeline Blowdown	Hazardous Materials	Cherry Township	05/05/14
Vehicle Accident - Haz-Mat	Hazardous Materials	Dushore Borough	11/05/14
Freon Leak	Hazardous Materials	Laporte Borough	07/08/15
Natural Gas Pipeline Leak Elkland Township	Hazardous Materials	Sullivan County	07/24/15
Pipeline Blowdown, Cherry Township	Hazardous Materials	Cherry Township	11/20/15
Minor Gas Leak from Pipeline	Hazardous Materials	Elkland Township	07/21/16
MVA w fuel spill	Hazardous Materials	Forks Township	08/11/17
Gas Well Blowdown Elkland Twp	Hazardous Materials	Elkland Township	01/30/18
Gas well Blowdown Elkland Township Sullivan Co	Hazardous Materials	Elkland Township	01/31/18

Table 52 - Land Recycling Cleanup Locations

Land Recycling Cleanup Locations *(PA DEP, 2018)*				
Site Name	**Cause**	**Contaminated Material**	**Site Status (October 2018)**	**Municipality**
Barry Stepp Prop	Unavailable	Soil Media	Active	Laporte Township
Ness Prop	Unavailable	Groundwater Media	Active	Fox Township
Colley Township Building	Unavailable	Soil Media	Active	Colley Township
Curtin Freshwater Impoundment	Unavailable	Soil Media	Active	Cherry Township
Hemlock Unit Pad B Og ESCGP	Oil & Gas	Soil Media	Active	Elkland Township
Darway Nursing Home	Unavailable	Groundwater Media	Inactive	Elkland Township
Darway Nursing Home	Unavailable	Soil Media	Inactive	Elkland Township
Pumpco Energy Svcs Route 154 Shunk Accident	Transportation Incidents	Soil Media	Inactive	Fox Township
PA DOT Maint Fac -Estella	Unavailable	Groundwater Media	Active	Elkland Township
Savage Well Pad	Oil & Gas	Soil Media	Active	Elkland Township
Latona Trucking	Unavailable	Soil Media	Inactive	Cherry Township
Rick Phillips	Unavailable	Soil Media	Active	Cherry Township
PA DOT Maint Fac -Estella	Unavailable	Groundwater Media	Active	Elkland Township
Former Gridiron Hotel	Unavailable	Soil Media	Active	Colley Township
New Way Drilling Accident Release	Residential	Soil Media	Inactive	Laporte Township
Hudak Transport Diesel Spill Sr 4016 Elkand Township	Transportation Incidents	Soil Media	Inactive	Elkland Township

4.3.20.4 Future Occurrence

Hazardous material release incidents are generally difficult to predict, but the presence and use of such known dangerous materials warrants preparation for release events. Emergency response in Sullivan County should be prepared to handle the types of hazardous materials housed and used in the SARA Title III facilities, TRI facilities and oil and gas wells that are located in the county. The federal Superfund Amendments and Reauthorization Act (SARA) is also known as the Emergency Planning and Community Right-to-Know Act (EPCRA), and Local Emergency Planning Committees (LEPCs) are designed by EPCRA to ensure that state and local communities are prepared to respond to potential chemical accidents.

4.3.20.5 Vulnerability Assessment

A hazardous material spill can be a secondary effect of a natural hazard such as flooding, other severe weather, or an earthquake. Due to the agricultural industry and traffic on transportation routes, Sullivan County can be susceptible to manure spills. There are fourteen manure storage locations with approximately one million or more gallons of manure being stored, they are all located in the northern half of the county (see *Figure 46 - Manure Storage Sites*).

Sullivan County conducted a commodity flow study in 2017 to check in on what hazardous materials are being transported through the county. The study found that class 3 flammables and specifically UN1203 (gasoline) and UN 1993 (generally fuel oils) were the most commonly transported hazardous material in Sullivan County. There were many other hazardous materials identified and emergency responders should be familiar with all materials discovered in the commodity flow study. Due to the agricultural industry in Sullivan County and the transportation of fertilizers, Sullivan County can be susceptible to spills involving manure and petrochemical fertilizers. Populations, critical facilities and natural habitats within a quarter mile of major highways and railways are considered to be at risk for hazardous material transportation incidents.

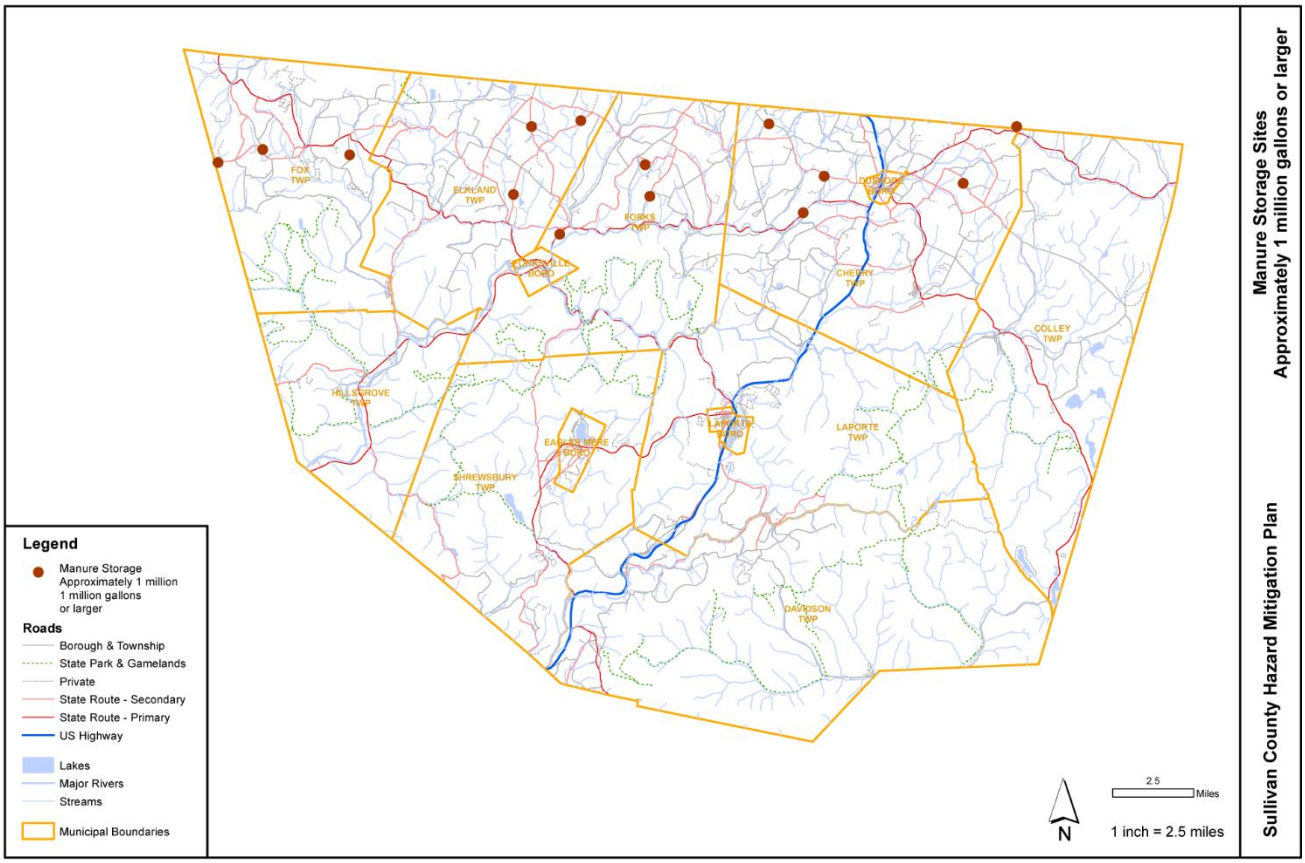
Private water supplies such as domestic drinking water wells in the vicinity of oil and gas wells are at risk of contamination from brine and other pollutants, including methane which can pose a fire and explosive hazard. Ideally, vulnerability of private drinking well owners would be established by comparing the distance of drinking water wells to known oil and gas well locations, but this extensive detailed data is not readily available at this time. Private drinking water is largely unregulated and information on these wells is voluntarily submitted to the Pennsylvania Topographic and Geologic Survey by water well drillers, and the existing data is largely incomplete and/or not completely accurate.

Table 53 - Oil Gas & Drinking Water Wells

Oil Gas & Drinking Water Wells *(PASDA & PAGWIS, 2017)*		
Municipality	**Oil & Gas Wells**	**Domestic Water Wells**
Cherry Township	118	235
Colley Township	25	102
Davidson Township	13	74
Dushore Borough	0	25
Eagles Mere Borough	0	82
Elkland Township	118	115
Forks Township	45	108
Forksville Borough	0	6
Fox Township	76	115
Hillsgrove Township	0	64

Oil Gas & Drinking Water Wells *(PASDA & PAGWIS, 2017)*		
Municipality	**Oil & Gas Wells**	**Domestic Water Wells**
Laporte Borough	0	8
Laporte Township	0	133
Shrewsbury Township	14	53
Undesignated	0	47
Total	**409**	**1167**

Figure 46 - Manure Storage Sites



4.3.21. Opioid Epidemic

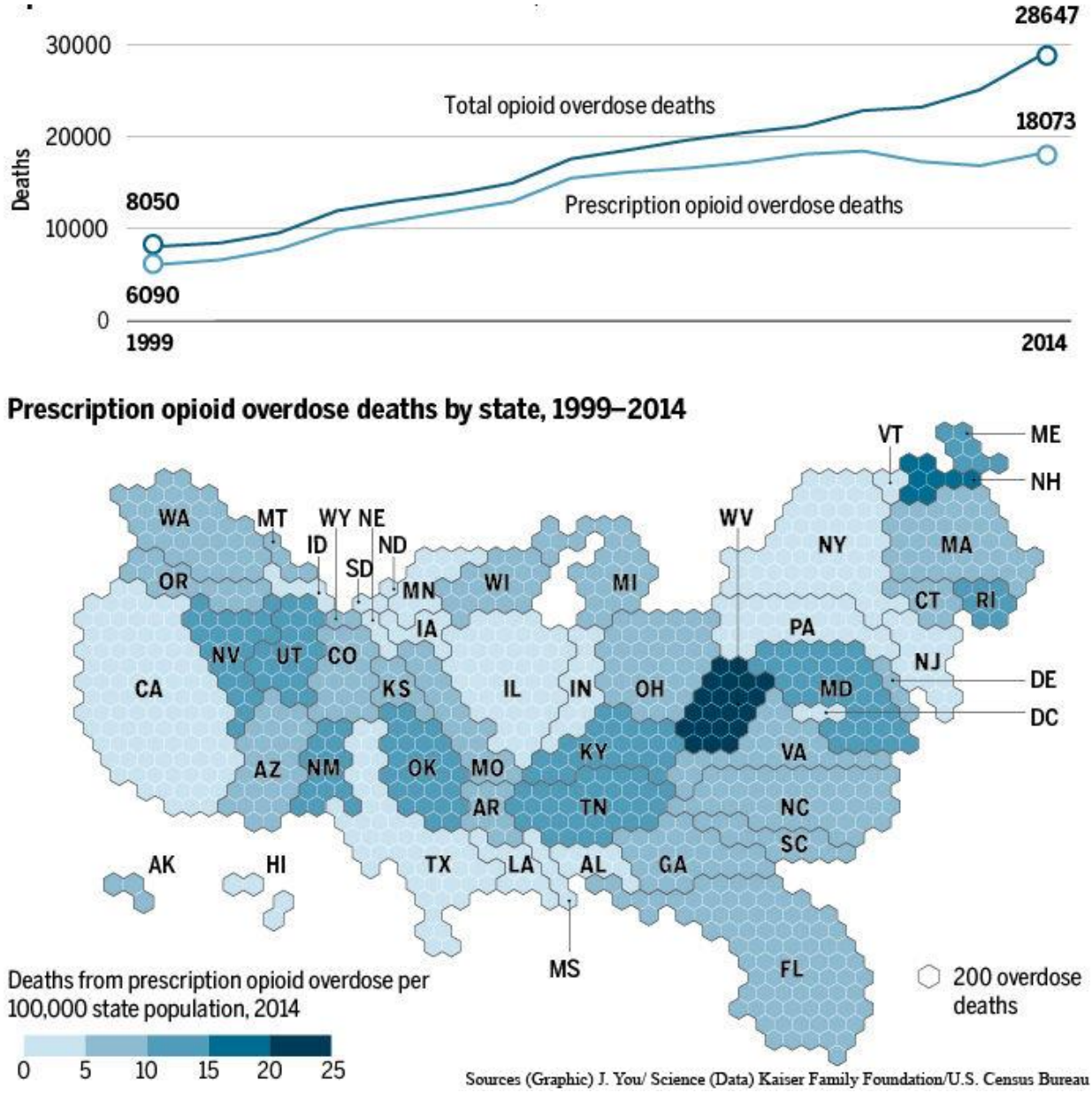
4.3.21.1 Location and Extent

Opioids are a class of drugs that interact with receptors on nerve cells in the body and brain, producing euphoria and pain relief (NIH, 2017). Opioid drugs are highly addictive,

and the commonwealth and country at large have been experiencing an epidemic of opioid addiction and abuse, resulting in increasing numbers of overdose deaths from both prescribed (e.g. fentanyl) and illicit (e.g. heroine) opioids (see *Figure 47 - US Opioid Deaths 1999-2014*). Overdose deaths from opioids occur when a large dose slows breathing, which can be especially likely when opioids are combined with alcohol or antianxiety drugs. While generally prescribed with good intentions, opioids can often be over-prescribed, resulting in addiction due to their highly addictive nature.

The opioid crisis was declared to be a public health emergency October 26, 2017. While the declaration provides validation for the scope and severity of the problem, it was not accompanied by any release of funding for mitigating actions. On January 10, 2018, Governor Wolf declared the Opioid Epidemic to be a statewide public health disaster emergency for Pennsylvania. The declaration is intended to enhance response, increase access to treatment.

Figure 47 - US Opioid Deaths 1999-2014



4.3.21.2 Range of Magnitude

According to the CDC, more than 140 Americans die every day from an opioid overdose. In 2014, 2,742 overdose deaths were reported across Pennsylvania. This number increased to 3,376 reported overdose deaths in 2015, an increase of 23.4 percent (DEA, 2015). Reported overdose deaths increased again in 2016 to 4,642, an increase of 37 percent from 2015 (DEA & PITT, 2017). Pennsylvania ranked 8th in the country for overdose deaths in 2014 at 21.9 deaths per 100,000 people (DEA, 2015).

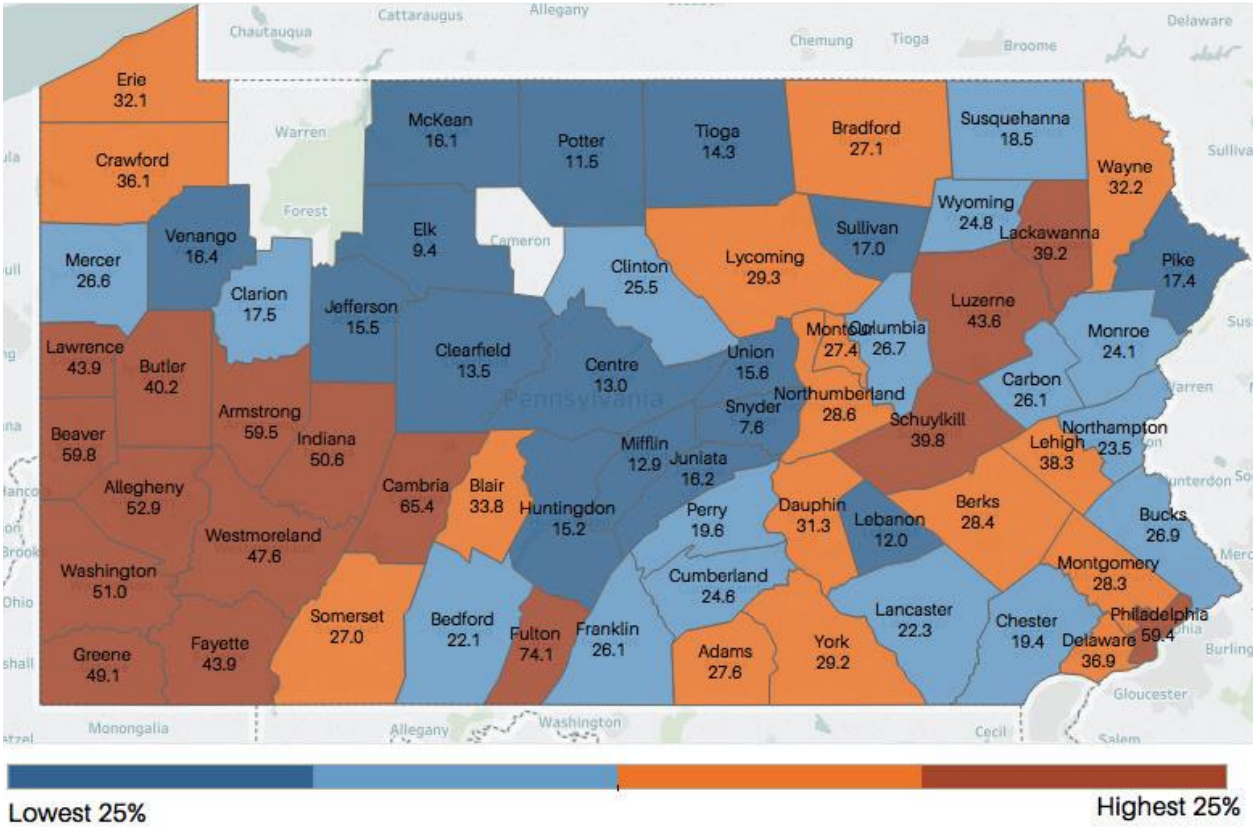
4.3.21.3 Past Occurrence

However, for both years of 2014 and 2015, Sullivan County had 15.8 overdose deaths per 100,000 people per year, with fewer than ten recorded overdose deaths occurring in the county each year (DEA, 2015). *Figure 48 - Pennsylvania Opioid Overdose Deaths* shows overdose deaths per 100,000 people in the year 2016 for Pennsylvania by County. Prescription opioids were the most prevalent drugs present in opioid drug-related overdose deaths that occurred in Sullivan County. *Table 54 - Pennsylvania Overdose Death History* shows recorded overdose deaths in Sullivan County as reported by the PA Coroner's Office, Overdose Free PA, and the Sullivan County Coroner. The coroner reports that there has been significant Naloxone use in the county. In along with the two overdose deaths that occurred in 2017, two additional Sullivan County residents died of opioid drug-related overdoses, however they passed away in neighboring Lycoming County. As of October 1, 2018, there have been no overdose deaths in Sullivan County in 2018.

Table 54 - Pennsylvania Overdose Death History

Pennsylvania Overdose Death History *(PA Coroner's Office, Sullivan County Coroner, 2018)*			
Year	**Overdose Deaths**	**Overdose Deaths / 100,000 People**	**Overdose Deaths / 100,000 People PA Wide**
2014	<10	15.8	21.9
2015	1	15.8	26.7
2016	1	17	36.5
2017	2	Data Not Available	42.5

Figure 48 - Pennsylvania Opioid Overdose Deaths



4.3.21.4 Future Occurrence

According to recent research, in states where medical marijuana has been permitted, overdose deaths from opioids have decreased about twenty-five percent, and the effect was even stronger five to six years after medical cannabis was allowed (Bachhuber et al., 2014). In those states where medical cannabis is permitted, each physician prescribed an average of 1826 fewer doses of pain medication each year (Bradford & Bradford, 2016), suggesting that medical cannabis could help prevent patients from ever being exposed to addicting opioids (Miller, 2016). Another possible alternative pain treatment comes from hemp extracted cannabidiol, or CBD. Unlike THC (the psychoactive constituent of cannabis) CBD in non-psychoactive and does not have the same intoxicating effect as THC, however CBD and can provide relief from pain (Lynch & Campbell, 2011) inflammation (Burstein, 2015), anxiety (Scuderi et al., 2009) and even psychosis (Iseger & Bossong, 2015).

Rather than reduce pain, in some cases high doses of opioid painkillers can actually increase pain due to a phenomenon known as opioid-induced hyperalgesia (OIH). It is however difficult to know how much of an influence OIH has on the opioid epidemic. Some researchers think that OIH could be increasing patients' pain and in turn, increasing their dosages and dependence on opioid drugs, suggesting that patients should work

with lower dosages of opioids (Servick, 2016). However, other researchers are unsure of the importance of OIH for opioid users (Servick, 2016).

In the event of an opioid overdose, death can sometimes be prevented with the use of the drug naloxone. Emergency medical responders have access to the treatment, and as of 2015, naloxone is available without a prescription in Pennsylvania. Furthermore, with the January 10, 2018 Disaster Declaration, Emergency Medical Technicians (EMTs) are now allowed to leave naloxone behind at a scene, further increasing distribution and accessibility of this lifesaving medication. Sullivan County participates in this program.

4.3.21.5 Vulnerability Assessment

Deaths from prescription opioid drugs like oxycodone, hydrocodone, and methadone have increased by more than four-fold since 1999. While opioid addiction is often viewed as a criminal problem, a more productive way to view the epidemic can be to view opioid addiction as a chronic disease. This paradigm shift moves away from faulting the abuser and incentivizing quick cures, to viewing the abuser as a patient and working towards long-term management of the disease (ASAM, 2014).

In general, it is important to consider alternative approaches to pain treatment in order to avoid beginning a dependence on highly addictive prescribed opioids. CBD and medical cannabis appear to be promising alternatives in some contexts. CBD is legal to purchase and use without a prescription, making it much more accessible for Pennsylvanian residents compared to medical cannabis.

The January 10, 2018 gubernatorial disaster declaration was accompanied by thirteen initiatives in three areas of focus which illustrate the current status of the opioid crisis in the Commonwealth as of January 2018:

Enhancing Coordination and Data Collection to Bolster State and Local Response

- **Establishes and Opioid Command Center located at the Pennsylvania Emergency Management Agency (PEMA)**, which will house the Unified Opioid Coordination Group that will meet weekly during the disaster declaration to monitor implementation and progress of the initiatives in the declaration.
- Expands Access to Prescription Drug Monitoring Program (PDMP) to Other Commonwealth Entities for Clinical Decision-Making Purposes to improve treatment outcomes and better monitor compliance among prescribers. Since 2016, 90,000 physicians have conducted more than 1 million searches on the PDMP.
- Adds Overdoses and Neonatal Abstinence Syndrome (NAS) as Reportable Conditions in Title 28, Chapter 27 to the DOH in order to increase data collection and improve outcomes in both areas.
- **Authorizes Emergency Purchase Under Procurement Code for Hotline Contract with Current Vendor,** giving DDAP further emergency purchase authorization to allow the department to enter into a contract with the current drug and alcohol hotline vendor to ensure uninterrupted services. To date, the 24/7 helpline, 1-800-662-HELP, has received more than 18,000 calls to connect those suffering from substance use disorder with treatment.

Improving Tools for Families, First Responders, and Others to Save Lives

- **Enables Emergency Medical Services providers to leave behind naloxone** by amending the current Standing Order to include dispensing by first responders, including Emergency Medical Technicians (EMTs). The existing naloxone standing order and funding for naloxone to first responders has allowed for more than 5,000 lives to be saved so sufferers can be linked to treatment for substance use disorder.
- **Allows Pharmacists to Partner with Other Organizations to Increase Access to Naloxone** by waiving regulations to allow pharmacists to partner with other organizations, including prisons and treatment programs to make naloxone available to at-risk individuals upon discharge from these facilities.
- Allows for the immediate temporary rescheduling of all fentanyl derivatives to align with the federal DEA schedule while working toward permanent rescheduling.
- **Authorizes emergency purchasing under Section 516 of the Procurement Code** to allow for an emergency contract to expand the advanced body scanner pilot program currently in place at Wernersville that is used on re-entrants returning to the facility. This would prevent the program from lapsing.

Speeding Up and Expanding Access to Treatment

- **Waive the face-to-face physician requirement for Narcotic Treatment Program (NTP) admissions** to allow initial intake review by a Certified Registered Nurse Practitioner (CRNP) or Physician Assistant (PA) to expedite initial intakes and streamline coordination of care when an individual is most in need of immediate attention.
- **Expand access to medication-assisted treatment (MAT)** by waiving the regulatory provision to permit dosing at satellite facilities even though counseling remains at the base NTP. This allows more people to receive necessary treatments at the same location, increasing their access to all the care and chances for recovery.
- **Waive annual licensing requirements for high-performing drug and alcohol treatment facilities** to allow for bi-annual licensure process which streamlines licensing functions and better allocates staff time. DDAP will request that facilities seek a waiver by filing exception requests to the annual licensing requirement.
- **Waive the fee provided for in statute for birth certificates** for individuals who request a good-cause waiver by attesting that they are affected by OUD. This is of particular importance to individuals experiencing homelessness and other vulnerable populations who often cannot obtain copies of their birth certificates in order to access treatment and other benefits due to the financial requirements.
- **Waive separate licensing requirements** for hospitals and emergency departments to expand access to drug and alcohol treatment to allow physicians to administer short-term MAT consistent with DEA regulations without requiring separate notice to DDAP.

4.3.22. Structure Building Collapse

4.3.22.1 Location and Extent

Structural collapses could happen anywhere in Sullivan County due to the age, construction and maintenance performed on buildings. Structural collapse could be a primary event or a secondary event due to a storm, strong wind event or tornado, fire, earthquake, or flood.

4.3.22.2 Range of Magnitude

The Occupational Health and Safety Administration (OSHA) defines a structural collapse as a point when a load bearing structural element fails. The severity can range from one element failing to a cascading event in which the entire structure collapses.

After a collapse, many secondary events may occur resulting in a highly hazardous environment. Building construction has blueprinted voids and chases in them to accommodate gas, water, electric and sewage lines. Considering the age of the structure and the magnitude of the collapse, dust particulates including gypsum and asbestos could be released, creating an inhalation hazard.

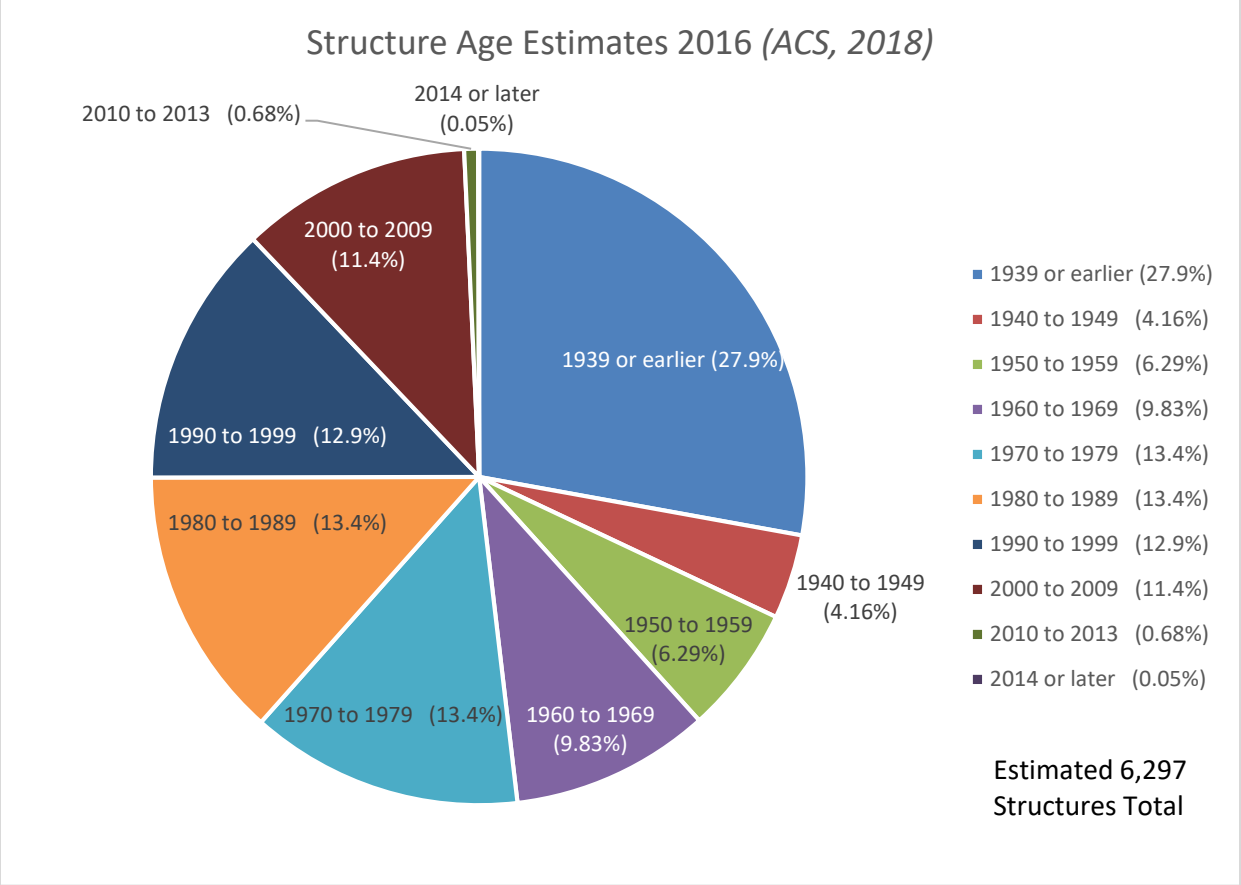
4.3.22.3 Past Occurrence

Comprehensive data on building and structure collapses was not possible to acquire for this profile. A barn roof collapse in Cherry Township was reported to the Knowledge Center on April 19, 2013 due a severe storm.

4.3.22.4 Future Occurrence

Structural collapse in Sullivan County is generally considered a secondary event following another incident. The regional geography, soil make-up, and age of infrastructure leave Sullivan County prone to incidents such as land subsidence, sinkholes from abandoned mine land, and flooding. Earthquakes are unlikely to have significant impact in Sullivan County, and therefore is not likely to result in collapse of structures. According to US Census Bureau data and the American Community Survey, almost 50% of structures in Sullivan County were built before the year 1970, and almost 30% of structures were built before the year 1940 (ACS, 2018). Older structures are at a higher risk for collapse and require regular maintenance and monitoring. A full breakdown of structure age estimates in Sullivan County can be seen in *Figure 49 - Structure Age Estimates*.

Figure 49 - Structure Age Estimates



4.3.22.5 Vulnerability Assessment

All commercial and residential structures and buildings within Sullivan County are vulnerable to loss due to structural collapse whether it be a collapse as a secondary incident, or a catastrophic structural failure due to age or other compounding factors. This vulnerability is compounded due to the ground composition and topography in Sullivan County. Eagles Mere Borough and Laporte Borough are identified as higher hazard areas for structure and building collapse.

4.3.23. Terrorism

4.3.23.1 Location and Extent

Following several serious international and domestic terrorist incidents during the 1990's and early 2000's, citizens across the United States paid increased attention to the potential for deliberate, harmful actions of individuals or groups. The term “terrorism” refers to intentional, criminal, malicious acts. The functional definition of terrorism can be interpreted in many ways. Officially, terrorism is defined in the Code of Federal Reg-

ulations as "*…the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives*." (28 CFR §0.85)

The Federal Bureau of Investigation (FBI) further characterizes terrorism as either domestic or international, depending on the origin, base, and objectives of the terrorist organization. However, the origin of the terrorist or person causing the hazard is far less relevant to mitigation planning than the hazard itself and its consequences.

Critical facilities are either in the public or private sector that provide essential products and/or services to the general public. Critical facilities are often necessary to preserve the welfare and quality of life in the county, or fulfill important public safety, emergency response, and/or disaster recovery functions. Critical facilities identified in the county are shelters; gas, electric and communication utilities; hospitals and other health care facilities; water and wastewater treatment plants, hazardous waste sites; and schools.

In addition to critical facilities, the county contains at risk populations that should be factored into a vulnerability assessment. These populations include not only the residents and workforce in the county, but also the tourists that visit the area on a daily basis, those that are traveling through the county on any of the major highways and marginalized groups such as LGBTQ persons and racial minorities. Potential targets for attack include:

- Commercial facilities
- Abortion or family planning clinics and other organizations associated with controversial issues.
- Education facilities
- Events attracting large amounts of people
- Places of worship
- Industrial facilities, especially those utilizing large quantities of hazardous materials
- Transportation infrastructure
- Historical sites
- Government facilities

4.3.23.2 Range of Magnitude

Terrorism refers to the use of weapons of mass destruction (WMD) (including, biological, chemical, nuclear, and radiological weapons) arson, incendiary, explosive, armed attacks, industrial sabotage, intentional hazardous materials releases and cyber-terrorism. Within these general categories, however, there are many variations. Particularly in the area of biological and chemical weapons, there are a wide variety of agents and ways for them to be disseminated. Terrorist methods can take many forms, including:

- Active Shooter
- Agri-terrorism
- Arson/incendiary attack

- Armed attack
- Biological agent
- Chemical agent
- Cyber-terrorism
- Conventional bomb or bomb threat
- Hazardous material release (intentional)
- Nuclear bomb
- Radiological agent

Cyber terrorism is becoming increasingly prevalent. Cyber terrorism can be defined as activities intended to damage or disrupt vital computer systems. These acts can range from taking control of a host website to using networked resources to directly cause destruction and harm. Protection of databases and infrastructure are the main goals for a safe cyber environment. Cyber terrorists can be difficult to identify because the internet provides a meeting place for individuals from various parts of the world. Individuals or groups planning a cyber-attack are not organized in a traditional manner, as they are able to effectively communicate over long distances without delay. The largest threat to institutions from cyber terrorism comes from any processes that are networked and controlled via computer. Any vulnerability that could allow access to sensitive data or processes should be addressed and any possible measures taken to harden those resources to attack.

4.3.23.3 Past Occurrence

Active shooters, as defined by the US Department of Homeland Security, is an individual actively engaged in killing or attempting to kill people in a confined area; in most cases, active shooters use firearm(s) and there is not necessarily a pattern or method to their selection of victims. As of November 27, 2018, there have been a total of 323 active shooter incidents in the United States according to the non-profit GunViolenceArchive.org. One significant event that occurred in Pennsylvania happened on October 27, 2018, when eleven people were killed by a gunman in the Pittsburgh, PA neighborhood of Squirrel Hill. The gunman attacked the congregation at the Tree of Life Synagogue in a shooting that targeted the Jewish population and was fueled by the gunman's anti-Semitic, anti-immigrant, and anti-refugee sentiments.

Another high-profile shooting occurred at the Pulse Nightclub in Orlando, Florida on June 12, 2016 where the LGBTQ community was targeted – forty-nine people were killed and fifty-three were wounded. A few other significant active shooter events include those that occurred at Virginia Tech (April 2007), Sandy Hook elementary School (December 2012), San Bernardino California (December 2015), an Aurora Colorado movie theater (July 2012) and a church in Charleston South Carolina (June 2015). A 2014 study by the FBI concluded that there has been a significant recent increase in frequency of active shooter incidents, and the vast majority (154 of 160 shooters between 2000 and 2013) were male (FBI, 2014). Of these 160 incidents, 45.6% took place in commercial environments, 24.3% took place in an educational environment, and the remaining 30.1% took

place at other locations such as open spaces, military and other government properties, residential locations, houses of worship, and health care facilities (FBI, 2014). *Figure 50 - Active Shooter Incidents 2000-2013* summarizes the FBI's findings in the study.

Significant international terrorism incidents in the USA include: the World Trade Center bombing in 1993, the bombing of the Murrow Building in Oklahoma City in 1995, and the September 11, 2001 attack on the World Trade Center. Sullivan County has not been directly impacted by any significant international terrorist incidents.

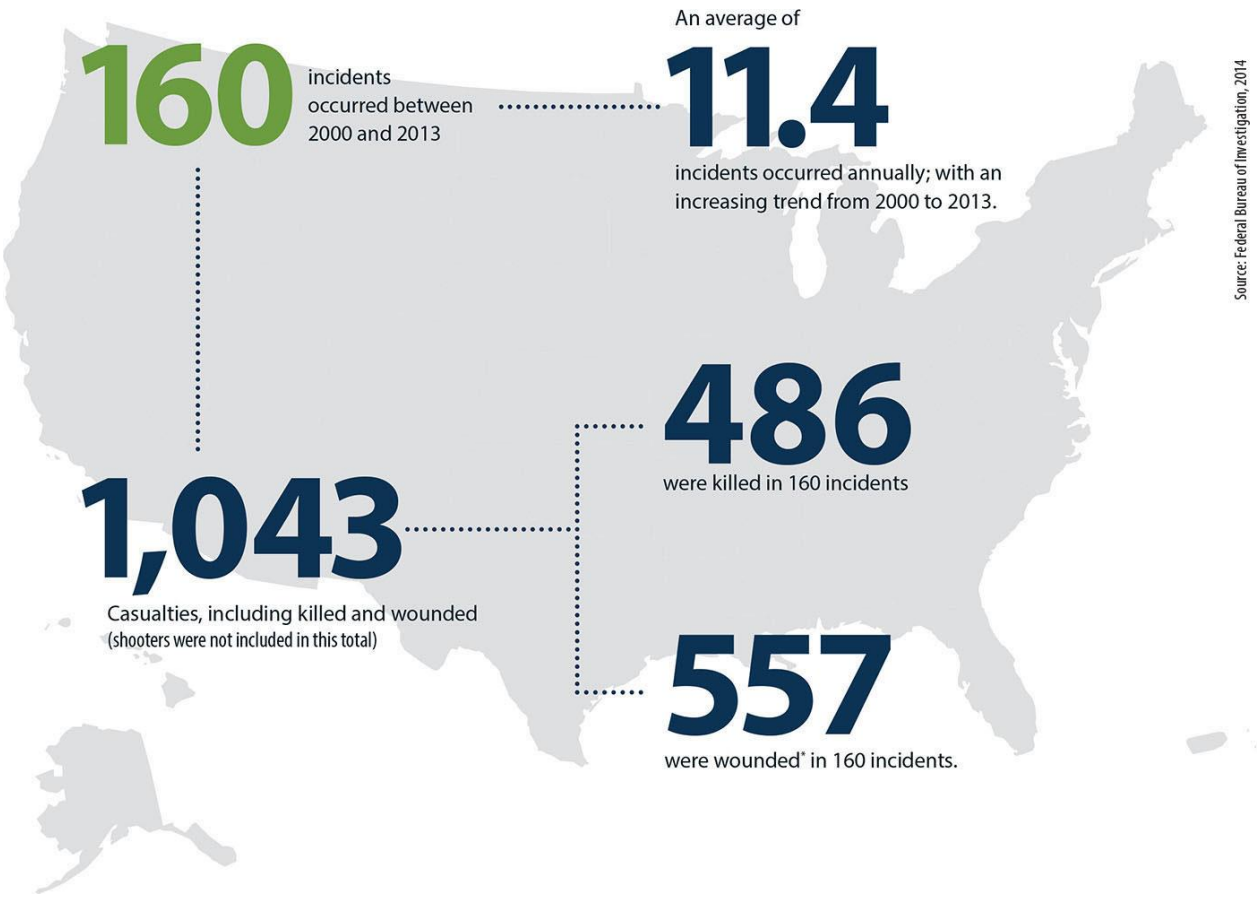
While the largest scale terrorist incidents have largely had international stimulus, many other incidents are caused by home grown actors who may have become radicalized through hate groups either in real life or online, and who may have mental health struggles. Hate groups such as the Ku Klux Klan (KKK), Aryan Nation and, more recently, the Alt-Reich have in one way or another been a part of domestic terrorism in different forms.

Knowledge Center reports of terrorist activity in Sullivan County as of October 2018 can be found in *Table 55 - Terrorist Activity in Sullivan County*. These incidents have centered about the Sullivan County High School and have been primarily bomb threats. On January 19, 2006, State Police received notice of the bomb threat incident at 3:03 pm and bomb dogs arrived at the school at 4:19 pm. No bomb was found and the incident was terminated at 7:07 pm.

Table 55 - Terrorist Activity in Sullivan County

Terrorist Activity in Sullivan County ***(Knowledge Center, 2018)***		
Description	**Location**	**Date**
Bomb Threat	Laporte Borough	01/19/2006
Suspicious Note – Sullivan County HS.	Laporte Borough	10/19/2015
Bomb Threat	Laporte Borough	04/27/2016

Figure 50 - Active Shooter Incidents 2000-2013



4.3.23.4 Future Occurrence

The likelihood of Sullivan County being a primary target for a major international terrorist attack is somewhat small. More likely terrorist activity in Sullivan County are bomb threats or other incidents at schools.

4.3.23.5 Vulnerability Assessment

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

All communities in Sullivan County are vulnerable on some level, directly or indirectly, to a terrorist attack. However, communities where critical facilities such as Sullivan

County High School in Laporte Borough are located should be considered more vulnerable. Site-specific assessments should be based on the relative importance of a particular site to the surrounding community or population, threats that are known to exist, and vulnerabilities, including:

Inherent vulnerability:

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

Tactical vulnerability:

Site Perimeter:

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

Building Envelope:

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

Facility Interior:

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

4.3.24. Transportation Accidents

4.3.24.1 Location and Extent

Transportation accidents are a daily occurrence across Pennsylvania and include incidents involving road, air and rail travel. Sullivan County is served by one U.S. Highway (U.S. Route 220), and PA State Routes 87, 154, 42 and 487. There are over 244 miles of state-maintained highways and over 298 miles of locally maintained roads throughout the county. Transportation accidents are directly impacted by hazardous weather events such as winter weather, heavy rainfall, and extreme temperatures. Sullivan County serves as a major transportation corridor and is heavily traveled by various motorists. Hazardous materials are transported through Sullivan County on a daily basis *Figure 51 - Major Transportation Routes* shows the major transportation systems in Sullivan County along with the annual average daily traffic volume by number of vehicles.

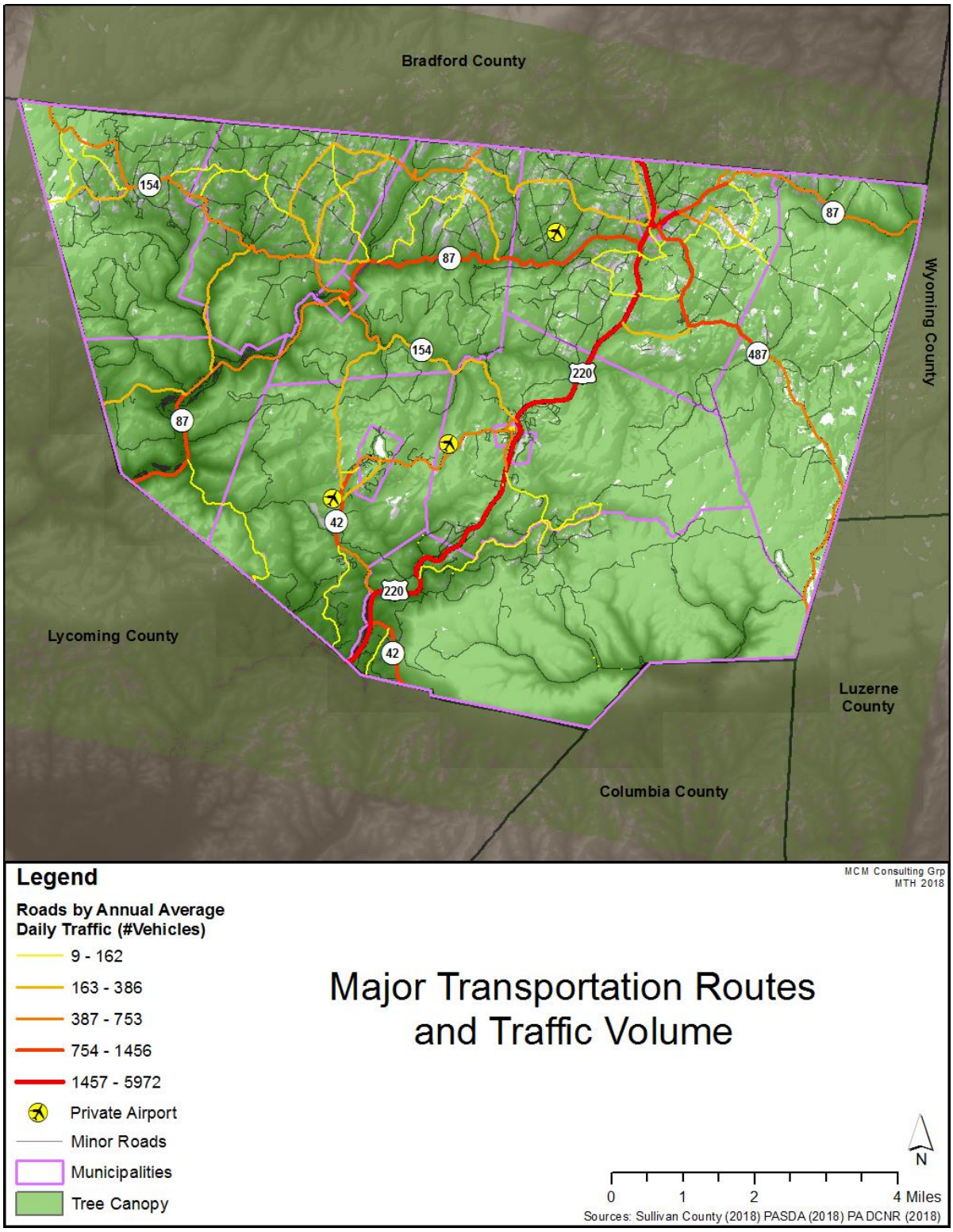
There are a large number of pipelines throughout Sullivan County as it is located in the heart of the Marcellus fairway. The natural gas development in this area presents a number of risks including increases in traffic, new roads, and environmental impacts. Each additional well pad in place increases the likelihood of a hazardous materials-related incident taking place.

There are three privately-owned airports in the county. There is no commercial air traffic in the county. There are no active railroads in the county. For more details see *Table 56 - Airports* and *Figure 51 - Major Transportation Routes*.

Table 56 - Airports

Airports			
Name	**Address**	**Ownership**	**Usage**
Dwight's Delight Airport – PA71	Dushore, PA 18614	Private	Airport
Eagles Mere Field Airport – 40PN	Eagles Mere, PA 17758	Private	Airport
Merritt Field Airport – 4PN7	Eagles Mere, PA 17731	Private	Airport

Figure 51 - Major Transportation Routes



4.3.24.2 Range and Magnitude

Transportation accidents can result in death or serious injury and extensive property loss or damage. In the United States, over 37,000 people die in road crashes annually (ASIRT, 2017). Inclement weather and higher traffic volume and speed increase the risk for automobile accidents. Road and railway accidents in particular have a potential to result in hazardous material releases. Accidents involving hazardous materials can pose an environmental hazard and potentially contaminate the air, water and or soil. Hazardous material release is covered in more detail in *Section 4.3.20 Environmental Hazards*.

Aviation incidents most often occur near landing or take-off sites; a five-mile radius around each airport in Sullivan County is considered high-risk areas.

4.3.24.3 Past Occurrence

The most serious transportation concerns in Sullivan County involve U.S. Route 220, and State Routes 87, 154, 42 and 487. *Table 57 - Transportation Incidents* shows the accidents that were reported to the Sullivan County 911 as entered into the Sullivan County CAD database between January 2014 and December 2017. *Table 58 - PennDOT Sullivan County Crash Report* shows crash statistics recorded by the Pennsylvania Department of Transportation between 2008 and 2017.

There have been several transportation incidents in Sullivan County. One notable incident took place on October 31, 2017. One person passed away following a head-on collision between a pickup truck and tractor trailer on state Route 220 in Cherry Township. The driver of the pickup truck was thrown from the truck and died at the scene. The driver of the tractor trailer was flown to the hospital. Hazmat was called to the scene shortly after the incident took place and assisted with leaking fuel and oil from the vehicles involved in the accident.

Table 57 - Transportation Incidents

Transportation Incidents		
Description	**Location**	**Date**
MVA involving HazMat	Rt. 220 - Davidson Township	01/21/2014
MVA	Rt. 220 and Rt. 87 - Cherry Township	02/17/2014
MVA	500 Elk Creek Rd – Hillsgrove Township	03/12/2014
MVA	Rt. 154 Hwy and Rt. 220 Hwy – Laporte Township	04/08/2014
MVA involving HazMat	3800 Rt. 487 Hwy – Colley Township	04/16/2014
MVA with entrapment	500 Dry Run Rd- Hillsgrove Townhip	04/25/2014
MVA	Rt. 154 Hwy – Fox Township	06/08/2014
MVA with entrapment	7793 Rt. 487 Hwy – Cherry Township	06/26/2014
MVA involving HazMat	1650 Rt. 220 Hwy – Davidson Township	07/07/2014
MVA with entrapment	Rt. 220 and Rt. 42 Hwy	07/10/2014
MVA involving HazMat	Rt. 87 Hwy – Colley Township	07/13/2014

Transportation Incidents		
Description	**Location**	**Date**
MVA with entrapment	8600 Rt. 87 Hwy – Forks Township	08/04/2014
MVA	Rt. 487 Hwy and Mattichak Rd – Colley Township	08/21/2014
MVA	6069 Rt. 487 Hwy – Colley Township	09/19/2014
MVA	Rt. 42 Hwy and Rt. 220 Hwy – Davidson Township	09/27/2014
MVA involving HazMat	Rt. 154 and Rt 220 Hwy – Laporte Township	11/15/2014
MVA involving HazMat	Rt. 87 Hwy and S Black Creek Rd - Forks Township	11/26/2014
MVA	121 Hottensteins Hill Rd – Forks Township	12/29/2014
MVA involving HazMat	9922 Rt. 154 Hwy – Fox Township	01/10/2015
MVA with entrapment	Rt. 87 Hwy – Cherry Township	01/18/2015
MVA	Rt. 87 Hwy – Cherry Township	01/28/2015
MVA	1355 Gainer Hill Rd – Cherry Township	02/12/2015
MVA	Browns Rd and Eldredsville Rd – Elkland Township	02/22/2015
MVA involving HazMat	Rt. 154 Hwy – Fox Township	03/01/2015
MVA	1433 Champion Hill Rd – Davidson Township	03/21/2015
MVA	800 Rt. 220 Hwy – Cherry Township	03/31/2015
MVA involving HazMat	9000 Rt. 87 Hwy – Forks Township	04/21/2015
MVA	207 Boxer Dr – Dushore Borough	04/23/2015
MVA	600 Whiskey Run Rd – Davidson Township	04/26/2015
MVA involving HazMat	7482 Rt. 87 Hwy – Forks Township	04/28/2015
MVA	3252 Rt. 220 Hwy – Davidson Township	05/03/2015
MVA with entrapment	2312 Rt 220 Hwy – Davidson Township	05/08/2015
MVA	612 Gavitt Rt – Laporte Township	06/13/2015
MVA involving HazMat	1847 North St – Fox Township	06/07/2015
MVA	Rt. 220 Hwy and Horseshoe Rd – Cherry Township	06/28/2015
MVA	5703 Rt 487 Hwy – Colley Township	07/21/2015
MVA with entrapment	822 Maple Summit Rd – Fox Township	08/25/2015
MVA	Rt. 87 Hwy and Rt 154 Hwy – Forksville Borough	08/28/2015
MVA involving HazMat	4048 Rt. 87 Hwy – Hillsgrove Township	09/10/2015
MVA	11603 Rt. 220 Hwy – Cherry Township	09/11/2015
MVA	212 Bernice Rd – Davidson Township	09/15/2015
MVA	Rt. 87 Hwy and Lambert Hill Rd	10/28/2015
MVA	123 W Main St – Davidson Township	10/28/2015
MVA	547 Eagles Mere Ave – Eagles Mere Borough	11/07/2015
MVA with entrapment	Rt. 87 Hwy and Star Rd – Colley Township	11/26/2015
MVA	5636 Rt. 487 Hwy – Colley Township	12/03/2015
MVA	6575 Rt. 87 Hwy – Forksville Township	12/26/2015
MVA	12845 Rt. 87 Hwy – Cherry Township	12/29/2015
MVA involving HazMat	6000 Rt. 154 Hwy – Elkland Township	01/05/2016
MVA	Rt. 154 Hwy and Route 87 Hwy – Forksville Borough	01/09/2016
MVA	1721 Campbelltown Rd – Forks Township	01/23/2016
MVA involving HazMat	Rt. 220 Hwy and Rt. 42 Hwy - Davidson Township	02/16/2016
MVA	4400 Rt. 487 Hwy – Colley Township	02/23/2016
MVA	Rt. 220 Hwy and Rt. 42 Hwy - Davidson Township	03/08/2016

Transportation Incidents		
Description	**Location**	**Date**
MVA	1448 Rt. 220 Hwy – Davidson Township	03/14/2016
MVA	Rt. 154 Hwy and Elk Creek Rd – Elkland Township	03/24/2016
MVA	15916 Rt. 87 Hwy – Colley Township	04/09/2016
MVA involving HazMat	838 Horseshoe Rd – Cherry Township	05/02/2016
MVA	3800 Rt. 487 Hwy – Colley Township	05/05/2016
MVA involving HazMat	8000 Rt. 87 Hwy – Fox Township	05/13/2016
MVA	Warburton Hill Rd – Forks Township	05/28/2016
MVA involving HazMat	Rt. 487 Hwy – Colley Township	06/06/2016
MVA	7383 Rt. 487 Hwy – Cherry Township	06/12/2016
MVA	200 Molyneux Hill Rd – Forks Township	06/24/2016
MVA	9485 Rt. 87 Hwy – Cherry Township	07/07/2016
MVA involving HazMat	15615 Rt. 87 Hwy – Colley Township	08/02/2016
MVA with entrapment	5669 Dutch Mountain Rd – Colley Township	08/07/2016
MVA	Rt. 154 Hwy and Cotts Rd – Elkland Township	08/11/2016
MVA	1470 Rt. 220 Hwy – Davidson Township	08/20/2016
MVA involving HazMat	S. German St and E. Main St – Dushore Borough	09/19/2016
MVA	6684 Rt. 487 Hwy – Cherry Township	10/02/2016
MVA	580 Dushore Overton Rd – Cherry Township	10/29/2016
MVA involving HazMat	220 Hwy and Rt 42 Hwy – Davidson Township	11/21/2016
MVA	4011 Rt. 220 Hwy – Laporte Township	12/18/2016
MVA involving HazMat	121 Rt 4009 Hwy – Elkland Township	12/21/2016
MVA involving HazMat	3046 Rt. 4008 Hwy – Elkland Township	01/02/2017
MVA	Rt. 220 Hwy and Rt. 42 Hwy – Davidson Township	01/11/2017
MVA	7383 Rt. 487 Hwy – Cherry Township	01/14/2017
MVA	1200 Rt. 154 Hwy – Laporte Township	01/31/2017
MVA	2636 Campbellville Rd - Forks Township	02/07/2017
MVA	Rt. 87 Hwy and Lambert Hill Rd – Forks Township	02/12/2017
MVA	210 Water St – Dushore Borough	02/19/2017
MVA	11287 Rt. 87 Hwy – Cherry Township	02/28/2017
MVA	8800 Rt. 487 Hwy – Cherry Township	03/10/2017
MVA involving HazMat	1060 Connells Dam Rd – Cherry Township	03/13/2017
MVA	1221 Campbellville Rd – Forks Township	03/27/2017
MVA	Rt. 87 Hwy and Main St – Forksville Borough	04/15/2017
MVA	3100 Rt. 220 Hwy – Davidson Township	04/21/2017
MVA	3588 Rt. 87 Hwy – Hillsgrove Township	05/07/2017
MVA	Rt. 220 Hwy and Old Rt. 220 Hwy – Davidson Township	05/16/2017
MVA with entrapment	18 Flory Ct – Fox Township	05/29/2017
MVA	4000 Rt. 220 Hwy – Laporte Township	06/02/2017
MVA	Rouse Rd and Karge Rd – Cherry Township	06/19/2017
MVA	9704 Rt. 87 – Cherry Township	07/20/2017
MVA	232 S. German St – Dushore Borough	07/29/2017
MVA	14011 Rt. 87 Hwy – Cherry Township	08/01/2017
MVA	S. German St and E. Main St = Dushore Borough	08/17/2018

Transportation Incidents		
Description	**Location**	**Date**
MVA involving HazMat	289 S. German St – Cherry Township	09/08/2017
MVA	5508 Rt. 220 Hwy – Laporte Borough	10/14/2017
MVA	Rt. 220 Hwy and Nordmont Rd – Laporte Township	10/30/2017
MVA	10655 Rt. 42 Hwy – Davidson Township	10/31/2017
MVA involving HazMat	Rt. 220 Hwy – Cherry Township	10/31/2017
MVA	2500 Rt. 220 Hwy – Davidson Township	11/08/2017
MVA with entrapment	14782 Rt. 87 Hwy – Cherry Township	11/16/2017
MVA involving HazMat	775 Rt 220 Hwy – Davidson Township	12/06/2017
MVA	Ellis Rd and Rt. 154 Hwy – Fox Township	12/25/2017
MVA involving HazMat	Rt. 87 Hwy and Ambrosious Rd – Cherry Township	12/30/2017

Over a nine-year period from 2008-2017, all incidents, have remained relatively constant. *Table 58 - PennDOT Sullivan County Crash Report* summarizes the overall crash data within a nine-year period for Sullivan County. Information was gathered from PennDOT Crash Information Tool.

Table 58 - PennDOT Sullivan County Crash Report

PennDOT Sullivan County Crash Report											
Type	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
State Road	65	74	91	81	83	59	62	54	69	67	705
Local Road	15	12	19	19	14	21	14	12	10	11	147
Hazardous Truck	0	0	0	1	1	0	0	1	0	1	4
Alcohol Related	7	6	14	9	13	5	4	6	8	9	81
Serious Injury	6	5	9	4	3	1	2	5	4	10	49
Fatal	1	3	5	1	2	0	1	2	1	4	20
Total Incidents	**94**	**100**	**138**	**115**	**116**	**86**	**83**	**80**	**92**	**102**	**1,006**

Sullivan County has experienced two aviation accidents recorded by the Federal Aviation Administration (FAA) since 1990.

- January 27, 1991, Guthrie One Air Ambulance Helicopter, from Robert Packer Hospital in Sayre crashed on the North Mountain near Sonestown in Sullivan County, killing all four crewmembers
- August 31, 2010, a BIRD CK cashed upon take off in a grass field at the Merritt Airfield near Eagles Mere. No injuries were reported and the aircraft received moderate damage.

4.3.24.4 Future Occurrence

Automobile accidents occur frequently, and typically occur more frequently than a rail (not applicable to Sullivan County) or aviation accident. The most traveled roadways in Sullivan County are U.S. Route 220, and State Routes 87, 154, 42 and 487. Additionally, these roadways are also the most traveled by heavy freight vehicles which can often carry hazardous materials.

The average rate of aviation accidents occurs at a rate of one per 1.2 million flights; with the chances of dying in a plane crash at 1 in 11 million. Therefore, the likelihood of an aviation incident in Sullivan County is considered low, however past events show that they are not impossible. While they are infrequent, railroad accidents have a greater likelihood of affecting larger areas of population and/or the environment.

The probability of transportation accidents is characterized as highly likely as defined by the risk factor methodology probability criteria. An overall risk factor of 2.7 has been determined by the local planning team using this methodology.

4.3.24.5 Vulnerability Assessment

The combination of high traffic volume and severe winter weather in the county increase the chances of traffic accidents occurring. Vulnerability for highway accidents falls within a ¼ mile of Interstate and US highways. Sullivan County is also prone to aviation incidents near municipalities in close proximity to airports which includes Eagles Mere Borough, Shrewsbury Township, Dushore Borough, and Cherry Township. *Table 59 - Transportation Vulnerability* shows the number of vulnerable addressable structures and critical facilities by municipality. Those cells without any entries have no critical facilities or addressable structures according to this analysis.

Table 59 - Transportation Vulnerability

Transportation Vulnerability *(Sullivan County GIS, 2018)*				
Municipalities	**¼ Mile of Roads**		**5 Miles of Airports**	
	Addressable Structures	**Critical Facilities**	**Addressable Structures**	**Critical Facilities**
Cherry Township	576	3	900	1
Colley Township	251	1		
Davidson Township	212	1	373	1
Dushore Borough	295	5	314	5
Eagles Mere Borough	220	1	414	1
Elkland Township	111			
Forks Township	167	1	314	1
Forksville Borough	94	1		
Fox Township	199	1		
Hillsgrove Township	255	2	4	
Laporte Borough	230	5	274	8
Laporte Township	294	3	538	3
Shrewsbury Township	171		352	
Total	**3075**	**24**	**3483**	**20**

4.3.25. Urban Fire and Explosions

4.3.25.1 Location and Extent

Urban fire and explosion hazards incorporate vehicle and building/ structure fires, as well as overpressure ruptures, overheat explosions, or other explosions that do not ignite. Statewide, this hazard is most problematic in the denser, and more urbanized areas, occurring most often in residential structures (US Fire Administration, 2009). Urban fires can more easily spread from building to building in denser urban areas.

According to the U.S. Census Bureau, 2016 American Community Survey 5-year estimates Sullivan County has approximately 6,297 structures (see *Figure 49 - Structure Age Estimates* in Section 4.3.22.4). Buildings that were constructed fifty or more years ago are at a higher risk of urban fires due to improvement in fire safety engineering practices. Nearly 50% of all structures in Sullivan County were built before 1970, with the majority of housing units built before 1940.

Fires can start from numerous causes, such as human errors or electrical malfunctions. Most fires are small and have little impact on the greater community other than possibly increasing insurance rates. Oftentimes large urban fires are the result of other hazards such as storms, droughts, transportation accidents, hazardous material spills, arson or terrorism.

Natural gas exploration and extraction sites can be associated with fires and explosion events. Well flares regularly burn off excess gas, and if improperly managed, such activities can be dangerous for the surrounding areas.

4.3.25.2 Range of Magnitude

Urban fires can occur in any populated area, and fires affecting one structure happen quite often. Urban fires are most threatening when the fire can rapidly spread from one structure to another. Sullivan County is largely rural, and does not have significant expanses of dense population.

Damages from fire and explosions ranges from minor smoke inhalation and/or water damage to the destruction of buildings. A worst-case scenario for any fire and or explosion would be in injuries and/or death of the occupants of the structures and the potential of injury or death of firefighters.

There are economic consequences related to a fire and explosion hazard, including:

- Loss in wages due to temporarily or permanently closed businesses
- Destruction and damage to business and personal assets
- Loss of tax base
- Recovery costs
- Loss related to the ability of public, private, and non-profit entities to provide post-incident relief.

The secondary effects of urban fire and explosion events relate to the ability of public, private, and non-profit entities to provide post-incident relief. Human services agencies (community support programs, health and medical services, public assistance programs and social services) can be affected by urban fire and explosion events. Effects include causing physical damage to facilities and equipment, disruption of emergency communications, loss of health and medical facilities and supplies, and an overwhelming load of victims who are suffering from the effects of the urban fire, including loss of their home or place of business.

4.3.25.3 Past Occurrence

From 1910 to 1990, the Commonwealth of Pennsylvania experienced thirteen major fires in suburban and urban settings, and ten of them occurred after 1980. Between 1978 and 1982, the average number of deaths per fire was 2.7. After October 1990, the average number of deaths per fire has decreased. *Table 60 - Urban Fire Occurrence* reflects the major fires and explosions that have occurred in Sullivan County since the year 2000.

As of September 2018, there are ninety-eight active natural gas wells in Sullivan County (PA DEP, 2018). These locations should be closely monitored and safety protocols should be strictly adhered to in order to avoid explosions and starting fires. *Table 61 - Gas Well & Pipeline Events* shows all gas well and pipeline events reported to the Knowledge Center, including well flares and pipeline blow downs. Many of these are planned events and there are no catastrophic explosions reported, however they can still give a sense of the threat that these operations can present.

Table 60 - Urban Fire Occurrence

Urban Fire Occurrence *(Knowledge Center, 2018; 2014 HMP)*		
Date	**Location**	**Description**
05/30/04	1.5 miles South of Mildred on Route 487 in Cherry Township	A mine fire, 70' long and 9' deep, was reported in Cherry Township. No injuries or damage to structures were reported.
03/31/07	Wilcox Road in Forks Township	Residential structure fire. Bodies of 1 adult and two children were recovered from the structure. The 2-story cement block house was a total loss.
04/17/07	Along US 220 in Davison Township	Residential structure fire. US 220 North was closed during the fire.
03/07/09	The Highlands Nursing Home, Laporte Borough	Automatic Fire Alarm – light smoke. No evacuations
02/25/13	Forks Township	Structure Fire
12/25/13	Dushore Borough	Residential Structure Fire/ Fatality
03/18/14	Davidson Township	Working Structure Fire
08/08/14	Cherry Township	Structure Fire Ber Mil Apartments
03/28/16	Laporte Township	Fire, single-family, Nordmont

Table 61 - Gas Well & Pipeline Events

Gas Well & Pipeline Events *(Knowledge Center, 2018)*			
Description	**Location**	**Date**	**Duration**
Gas well Blowdown Elkland Township Sullivan Co	Elkland Township	01/31/2018 15:16	17 hours, 40 minutes
Gas well Blowdown Elkland Township	Elkland Township	01/30/2018 14:17	20 hours, 13 minutes
Pipeline Blowdown, Cherry Township	Cherry Township	11/20/2015 08:19	27 minutes
Pipeline Blowdown	Cherry Township	05/05/2014 15:25	17 hours, 13 minutes

Gas Well & Pipeline Events *(Knowledge Center, 2018)*			
Description	**Location**	**Date**	**Duration**
Pipe Line Blow Down	Sullivan County	04/09/2014 13:24	1 hours, 8 minutes
Control Blowdown of pipeline	Sullivan County	04/04/2014 12:50	40 minutes
Pipeline Blowdown	Elkland Township	03/28/2014 10:51	4 hours, 58 minutes
Pipeline Blowdown	Elkland Township	03/25/2014 13:06	58 minutes
Well Flare-Marquardt well, Davidson Township	Davidson Township	02/14/2014 13:38	19 hours, 13 minutes
Pipeline Blowdown	Lambert farm well pad	01/30/2014 13:37	2 hours, 13 minutes
Pipeline Blowdown-Roundtop PAD to Sick Rd	Sullivan County	01/24/2014 11:22	2 hours, 25 minutes
Pipeline Blowdown	Forks Township	11/27/2013 09:06	2 hours, 15 minutes
Well Flare	Sullivan County	08/19/2013 10:25	23 hours, 17 minutes
Well Flare	Cherry Township	08/14/2013 09:34	23 hours, 17 minutes
Well Flare	Elkland Township	08/03/2013 00:00	10 hours, 35 minutes
Planned Well Flaring	Cherry Township	07/01/2013 16:43	23 hours, 5 minutes
Well Flare	Cherry Township	06/30/2013 15:54	18 hours, 54 minutes
Well Flare Elkland Township	Elkland Township	06/06/2013 10:53	22 hours, 6 minutes
Well Flare	Cherry Township	05/06/2013 10:58	4 hours, 44 minutes
Well Flare	Cherry Township	04/30/2013 08:23	51 minutes
Well Flare	Cherry Township	04/14/2013 00:00	15 hours, 48 minutes
Well Flare	Elkland Township	04/04/2013 15:29	23 hours, 22 minutes
Well Flare	Sullivan County	02/26/2013 08:41	5 hours, 52 minutes

4.3.25.4 Future Occurrence

Small urban fires occur regularly and usually cause little damage. Because of housing density and age of structures, Eagles Mere and Laporte Borough are most at risk for urban fires and explosions.

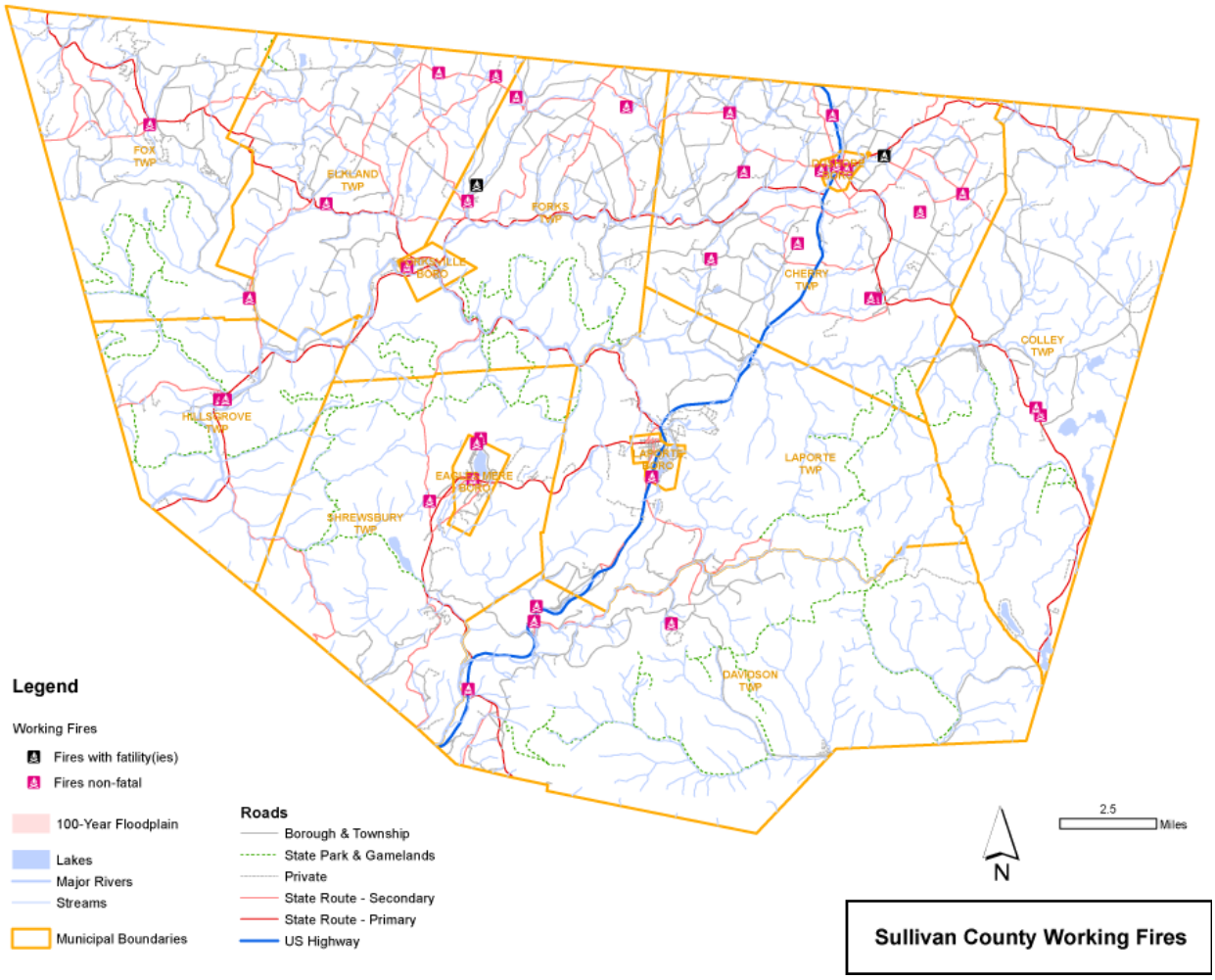
Any new construction has to comply with PA Department of Labor's statewide uniform construction codes. One requirement in the construction codes is automatic sprinkler

requirements for buildings other than one- and two-family dwellings. In most cases, this requirement will contain fires to the point of origin.

4.3.25.5 Vulnerability Assessment

Fire and explosion vulnerability greatly depend on the vulnerability of other hazards. Most fires result from the secondary effect of another hazard. The probability of a fire or explosion occurring increases with population and economic growth. The natural gas industry and exploration is active and growing in Sullivan County, and with it comes greater risk for fire and explosion. Urban fire risk also increases as the use of wood burning and kerosene space heaters increases. The elderly (those 65 years and older) tend to be more vulnerable to structure fires than other age groups, and often experience the highest number of deaths per fire. Structures built longer ago are more vulnerable to urban fire, and fires can spread faster to each other in areas with higher concentrations of housing. Potential secondary effects of urban fires include utility interruption and hazardous material spills. The following map *Figure 52 - Sullivan County Working Fires* identifies previous fires as well as which of those resulted in fatalities.

Figure 52 - Sullivan County Working Fires



4.3.26. Utility Interruptions

4.3.26.1 Location and Extent

Utility interruptions include any damage to electricity, natural gas, telecommunications, and water. Energy interruptions can be caused by severe solar storms, regional or national fuel or resource shortages, an electromagnetic pulse, public works failure, transmission facility accidents, and other major utility failures. Sullivan County has utility services for electric, water, fuel and telecommunications, all of which can experience interruptions for several different reasons.

Often, utility interruptions are a secondary impact of other hazards such as severe thunderstorms, windstorms, tornadoes, winter storms and even traffic accidents. Heat waves

may also result in rolling blackouts causing electric to not be available for an extended period of time. All municipalities within the county have a probability of experiencing a utility interruption.

Solar flares are concentrated releases of magnetic energy that emanate from sunspots and can last for minutes or hours. Solar flares can also cause coronal mass ejections (CME) from the outer solar atmosphere which are large clouds of plasma and magnetic field which induce geomagnetic currents when they reach the surface of Earth. A combination of these events can be referred to as solar storms or solar weather. Solar weather only impacts Earth when it occurs on the side of the sun that is actively facing Earth. A severe solar storm can have a geographically wide-ranging impact that can last for days or weeks (NASA, 2016). Most significantly, a severe solar storm has the potential to disrupt power grids, resulting is rolling blackouts.

Minor solar flares have no negative impacts on Earth thanks to the protection afforded by Earth's magnetic field and atmosphere. In fact, minor solar flares cause beautiful visual displays known as the Northern Lights or Aurora Borealis. However, severe solar storms can cause an electromagnetic pulse (EMP) that is able to break through Earth's magnetic field and send current to Earth's surface, inducing geomagnetic currents. Geomagnetic ally induced currents (GICs) impact the electrical grid and can cause transformers to burn and fail, potentially knocking out wide swatches of electricity infrastructure resulting in blackouts (Phillips, 2009).

Table 62 - Utility Providers

Utility Provider Summary ***(Comprehensive Plan, 2011)***						
Municipality	**Electric**	**Water**	**Gas**	**Telephone**	**Public Sanitary Sewer**	**Cable**
Cherry Township	Penelec Sullivan County Rural Electric Cooperative Claverack REC, Inc.	None	None	Frontier	Mildred	Comcast Blue Ridge Cable
Colley Township	Penelec	None	None	Frontier	None	None
Davidson Township	Penelec	None	None	Frontier	Sonestown	None
Dushore Borough	Penelec	Dushore Municipal Water Systems	None	Frontier	Dushore Municipal Sewer System	None
Eagles Mere Borough	Penelec	None	None	Frontier	Eagles Mere Borough Municipal Sewer System	None
Elkland Township	Penelec	None	None	Frontier	None	None

Utility Provider Summary *(Comprehensive Plan, 2011)*						
Municipality	**Electric**	**Water**	**Gas**	**Telephone**	**Public Sanitary Sewer**	**Cable**
Forks Township	Penelec	None	None	Frontier	None	None
Forksville Borough	Penelec Sullivan County Rural Electric	None	None	Frontier	None	None
Fox Township	Penelec	None	None	Frontier	None	None
Hillsgrove Township	Penelec	None	None	Frontier	None	None
Laporte Borough	Penelec Sullivan County Rural Electric	Laporte Municipal Water System	None	Frontier	None	None
Laporte Township	Penelec	None	None	Frontier	None	None
Shrewsbury Township	Penelec	None	None	Frontier	None	None

4.3.26.2 Range of Magnitude

At a minimum, energy emergencies can cause short term disruption in the daily operation of business, government, healthcare, and private citizens. A loss of energy and other utility services can have numerous impacts including, losing perishable foods and medicines, loss of functionality at health care and emergency medical facilities, limited water distribution capabilities, losing heating and air conditioning, losing telecommunication and internet services, basement flooding (sump pump failure), and lack of lighting. Energy emergencies can be most troubling when temperatures are at extremes due to the loss of heating or cooling capabilities and the added hazard that extreme heat and extreme cold present. Fuel shortages can result in increased cost of automotive gasoline, long lines at gas stations, disruptions in freight traffic, and shortage of heating fuels. On a small scale, these hazards can be a nuisance, but impacts can be devastating when an energy emergency has a large scope and impacts wide areas and a large population. Severe energy emergencies are often regional or national events.

Potential secondary effects of utility interruptions include an inadequate emergency response due to loss of communication and water supply. Efficient and effective communications and adequate portable water supply are critical resources for first responders. A loss of electricity and gas can have a negative impact on first responders as well.

4.3.26.3 Past Occurrence

The OPEC oil embargo of 1973 – 1974 caused fuel shortages and long lines at gasoline pumps nationwide. Government actions were taken to ensure that fuels and power were available for emergency and priority users. Between 1976 and 1977 there was a rapid increase in fuel prices accompanied by a severe winter resulting in a similar if less extreme fuel shortage. Those two events as well as the national gasoline shortage in 1979 emphasized the vulnerability of all residents in Sullivan County to energy emergencies.

Minor outages of electric and phone services occur annually. Recorded utility interruptions appear in *Table 63 - Utility Interruptions*. Events from 2004 until 2009 appear as presented in Sullivan County's 2014 Hazard Mitigation Plan. Events from 2012 until October 2018 appear as recorded in the Knowledge Center database. Events with a duration reported as "-" had no duration information available.

Table 63 - Utility Interruptions

Utility Interruptions ***(Knowledge Center, 2018; 2014 HMP)***			
Description	**Location**	**Date**	**Duration (days, hr:min)**
Power Outage (Penelec/ First Energy). 2 wires of a 3-phase electric line had a tree fall on it.	Shrewsbury Township	05/10/04	-
Telephone Outage (Commonwealth Telephone). 217 customers Adverse winter weather	Davidson Township	03/24/05	-
Power Outage (Penelec/ First Energy). 450 + customers winter weather	Davidson Township	03/24/05	-
Telephone Outage (Commonwealth Telephone). 196 customers affected	Elkland Township	06/10/05	-
Power Outage (Penelec/ First Energy)	Davidson Township	06/21/05	-
Telephone Outage (Commonwealth Telephone). 150 customers affected	Elkland and Forks townships	08/31/05	-
Water Outage (DEP, Keystone Water Testing Service). Boil Water Advisory for a chemical imbalance	Forksville – Almost Heaven Campgrounds well water	07/01/06	3 days
Telephone Outage (Commonwealth Telephone). 86 customers affected.	Elkland Township	02/20/07	-
Power Outage (Penelec/ First Energy). Winter Weather related	County wide	04/16/07	-
911 Communications Outage (Bill's Electronics). "Spatter" traced to an arcing receptacle at North Mountain Tower Site	County wide, Fire/EMS dispatch	02/25/08	4 days
Power Outage (Penelec/ First Energy). Trees and wires were down due to weather	Davidson Township	05/05/08	-

Utility Interruptions *(Knowledge Center, 2018; 2014 HMP)*			
Description	**Location**	**Date**	**Duration (days, hr:min)**
Telephone Outage (Frontier Communications). Unknown problem	Forskville Borough	05/20/08	-
911 Communications Outage (Bill's Electronics). 911 Center lost all capabilities to transmit over the radio system.	County Wide	06/09/08	-
Power Outage (Penelec/First Energy). 586 customers affected	Colley Township	09/21/08	-
Power Outage (Penelec/First Energy). Transportation Emergency – one residence affected	Davidson Township	01/01/09	-
Telephone Outage (Frontier Communications). Unknown problem	Elkland Township	06/09/09	-
Telephone Outage (Frontier Communications). Software problem	Elkland Township	06/26/09	-
911 Center Activation	Sullivan County	12/22/12	2:08
911 Center Activation	Sullivan County	12/25/12	11:01
Phone Outage	Colley Township	04/17/13	0:17
Phone Outage	Elkland Township	04/17/13	12:49
Phone Outage	Hillsgrove Township	04/19/13	2 days 11:20
Microwave Down to Lycoming	Sullivan County	04/28/13	4:28
Phone Outage	Colley Township	07/16/13	11:20
PHONE OUTAGE - Colley Twp	Colley Township	07/22/13	3 days 23:57
Sullivan 911 Activated	Sullivan County	08/06/13	2 days 2:57
Phone Outage - Nordmont Area	Laporte Township	10/31/13	20:12
Phone Outage	Cherry Township	05/16/14	3 days 0:33
Dam Failure	Laporte Township	05/28/14	1:12
Unknown water release Laporte Township	Laporte Township	05/28/14	0:59
Mildred Phone Outage	Sullivan County	08/14/14	4:07
Phone Outage	Elkland Township	12/02/14	6:18
Phone Outage - Sullivan County	Sullivan County	12/02/14	12:08
Power Outage - Sullivan County	Sullivan County	01/08/15	1 days 21:22
Frozen Water Lines	Laporte Borough	02/26/15	8 days 1:02
Nordmont 570-946-xxxx Phone Outage	Davidson Township	03/17/15	9 days 20:42
No Power: Dushore-New Albany, 500 wo PWR	Cherry Township	04/24/15	3 days 0:03
Phone outage Hillsgrove	Hillsgrove Township	05/08/15	15:29

Utility Interruptions *(Knowledge Center, 2018; 2014 HMP)*			
Description	**Location**	**Date**	**Duration (days, hr:min)**
Phone outage Hillsgrove	Hillsgrove Township	05/15/15	1:40
Phone Outage	Davidson Township	05/19/15	7:09
Phone outage Overton Area	Sullivan County	06/08/15	23:56
Phone Outage	Elkland Township	07/01/15	4 days 19:10
PHONE OUTAGE -570-928-xxxx	Dushore Borough	07/10/15	6:45
TELEPHONE OUTAGE - Sullivan County	Cherry Township	07/19/15	7:43
Sullivan Co Telephone Outage (Mildred)	Cherry Township	07/26/15	3:05
Pipeline Blowdown, Forks Township	Forks Township	12/07/15	2 days 6:50
SULLIVAN, Intermittent Power Failures	Sullivan County	04/04/16	1 days 0:00
Phone Outage	Hillsgrove Township	04/22/16	4 days 6:37
PSAP -SULLIVAN-Phone Outage	Sullivan County	05/31/16	9:14
Planned Outage PENELEC-1500-1800 7/6	Sullivan County	06/06/16	3 days 22:09
Telephone Outage	Laporte Township	07/10/16	2 days 5:19
Phone Outage	Dushore Borough	07/25/16	2:31
TELEPHONE OUTAGE	Cherry Township	08/11/16	9:24
Water Main Break Dushore Borough	Dushore Borough	12/19/16	5 days 23:41
Phone Outage	Davidson Township	01/04/17	4 days 21:24
Phone Outage	Fox Township	05/02/17	1 days 22:16
Phone Outage	Elkland Township	05/02/17	1 days 20:10
Phone Outage	Laporte Township	05/03/17	12:06
Phone Outage	Eagles Mere Borough	05/04/17	4 days 5:25
Phone Outage	Cherry Township	05/06/17	1 days 16:27
Phone Outage	Cherry Township	06/19/17	12:40
Phone Outage	Cherry Township	06/27/17	2:56
Phone Outage	Laporte Township	07/17/17	2:10
Nordmont Village Phone Outage	Laporte Township	07/18/17	1 days 1:48
Phone Outage	Laporte Township	08/13/17	6:40
Phone Outage	Laporte Township	09/30/17	6:20
Phone Outage	Dushore Borough	10/24/17	2 days 1:40
Road Closure	Shrewsbury Township	10/24/17	1 days 19:12
Phone Outage	Laporte Township	11/09/17	12:24
Phone outage	Cherry Township	11/19/17	1 days 0:36
Phone Outage	Cherry Township	03/01/18	9:11

Utility Interruptions *(Knowledge Center, 2018; 2014 HMP)*			
Description	**Location**	**Date**	**Duration (days, hr:min)**
Nordmont Power Outage	Laporte Township	04/04/18	7:07
Frontier phone outage	Elkland Township	04/22/18	4:10
Phone Outage	Laporte Township	05/01/18	19:12
Phone Outage	Laporte Township	06/07/18	1:38
Phone Outages	Cherry Township	06/29/18	3 days 15:14
Phone Outages	Laporte Township	06/29/18	8:39
Phone Outage	Cherry Township	07/22/18	9:02
Phone Outage	Eagles Mere Borough	07/27/18	4:55
Phone Outage	Cherry Township	08/14/18	16:41
Phone Outage	Cherry Township	08/17/18	5:29
Phone Outage	Laporte Township	08/17/18	4 days 21:36
Phone Outage	Cherry Township	08/22/18	4:41

4.3.26.4 Future Occurrence

Minor, short-term outage events may occur several times a year for any given area in Sullivan County, while major, widespread and long-term events are significantly less common. Utility interruptions are most often by-products of severe weather events, so when citizens prepare for severe weather, they should include the possibility for utility interruption in their preparation.

As utility infrastructure ages, interruption events could occur more frequently. Utility providers can reduce Sullivan County's vulnerability to power outages by implementing improvements.

4.3.26.5 Vulnerability Assessment

All municipalities in Sullivan County are vulnerable to utility interruptions. Critical facilities such as emergency medical facilities, retirement homes and senior centers are particularly vulnerable to power outages. While back-up generators are often used at these facilities, loss of electricity accompanied by temperature extremes can be dangerous for elderly and other high-risk populations. Extreme temperatures can disrupt fuel and electricity supplies, with extreme cold weather triggering a higher demand for heating oil and natural gas as well as causing low gas pressure, and extreme hot weather possibly overloading electrical grids resulting in blackouts.

Electric

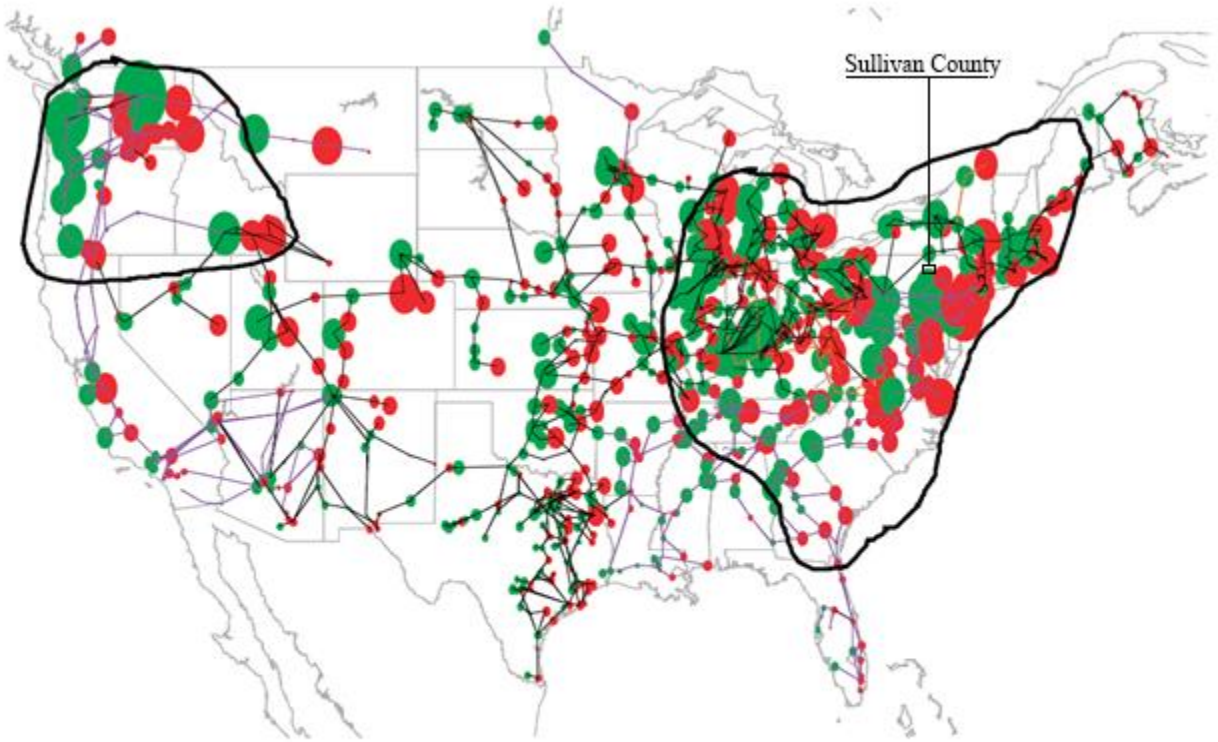
Pennsylvania Power and Lighting implemented a dispatch communications system called Mobile Operations Management (MOM). This system links every Pennsylvania Power and Lighting crew to a central emergency response coordination center. This technology has reduced average outage times in Pennsylvania from an average of 108 minutes between 2004 and 2008 to seventy-one minutes in 2009.

The National Oceanic and Atmospheric Administration (NOAA) monitors solar activity from the Space Weather Prediction Center (SWPC) and is able to alert power grid operators of the impending geomagnetic storm so they may make efforts to protect the grid from GICs (Baker et al., 2008). Events such as the 1989 Hydro-Quebec blackout have illuminated the hazard that solar storms pose to electricity infrastructure, however modern power grids are more vulnerable than ever. Power grids have become increasingly interconnected, improving efficiency in many ways, but also making them more vulnerable to wide ranging rolling failures as illustrated in *Figure 53 - Potential Electricity Grid Failure* (Baker et al., 2008) which shows electricity system interconnectivity and outlines areas that are most vulnerable to GICs, including all of Pennsylvania.

Geomagnetic storms can cause permanent damage to transformers that could result in much longer restoration times than experienced in the 1989 Hydro-Quebec outage. Transformer damage occurs when GICs cause excessive internal heating resulting in melting and burning of many large-amperage copper windings and leads. Such damage cannot be repaired, and the damaged transformer must be replaced. Transformers are extremely large and heavy apparatuses, and replacement can be a long process, suggesting that efforts should be taken to protect resident transformers from GICs. A workshop held by the Committee on the Societal and Economic Impacts of Severe Space Weather Events offered solutions to mitigating negative impacts of GICs, suggesting that supplemental transformer neutral ground resistors should be installed because they are relatively inexpensive, have low engineering trade-offs, and can produce sixty to seventy percent reduction of GIC levels during severe solar storms (Baker et al., 2008).

The Department of Homeland Security (DHS) has a Solar Storm Mitigation effort, which “aims to provide owners and operators of the electricity grid with advanced and actionable information about anticipated GCI current levels in the event of a solar storm” (US GAO, 2017). According to the DHS, when provided with accurate solar storm warnings, utility operators can “make operational decisions to mitigate the impacts from solar storms. This can range from canceling maintenance work to temporarily shutting down vulnerable grid components and preventing permanent damage” (DHS, 2015).

Figure 53 - Potential Electricity Grid Failure



Scenario showing effects of a 4800 nT/min geomagnetic field disturbance at 50° geomagnetic latitude scenario. The regions outlined are susceptible to system collapse due to the effects of the GIC disturbance; the impacts would be of unprecedented scale and involve populations in excess of 130 million. SOURCE: J. Kappenman, Metatech Corp., "The Future: Solutions or Vulnerabilities?," presentation to the space weather workshop, May 23, 2008.

Water

Water contamination can occur naturally, by human error, or intentionally. Occasionally, releases of manure and milk into the water supply can also cause contamination. Overflows from sewage systems and lagoons on farms can also cause contamination of groundwater and drinking water. There are also times when accidental spills and releases of hazardous materials contaminate water. Water supplies along transportation routes may be affected by hazardous material spills.

Water distribution can be affected in three ways: the amount of water available, the quality of the water, and the viability of the physical components of the distribution systems. Because Sullivan County is a rural county, a majority of the residential water comes from wells. Well contamination or water shortages due to drought pose a significant risk.

Communications

The Sullivan County primary provider from land-based telecommunications is Frontier Communications. Because Frontier is the only provider of land-based communications

in the county, a failure in this system could be a county wide emergency. Small-scale failures occur annually.

Cellular communication and coverage is sporadic in the county. Drastic elevation changes, topography issues and lack of cellular towers and vast natural areas in the county lead to a decreased ability to use cellular communications. Cellular communications infrastructure has grown over the past ten years but is still limited.

4.4. Hazard Vulnerability Summary

4.4.1. Methodology

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

RF values were obtained by assigning varying degrees of risk to five categories for each of the hazards profiled in the HMP update. Those categories include *probability*, *impact*, *spatial extent*, *warning time and duration*. Each degree of risk was assigned a value ranging from one to four. The weighting factor agreed upon by the planning team is shown in *Table 64 - Risk Factor Approach Summary*. To calculate the RF value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the following example equation:

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

Table 64 - Risk Factor Approach Summary summarizes each of the five categories used for calculating a RF for each hazard. According to the weighting scheme applied, the highest possible RF value is 4.0.

Table 64 - Risk Factor Approach Summary

Summary of Risk Factor Approach Used to Rank Hazard Risk.					
RISK ASSESSMENT CATEGORY	**DEGREE OF RISK**				**WEIGHT VALUE**
	LEVEL	**CRITERIA**		**INDEX**	
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	**UNLIKELY**	LESS THAN 1% ANNUAL PROBABILITY		1	30%
	POSSIBLE	BETWEEN 1 & 10% ANNUAL PROBABILITY		2	
	LIKELY	BETWEEN 10 &100% ANNUAL PROBABILITY		3	
	HIGHLY LIKELY	100% ANNUAL PROBABILTY		4	
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	**MINOR**	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.		1	30%
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY.		2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK.		3	
	CATASTROPHIC	HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE.		4	
SPATIAL EXTENT *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	**NEGLIGIBLE**	LESS THAN 1% OF AREA AFFECTED		1	20%
	SMALL	BETWEEN 1 & 10% OF AREA AFFECTED		2	
	MODERATE	BETWEEN 10 & 50% OF AREA AFFECTED		3	
	LARGE	BETWEEN 50 & 100% OF AREA AFFECTED		4	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	**MORE THAN 24 HRS**	SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	12 TO 24 HRS	SELF-DEFINED		2	
	6 TO 12 HRS	SELF-DEFINED		3	
	LESS THAN 6 HRS	SELF-DEFINED		4	
DURATION *How long does the hazard event usually last?*	**LESS THAN 6 HRS**	SELF-DEFINED	*(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	LESS THAN 24 HRS	SELF-DEFINED		2	
	LESS THAN 1 WEEK	SELF-DEFINED		3	
	MORE THAN 1 WEEK	SELF-DEFINED		4	

4.4.2. Ranking Results

Using the methodology described in Section 4.4.1, *Table 65 - Risk Factor Assessment Hazard Ranking* lists the risk factor calculated for each of the thirty-one potential hazards identified in the 2018 HMP. *It should be noted that some hazards were ranked individually versus in the group profile as reflected in section 4.3*. Hazards identified as *high* risk have risk factors greater than 2.5. Risk factors ranging from 2.0 to 2.4 were deemed *moderate* risk hazards. Hazards with risk factors 1.9 and less are considered *low* risk. Hazards that appear with a light blue background are natural hazards, while those with beige backgrounds are human-caused hazards.

Table 65 - Risk Factor Assessment Hazard Ranking

Risk Factor Assessment Hazard Ranking							
Hazard Risk	**Hazard**	**Probability**	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**Risk Factor**
High	Flash Flooding	4	3	4	4	3	**3.6**
	Invasive Species	4	3	4	1	4	**3.4**
	Pandemic/ Infectious Disease	3	4	4	1	4	**3.4**
	Emergency Services	4	3	4	1	4	**3.4**
	Disorientation	4	3	2	4	3	**3.2**
	Terrorism: Cyber Attack	3	2	4	4	3	**3**
	Opioid Epidemic	3	3	3	1	4	**2.9**
	Radon	3	2	4	1	4	**2.8**
	Winter Storms	3	2	4	2	3	**2.8**
	Utility Interruptions	4	2	2	4	2	**2.8**
	Extreme Temperature	3	2	4	1	3	**2.7**
	Hurricanes/ Tropical Storms	2	3	4	1	3	**2.7**
	Lightning Strike	3	2	3	4	2	**2.7**
	Transportation Accidents	4	2	2	4	1	**2.7**
	Dam Failure	1	3	3	4	4	**2.6**
	Landslides	3	2	2	4	3	**2.6**
	Windstorms	3	2	2	4	3	**2.6**
	Drought	2	2	4	1	4	**2.5**
	Environmental Hazard: Transportation	2	3	2	4	2	**2.5**

Risk Factor Assessment Hazard Ranking							
Hazard Risk	**Hazard**	**Probability**	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**Risk Factor**
Moderate	Flooding River	2	2	3	2	4	**2.4**
	Terrorism: Bomb Threats	2	1	4	4	2	**2.3**
	Tornadoes	2	2	2	4	3	**2.3**
	Wildfires	2	2	2	4	2	**2.2**
	Flooding Ice Jam	2	2	2	2	3	**2.1**
	Earthquake	1	2	3	4	1	**2**
	Subsidence/ Sinkholes	1	2	2	4	3	**2**
Low	Environmental Hazard: Fixed Facility	2	1	2	4	2	**1.9**
	Urban Fires/Explosions	1	2	2	4	2	**1.9**
	Drowning	2	1	1	4	1	**1.6**
	Civil Disturbance	1	1	1	4	1	**1.3**
	Structure/ Building Collapse	1	1	1	4	1	**1.3**

Based on these results, there are nineteen *high* risk hazards, seven *moderate* risk hazards and five *low* risk hazards in Sullivan County. Mitigation actions were developed for all high, moderate and low risk hazards (see Section 6.4). The threat posed to life and property for moderate and high-risk hazards is considered significant enough to warrant the need for establishing hazard-specific mitigation actions. Mitigation actions related to future public outreach and emergency service activities are identified to address low risk hazard events.

A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. *Table 66 - Countywide Risk Factor by Hazard* shows the different municipalities in Sullivan County and whether their risk is greater than (>), less than (<), or equal to (=) the risk factor assigned to the county as a whole. This table was developed by the consultant based on the findings in the hazard profiles located in sections 4.3.1 through 4.3.26.

Table 66 - Countywide Risk Factor by Hazard

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk																
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR																
JURISDICTION	Flash Flooding (N)	Invasive Species (N)	Pandemic/ Infectious Disease (N)	Emergency Services (M)	Disorientation (M)	Terrorism: Cyber Attack (M)	Opioid Epidemic (M)	Radon (N)	Winter Storms (N)	Utility Interruptions (M)	Extreme Temperature (N)	Hurricanes/ Tropical Storms (N)	Lightning Strike (N)	Transportation Accidents (M)	Dam Failure (M)	Landslides (N)
	3.6	***3.4***	***3.4***	***3.4***	***3.2***	***3***	***2.9***	***2.8***	***2.8***	***2.8***	***2.7***	***2.7***	***2.7***	***2.7***	***2.6***	***2.6***
Cherry Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Colley Township	=	=	<	=	=	<	=	=	>	=	=	=	=	<	=	=
Davidson Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Dushore Borough	=	=	=	=	=	=	>	=	=	=	=	=	=	>	=	=
Eagles Mere Borough	=	=	=	=	>	=	=	=	>	=	=	=	=	=	<	=
Elkland Township	=	>	<	=	<	=	<	>	=	=	=	=	=	>	=	=
Forks Township	=	=	<	=	<	<	=	=	=	=	=	=	=	<	<	=
Forksville Borough	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Fox Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Hillsgrove Township	>	=	=	=	=	=	=	=	>	>	=	=	=	=	=	=
Laporte Borough	<	=	=	=	<	=	<	=	=	=	=	=	=	=	=	<
Laporte Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Shrewsbury Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=

Calculated Countywide Risk Factor by Hazard and Comparative Jurisdictional Risk															
IDENTIFIED HAZARD AND CORRESPONDING COUNTYWIDE RISK FACTOR															
JURISDICTION	Windstorms (N)	Drought (N)	Environmental Hazard: Transportation (M)	Flooding River (N)	Terrorism: Bomb Threats (M)	Tornadoes (N)	Wildfires (N)	Flooding Ice Jam (N)	Earthquake (N)	Subsidence/ Sinkholes (N)	Environmental Hazard: Fixed Facility (M)	Urban Fires/Explosions (M)	Drowning (M)	Civil Disturbance (M)	Structure/ Building Collapse (M)
	2.6	***2.5***	***2.5***	***2.4***	***2.3***	***2.3***	***2.2***	***2.1***	***2***	***2***	***1.9***	***1.9***	***1.6***	***1.3***	***1.3***
Cherry Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Colley Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Davidson Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Dushore Borough	=	=	=	=	=	>	=	=	=	=	=	=	=	=	=
Eagles Mere Borough	=	=	=	<	=	=	=	>	=	=	=	<	>	=	=
Elkland Township	>	<	>	>	<	>	=	=	=	<	>	=	=	=	=
Forks Township	=	=	<	=	<	=	=	=	=	=	=	<	=	=	=
Forksville Borough	=	=	=	=	=	=	=	>	=	=	=	=	=	=	=
Fox Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Hillsgrove Township	=	=	>	=	=	=	=	=	=	=	=	=	>	=	=
Laporte Borough	=	=	=	<	=	=	<	<	=	<	<	=	=	=	<
Laporte Township	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
Shrewsbury 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 flooding. Estimates provided in this section are based on HAZUS-MH, version MR4, geospatial analysis, and previous events. Estimates are considered *potential* in that they generally represent losses that could occur in a countywide hazard scenario. In events that are localized, losses may be lower, while regional events could yield higher losses.

Potential loss estimates have four basic components, including:

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

The parcel 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.

Flooding Loss Estimation:

Flash flooding is a high-risk natural hazard in Sullivan County. The estimation of potential loss in this assessment focuses on the monetary damage that could result from flooding. The potential property loss was determined for each municipality and for the entire county.

MCM Consulting Group conducted a county wide flood study using the Hazards U.S. Multi-Hazard (HAZUS-MH) software that is provided by the Federal Emergency Management Agency. This software is a standardized loss estimation software deriving economic loss, building damage, content damage and other economic impacts that can be used in local flood mitigation planning activities.

Using HAZUS-MH, total building-related losses from a 1%-annual-chance flood in Sullivan County are estimated to equal $28,880,000. Residential occupancies make up 59.72% of the total estimated building-related losses. Total economic loss, including replacement value, content loss, functional loss and displacement cost, from a countywide 1%-annual-chance flood are estimated to equal $52,990,000.

4.4.4. Future Development and Vulnerability

Risk and vulnerability to natural and human-caused hazard events are not static. Risk will increase or decrease as counties and municipalities see changes in land use and development as well as changes in population. Sullivan 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.

As of the 2010 Comprehensive Plan, land use in Sullivan County was 89.8% Forested, 6% Agriculture, 2.8% Water bodies and wetlands, 1.2% Residential, institutional, and commercial properties, and 0.2% Mining. State and non-resident land ownership consists of 70% of county land. Zoning regulations are limited to Eagles Mere Borough and Laporte Borough. The entire county is under the jurisdiction of the Sullivan County Subdivision and Land Development Ordinance. Forest and agriculture will continue to be the leading use of land in Sullivan County in the foreseeable future, however natural gas exploration and extraction has increased dramatically in the last ten years. This results in more extraction wells and local pipelines to transport the extracted gas. The increase has economic ramifications, but also can have marked negative effects on environmental health (See section 4.3.20). Natural gas hydraulic fracturing has been correlated with increases in seismicity as well (See section 4.3.2).

Total population in Sullivan County decreased by approximately two percent from 2000 to 2010, and another four and a half percent from 2010 until 2016. The estimated population of Sullivan County as of 2017 is 6,089, lower yet from the 2016 estimate by forty-eight people. More detailed population changes by municipality can be seen in *Table 67 - Population Change.* This overall change reflects a consistent decrease in population in all thirteen municipalities based on the 2016 estimated population. Most of the municipalities experienced a decrease of three percent or greater with the exception of Colley Township and Laporte Township who had two percent decreases.

As of the 2010 census, seasonal housing accounts for 52% of total housing in Sullivan County. Municipalities with large numbers of seasonal housing units include Fox Township, Cherry Township, Colley Township and Davidson Township. Median value of Sullivan County owner occupied housing units from 2012-2016 is estimated at $145,000.

Table 67 - Population Change

Population Change *(US Census Bureau, 2018)*			
Municipality	**2010 Population**	**2016 Estimate**	**Percent Change**
Cherry Township	1,705	1,626	-4.6%
Colley Township	694	680	-2.0%
Davidson Township	573	539	-5.9%
Dushore Borough	608	572	-5.9%
Eagles Mere Borough	120	114	-5.0%
Elkland Township	577	544	-5.7%
Forks Township	377	362	-4.0%
Forksville Borough	145	140	-3.4%

Population Change *(US Census Bureau, 2018)*			
Municipality	**2010 Population**	**2016 Estimate**	**Percent Change**
Fox Township	358	336	-6.1%
Hillsgrove Township	287	276	-3.8%
Laporte Borough	316	300	-5.1%
Laporte Township	349	342	-2.0%
Shrewsbury Township	319	306	-4.1%
Total	**6,428**	**6,137**	**-4.5%**

5. Capability Assessment

5.1. Update Process Summary

The capability assessment is an evaluation of Sullivan County's governmental structure, political framework, legal jurisdiction, fiscal status, policies and programs, regulations and ordinances and resource availability. Each category is evaluated for its strengths and weaknesses in responding to, preparing for and mitigating the effects of the profiled hazards. A capability assessment is an integral part of the hazard mitigation planning process. Here, the county and municipalities identify, review and analyze what they are currently doing to reduce losses and identify the framework necessary to implement new mitigation actions. This information will help the county and municipalities evaluate alternative mitigation actions and address shortfalls in the mitigation plan.

A capabilities assessment survey was provided to the municipalities during the planning process at meetings held with Sullivan County officials. These meetings were designed to seek input from key county and municipal stakeholders on legal, fiscal, technical and administrative capabilities of all jurisdictions. As such, the capabilities assessment helps guide the implementation of mitigation projects and will help evaluate the effectiveness of existing mitigation measures, policies, plans, practices and programs.

Throughout the planning process, the mitigation local planning team considered the county's thirteen municipalities. Pennsylvania municipalities have their own governing bodies, pass and enforce their own ordinances and regulations, purchase equipment and manage their own resources, including critical infrastructure. These capability assessments, therefore, consider the various characteristics and capabilities of municipalities under study. Additionally, NFPA 1600 recommends that a corrective action program be established to address shortfalls and provide mechanisms to manage the capabilities improvement process.

The evaluation of the following categories – political framework, legal jurisdiction, fiscal status, policies and programs and regulations and ordinances – allows the mitigation planning team to determine the viability of certain mitigation actions. The capability assessment analyzes what Sullivan County and its municipalities have the capacity to do and provides an understanding of what must be changed to mitigate loss.

Sullivan County has a number of resources it can access to implement hazard mitigation initiatives including emergency response measures, local planning and regulatory tools, administrative assistance and technical expertise, fiscal capabilities and participation in local, regional, state and federal programs. The presence of these resources enables community resiliency through actions taken before, during and after a hazardous event. While the capability assessment serves as a good instrument for identifying local capa-

bilities, 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

All thirteen municipalities within Sullivan County completed and submitted a capability assessment survey. The results of the survey were collected, aggregated and analyzed.

5.2.1. Planning and Regulatory Capability

Municipalities have the authority to govern more restrictively than state and county minimum requirements; as long as they are in compliance with all criteria established in the Pennsylvania Municipalities Planning Code (MPC) and their respective municipal codes. Municipalities can develop their own policies and programs and implement their own rules and regulations to protect and serve their local residents. Local policies and programs are typically identified in a comprehensive plan, implemented through a local ordinance and enforced by the governmental body or its appointee.

Municipalities regulate land use via the adoption and enforcement of zoning, subdivision and land development, building codes, building permits, floodplain management and/or storm water management ordinances. When effectively prepared and administered, these regulations can lead to an opportunity for hazard mitigation. For example, the National Flood Insurance Program (NFIP) established minimum floodplain management criteria. Adoption of the Pennsylvania Floodplain Management Act (Act 166 of 1978) established higher standards. A municipality must adopt and enforce these minimum criteria to be eligible for participation in the NFIP. Municipalities have the option of adopting a single-purpose ordinance or incorporating these provisions into their zoning, subdivision and land development, or building codes; thereby mitigating the potential impacts of local flooding. This capability assessment details the existing Sullivan County and municipal legal capabilities to mitigate the profiled hazards. It identifies the county's and the municipalities' existing planning documents and their hazard mitigation potential. Hazard mitigation recommendations are, in part, based on the information contained in the assessment.

Building Codes

Building codes are important in mitigation because they are developed for a region of the country in respect to the hazards existing in that area. Consequently, structures that are built according to applicable codes are inherently resistant to many hazards, such as strong winds, floods and earthquakes; and can help mitigate regional hazards, such as wildfires. In 2003, Pennsylvania implemented the Uniform Construction Code (UCC) (Act

45), a comprehensive building code that establishes minimum regulations for most new construction, including additions and renovations to existing structures.

The code applies to almost all buildings, excluding manufactured and industrialized housing (which are covered by other laws), agricultural buildings and certain utility and miscellaneous buildings. The UCC has many advantages. It requires builders to use materials and methods that have been professionally evaluated for quality and safety, as well as inspections to ensure compliance.

The initial election period, during which all of Pennsylvania's 2,565 municipalities were allowed to decide whether the UCC would be administered and enforced locally, officially closed on August 7, 2004. The codes adopted for use under the UCC are the 2003 International Codes issued by the International Code Council (ICC). Supplements to the 2003 codes have been adopted for use over the years since.

If a municipality has "opted in", all UCC enforcement is local, except where municipal (or third party) code officials lack the certification necessary to approve plans and inspect commercial construction for compliance with UCC accessibility requirements. If a municipality has "opted out", the PA Department of Labor and Industry is responsible for all commercial code enforcement in that municipality; and all residential construction is inspected by independent third-party agencies selected by the owner. The department also has sole jurisdiction for all state-owned buildings no matter where they are located. Historical buildings may be exempt from such inspections and Act 45 provides quasi-exclusion from UCC requirements.

The municipalities in Sullivan County adhere to the standards of the Pennsylvania Uniform Construction Code (Act 45). All thirteen municipalities in Sullivan County have opted in on building code enforcement.

Zoning Ordinance

Article VI of the Municipalities Planning Code (MPC) authorizes municipalities to prepare and enact zoning to regulate land use. Its regulations can apply to: the permitted use of land; the height and bulk of structures; the percentage of a lot that may be occupied by buildings and other impervious surfaces; yard setbacks; the density of development; the height and size of signs; the parking regulations. A zoning ordinance has two parts, including the zoning map that delineates zoning districts and the text that sets forth the regulations that apply to each district. Three of the thirteen municipalities provide their own zoning enforcement. The remaining ten municipalities do not have municipal zoning regulations.

Subdivision Ordinance

Subdivision and land development ordinances include regulations to control the layout of streets, the planning of lots and the provision of utilities and other site improvements. The objectives of a subdivision and land development ordinance are to: coordinate street

patterns; assure adequate utilities and other improvements are provided in a manner that will not pollute streams, wells and/or soils; reduce traffic congestion; and provide sound design standards as a guide to developers, the elected officials, planning commissions and other municipal officials. Article V of the Municipality Planning Code authorizes municipalities to prepare and enact a subdivision and land development ordinance. Subdivision and land development ordinances provide for the division and improvement of land. All municipalities in Sullivan County utilize some form of land use and land development regulation. The Sullivan County Subdivision and Land Development Ordinance provides regulatory guidance for twelve of the thirteen municipalities. One municipality has their own subdivision and land development ordinance.

Stormwater Management Plan/Stormwater Ordinance

The proper management of storm water runoff can improve conditions and decrease the chance of flooding. Pennsylvania's Storm Water Management Act (Act 167) confers on counties the responsibility for development of watershed plans. The Act specifies that counties must complete their watershed storm water plans within two years following the promulgation of these guidelines by the DEP, which may grant an extension of time to any county for the preparation and adoption of plans. Counties must prepare the watershed plans in consultation with municipalities and residents. This is to be accomplished through the establishment of a watershed plan advisory committee. The counties must also establish a mechanism to periodically review and revise watershed plans so they are current. Plan revisions must be done every five years or sooner, if necessary.

Municipalities have an obligation to implement the criteria and standards developed in each watershed storm water management plan by amending or adopting laws and regulation for land use and development. The implementation of storm water management criteria and standards at the local level are necessary since municipalities are responsible for local land use decisions and planning. The degree of detail in the ordinances depends on the extent of existing and projected development. The watershed storm water management plan is designed to aid the municipality in setting standards for the land uses it has proposed. Municipalities within rapidly developing watersheds will benefit from the watershed storm water management plan and will use the information for sound land use considerations. A major goal of the watershed plan and the attendant municipal regulations is to prevent future drainage problems and avoid the aggravation of existing problems. Sullivan County does not have any approved Act 167 Stormwater Management Plans.

Comprehensive Plan

A comprehensive plan is a policy document that states objectives and guides the future growth and physical development of a municipality. The comprehensive plan is a blueprint for housing, transportation, community facilities, utilities and land use. It examines

how the past led to the present and charts the community's future path. The Pennsylvania Municipalities Planning Code (MPC Act 247 of 1968, as reauthorized and amended) requires counties to prepare and maintain a county comprehensive plan. In addition, the MPC requires counties to update the comprehensive plan every ten years.

With regard to hazard mitigation planning, Section 301.a(2) of the Municipality Planning Code requires comprehensive plans to include a plan for land use, which, among other provisions, suggests that the plan give consideration to floodplains and other areas of special hazards and other similar uses. The MPC also requires comprehensive plans to include a plan for community facilities and services and recommends giving consideration to storm drainage and floodplain management.

Sullivan County has a county comprehensive plan that was adopted on January 18, 2011. Sullivan County plans to apply for funding to update their comprehensive plan in 2019.

Article III of the MPC enables municipalities to prepare a comprehensive plan; however, development of a comprehensive plan is voluntary. There are currently no municipalities in Sullivan County that have their own comprehensive plan.

Capital Improvements Plan

The capital improvements plan is a multi-year policy guide that identifies needed capital projects and is used to coordinate the financing and timing of public improvements. Capital improvements relate to streets, storm water systems, water distribution, sewage treatment and other major public facilities. A capital improvements plan should be prepared by the respective county's planning department and should include a capital budget. This budget identifies the highest priority projects recommended for funding in the next annual budget. The capital improvements plan is dynamic and can be tailored to specific circumstances. There are currently no municipalities in Sullivan County that have a capital improvement plan in place.

Participation in the National Flood Insurance Program (NFIP)

Floodplain management is the operation of programs or activities that may consist of both corrective and preventive measures for reducing flood damage, including but not limited to such things as emergency preparedness plans, flood control works and flood plain management regulations. The Pennsylvania Floodplain Management Act (Act 166) requires every municipality identified by the Federal Emergency Management Agency (FEMA) to participate in the National Flood Insurance Program (NFIP) and permits all municipalities to adopt floodplain management regulations. It is in the interest of all property owners in the floodplain to keep development and land usage within the scope of the floodplain regulations for their community. This helps keep insurance rates low and makes sure that the risk of flood damage is not increased by property development.

The Pennsylvania DCED provides communities, based on their CFR, Title 44, Section 60.3 level of regulations, with a suggested ordinance document to assist municipalities in meeting the minimum requirements of the NFIP along with the Pennsylvania Flood Plain Management Act (Act 166). These suggested or model ordinances contain provisions that are more restrictive than state and federal requirements. Suggested provisions include, but are not limited to:

1. Prohibiting manufactured homes in the floodway.
2. Prohibiting manufactured homes within the area measured fifty feet landward from the top-of bank of any watercourse within a special flood hazard area.
3. Special requirements for recreational vehicles within the special flood hazard area.
4. Special requirement for accessory structures.
5. Prohibiting new construction and development within the area measured fifty feet landward from the top-of bank of any watercourse within a special flood hazard area.
6. Providing the county conservation district an opportunity to review and comment on all applications and plans for any proposed construction or development in any identified floodplain area.

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

The NFIP's Community Rating System (CRS) provides discounts on flood insurance premiums in those communities that establish floodplain management programs that go beyond NFIP minimum requirements. Under the CRS, communities receive credit for more restrictive regulations; acquisition, relocation, or flood-proofing of flood-prone buildings; preservation of open space; and other measures that reduce flood damages or protect the natural resources and functions of floodplains.

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

Under the Community Rating System, flood insurance premium rates are adjusted to reflect the reduced flood risk resulting from community activities that meet a minimum of three of the following CRS goals:

1. Reduce flood losses
2. Protect public health and safety
3. Reduce damage to property
4. Prevent increases in flood damage from new construction
5. Reduce the risk of erosion damage
6. Protect natural and beneficial floodplain functions
7. Facilitate accurate insurance rating
8. Promote the awareness of flood insurance

There are ten Community Rating System classes. Class 1 requires the most credit points and gives the largest premium reduction; Class 10 receives no premium reduction. CRS premium discounts on flood insurance range from five percent for Class 9 communities up to forty-five percent for Class 1 communities. The CRS recognizes eighteen credible activities, organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction and Flood Preparedness.

FEMA Region III makes available to communities, an ordinance review checklist which lists required provisions for floodplain management ordinances. This checklist helps communities develop an effective floodplain management ordinance that meets federal requirements for participation in the NFIP. The Pennsylvania Department of Community and Economic Development (DCED) provides communities, based on their 44 CFR 60.3 level of regulations, with a suggested ordinance document to assist municipalities in meeting the minimum requirements of the NFIP and the Pennsylvania Flood Plain Management Act (Act 166). Act 166 mandates municipal participation in and compliance with the NFIP. It also establishes higher regulatory standards for hazardous materials and high-risk land uses. As new digital flood insurance rate maps (DFIRMs) are published, the Pennsylvania State NFIP Coordinator at DCED works with communities to ensure the timely and successful adoption of an updated floodplain management ordinance by reviewing and providing feedback on existing and draft ordinances.

All thirteen municipalities that reside in Sullivan County have floodplain regulations in place that meet requirements set forth by the NFIP. Currently, no municipalities have completed or started to complete the CRS program. Additional research will be conducted on the CRS program and mitigation actions will be developed in support of the CRS.

5.2.2. Administrative and Technical Capability

There are four boroughs and nine townships within Sullivan County. Each of these municipalities conducts its daily operations and provides various community services according to local needs and limitations. Some of these municipalities have formed cooperative agreements and work jointly with their neighboring municipalities to provide services such as police protection, fire and emergency response, infrastructure maintenance and water supply management. Others choose to operate on their own. Municipalities vary in staff size, resource availability, fiscal status, service provision, constituent population, overall size and vulnerability to the profiled hazards.

County Planning Department

In Pennsylvania, planning responsibilities traditionally have been delegated to each county and local municipality through the Municipalities Planning Code (MPC). A planning agency acts as an advisor to the governing body on matters of community growth and development. A governing body may appoint individuals to serve as legal or engineering advisors to the planning agency. In addition to the duties and responsibilities authorized by Article II of the MPC, a governing body may, by ordinance, delegate approval authority to a planning agency for subdivision and land development applications. A governing body has considerable flexibility, not only as to which powers and duties are assigned to a planning agency, but also as to what form an agency will possess. A governing body can create a planning commission, a planning department, or both. The Sullivan County Planning Commission assists all municipalities in the county as needed. The county employs a county planner on an annual basis.

Municipal Engineer

A municipal engineer performs duties as directed in the areas of construction, reconstruction, maintenance and repair of streets, roads, pavements, sanitary sewers, bridges, culverts and other engineering work. The municipal engineer prepares plans, specifications and estimates of the work undertaken by the municipality. All municipalities employ a municipal engineer on an as needed basis. This is usually a subcontracted service.

Personnel Skilled in GIS or FEMA HAZUS Software

A geographic information system (GIS) is an integrated, computer-based system designed to capture, store, edit, analyze and display geographic information. Some examples of uses for GIS technology in local government are: land records management, land use planning, infrastructure management and natural resources planning. A GIS automates existing operations such as map production and maintenance, saving a great deal of time and money. The GIS also includes information about map features such as the capacity of a municipal water supply or the acres of public land. GIS data is managed, maintained and developed by the Sullivan County GIS Department. There are currently no members of the Sullivan County GIS Department that have completed Basic HAZUS-MH.

Emergency Management Coordinator

Emergency management is a comprehensive, integrated program of mitigation, preparedness, response and recovery for emergencies/disasters of any kind. No public or private entity is immune to disasters and no single segment of society can meet the complex needs of a major emergency or disaster on its own.

A municipal emergency management coordinator is responsible for emergency management – preparedness, response, recovery and mitigation within his/her respective authority having jurisdiction (AHJ). The responsibilities of the emergency management coordinator are outlined in PA Title 35 §7503:

- Prepare and maintain a current disaster emergency management plan
- Establish, equip and staff an emergency operations center
- Provide individuals and organizational training programs
- Organize and coordinate all locally available manpower, materials, supplies, equipment and services necessary for disaster emergency readiness, response and recovery
- Adopt and implement precautionary measures to mitigate the anticipated effects of a disaster
- Cooperate and coordinate with any public and private agency or entity
- Provide prompt information regarding local disaster emergencies to appropriate Commonwealth and local officials or agencies and the general public
- Participate in all tests, drills and exercises, including remedial drills and exercises, scheduled by the agency or by the federal government

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

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

The Emergency Management Services Code (PA Title 35) requires that all municipalities in the Commonwealth have a local emergency operations plan (EOP) which is updated every two years. Ten of the thirteen municipalities indicated that they have an EOP in place on the capability assessment survey. The notification and resource section of the plan was developed individually by each municipality.

Political Capability

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

The capability assessment survey was used to capture information on each jurisdiction's political capability. Survey respondents were asked to identify examples of political ca-

pability, such as guiding development away from hazard areas, restricting public investments or capital improvements within hazard areas, or enforcing local development standards that go beyond minimum state or federal requirements (i.e. building codes, floodplain management ordinances, etc.). These examples were used to guide respondents in scoring their community on a scale of "unwilling" (0) to "very willing" (5) to adopt policies and programs that reduce hazard vulnerabilities. Of the municipalities that responded, eleven of the municipalities completed this section with a numerical response. *Table 68 - Sullivan County Community Political Capability* summarizes the results of political capability.

Table 68 - Sullivan County Community Political Capability

Sullivan County Community Political Capability						
Municipality Name	**Capability Ranking**					
	0	**1**	**2**	**3**	**4**	**5**
Cherry Township				X		
Colley Township				X		
Davidson Township					X	
Dushore Borough				X		
Eagles Mere Borough	Not completed by municipality					
Elkland Township						X
Forks Township					X	
Forksville Borough				X		
Fox Township				X		
Hillsgrove Township					X	
Laporte Borough					X	
Laporte Township	Not completed by municipality					
Shrewsbury Township				X		

Self-Assessment

In addition to the inventory and analysis of specific local capabilities, the capability assessment survey required each local jurisdiction to conduct its own self-assessment of its capability to effectively implement hazard mitigation activities. As part of this process, county and municipal officials were encouraged to consider the barriers to implementing proposed mitigation strategies in addition to the mechanisms that could enhance or further such strategies. In response to the survey questionnaire, local officials classified each of the capabilities as either "L = limited" "M = moderate" or "H = high." *Table 69 - Capability Self-Assessment Matrix* summarizes the results of the self-assessment survey.

Table 69 - Capability Self-Assessment Matrix

Sullivan County Capability Self-Assessment Matrix				
Municipality Name	**Capability Category**			
	Planning and Regulatory Capability	**Administrative and Technical Capability**	**Fiscal Capability**	**Community Political Capability**
Cherry Township	L	M	M	M
Colley Township	M	M	L	L
Davidson Township	L	L	L	L
Dushore Borough	L	L	L	M
Eagles Mere Borough	M	L	H	M
Elkland Township	L	M	H	M
Forks Township	M	M	L	H
Forksville Borough	M	L	M	M
Fox Township	M	M	M	H
Hillsgrove Township	L	L	H	M
Laporte Borough	M	L	M	M
Laporte Township	L	L	L	L
Shrewsbury Township	L	L	L	L

Existing Limitations

Funding has been identified as the largest limitation for a municipality to complete mitigation activities. The acquisition of grants is the best way to augment this process for the municipalities. The county and municipality representatives will need to rely on regional, state and federal partnerships for future financial assistance. Development of intra-county regional partnerships and intra-municipality regional partnerships will bolster this process.

5.2.3. Financial Capability

Fiscal capability is significant to the implementation of hazard mitigation activities. Every jurisdiction must operate within the constraints of limited financial resources. The following information pertains to various financial assistance programs relevant to hazard mitigation.

State and Federal Grants

During the 1960s and 1970s, state and federal grants-in-aid were available to finance a large number of municipal programs, including streets, water and sewer facilities, airports, parks and playgrounds. During the early 1980s, there was a significant change in federal policy, based on rising deficits and a political philosophy that encouraged states

and local governments to raise their own revenues for capital programs. The result has been a growing interest in "creative financing."

Capital Improvement Financing

Because most capital investments involve the outlay of substantial funds, local governments can seldom pay for these facilities through annual appropriations in the annual operating budget. Therefore, numerous techniques have evolved to enable local government to pay for capital improvements over a time period exceeding one year. Public finance literature and state laws governing local government finance classify techniques that are used to finance capital improvements. The techniques include: revenue bonds; lease-purchase, authorities and special district; current revenue (pay-as-you-go); reserve funds; and tax increment financing. Most municipalities have very limited local tax funds for capital projects. Grants and other funding are always a priority.

Indebtedness through General Obligation Bonds

Some projects may be financed with general obligation bonds. With this method, the jurisdiction's taxing power is pledged to pay interest and principal to retire debt. General obligation bonds can be sold to finance permanent types of improvements, such as schools, municipal buildings, parks and recreation facilities. Voter approval may be required.

Municipal Authorities

Municipal authorities are most often used when major capital investments are required. In addition to sewage treatment, municipal authorities have been formed for water supply, airports, bus transit systems, swimming pools and other purposes. Joint authorities have the power to receive grants, borrow money and operate revenue generating programs. Municipal authorities are authorized to sell bonds, acquire property, sign contracts and take similar actions. Authorities are governed by authority board members, who are appointed by the elected officials of the member municipalities.

Sewer Authorities

Sewer authorities include multi-purpose authorities with sewer projects. They sell bonds to finance acquisition of existing systems or for construction, extension, or system improvement. Sewer authority operating revenues originate from user fees. The fee frequently is based on the amount of water consumed and payment is enforced by the ability to terminate service or by the imposition of liens against real estate. In areas with no public water supply, flat rate charges are calculated on average use per dwelling unit.

Water Authorities

Water authorities are multi-purpose authorities with water projects, many of which operate both water and sewer systems. The financing of water systems for lease back to the

municipality is among the principal activities of the local government facilities' financing authorities. An operating water authority issues bonds to purchase existing facilities or to construct, extend, or improve a system. The primary source of revenue is user fees based on metered usage. The cost of construction or extending water supply lines can be funded by special assessments against abutting property owners. Tapping fees also help fund water system capital costs. Water utilities are also directly operated by municipal governments and by privately owned public utilities regulated by the Pennsylvania Public Utility Commission. The Pennsylvania Department of Environmental Protection has a program to assist with consolidating small water systems to make system upgrades more cost effective.

Circuit Riding Program (Engineer)

The Circuit Riding Program is an example of intergovernmental cooperation. This program offers municipalities the ability to join together to accomplish a common goal. The circuit rider is a municipal engineer who serves several small municipalities simultaneously. These are municipalities that may be too small to hire a professional engineer for their own operations yet need the skills and expertise the engineer offers. Municipalities can jointly obtain what no one municipality could obtain on its own.

5.2.4. Education and Outreach

Sullivan County has a limited education and outreach program. The Sullivan County Department of Emergency Services conducts some public outreach at public events to update the citizens and visitors of the county on natural and human-caused hazards. The county conservation district also conducts outreach on various activities and projects in the county. Many of these projects are related to or directly impact hazard mitigation projects.

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

Education and outreach on the NFIP is necessary. With new regulations in flood-plain management, updated digital flood insurance rate maps and new rate for insurance policies, education and outreach on the NFIP would assist the program. The Sullivan County Local Planning Team has identified actions necessary to complete this.

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 included the 2018 Commonwealth of Pennsylvania Standard All-Haz-

ard Mitigation Plan, local floodplain management ordinances, the Sullivan County Comprehensive Plan, Sullivan County Emergency Operations Plan, local emergency operation plans, local zoning ordinances, local subdivision and land development ordinances.

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. Floodplain management ordinance information was used to aid in the establishment of local capabilities in addition to participation in the National Flood Insurance Program (NFIP).

The Sullivan County Comprehensive Plan, the Sullivan County Emergency Operations Plan, and various municipal regulatory tools as identified in the capability assessment section of this plan, require alignment with this updated hazard mitigation plan. The county comprehensive plan has not been updated since 2011. This plan is very limited on the amount of hazard mitigation principles that are incorporated into the plan. Discussions on specific hazard areas within municipalities that may be used for future development must be addressed. Municipalities should also identify mitigation projects that could decrease the impact of hazards in these specific areas in the annual municipal capital improvement plan.

Stormwater management plans have not been implemented in the county and should strongly be considered and encouraged in the future. In the event that these plans are implemented, Sullivan County officials will ensure that hazard mitigation data and principles are implemented as appropriate.

Sullivan County is a small county with a limited population and a limited amount of resources to appropriately ensure and implement hazard mitigation principles into all regulatory tools. Sullivan County will continue to explore options to further enhance the implementation of these principles utilizing already multi-tasked staff and resources. Sullivan County will review other local and state plans that could be impacted with hazard mitigation principles over the next five-year planning period.

Pennsylvania All-Hazard Mitigation Plan

The Pennsylvania All-Hazard Mitigation Plan (PAHMP) is the baseline document for all county hazard mitigation plans in the Commonwealth of Pennsylvania. During the 2019 Sullivan County HMP update, the local planning team and steering committee reviewed and utilized the various sections of the PAHMP to provide information specific to the same sections of the Sullivan County HMP. As an example, the PAHMP risk assessment section provided copious amounts of past occurrence and vulnerability data for every hazard profile that was updated or developed new in the 2019 Sullivan County HMP. The PAHMP also provided information and data on contiguous counties to Sullivan County within the Commonwealth. Contiguous counties to Sullivan County are Lycoming, Bradford, Wyoming, Luzerne, and Columbia Counties. Information on past occurrences of hazards and mitigation actions and opportunities were utilized.

The PAHMP was also utilized to ensure that the updated Sullivan County mitigation strategy was aligned with the PAHMP mitigation strategy. High priority mitigation strategies in the PAHMP (like removal of repetitive loss and severe repetitive loss properties from the floodplain) were considered with the Sullivan County HMP mitigation strategy development. The local planning team consulted the PAHMP as they developed new actions and project opportunities.

National Flood Insurance Program and Municipal Floodplain Ordinance

The National Flood Insurance Program provided specific information that was incorporated into the flooding profile (section 4.3.3) and the capability assessment findings (section 5.2). Specifically, the amount of active insurance policies per municipality, repetitive loss properties and severe repetitive loss properties were used in the vulnerability assessment section of the flooding profile. This afforded the local planning team specific vulnerability information that was then used to develop mitigation actions and municipal mitigation project opportunity forms. Numerous municipalities identified flooding, flash flooding and ice jam flooding project opportunities that would decrease the loss of life and property damage when completed. These opportunities are identified in Appendix G.

A GIS dataset of the 1% annual chance floodplain as identified by FEMA Digital Flood Insurance Rate Maps (DFIRM) from 2016 was used to identify structures and critical facilities that fall within the floodplain in Sullivan County for the vulnerability assessment of the flooding profiles (section 4.3.3). While DFIRM maps are a useful tool and important to integrate into this planning process, it should also be noted that these are not completely accurate, and are estimates and models of vulnerability. A map of these floodplains for each municipality in Sullivan County can be found in Appendix D.

In the future, Sullivan County should ensure that all floodplain ordinance updates have integrated hazard mitigation principles by participation in NFIP programs and integrating the NFIP program data into any applicable hazard mitigation sections.

Sullivan County Comprehensive Plan

Article III of the Pennsylvania Municipalities Planning code (Act 247 of 1968, as reenacted and amended) requires all Pennsylvania counties (except Philadelphia) to adopt a comprehensive plan and update it at least every ten years. The Sullivan County Commissioners adopted the updated Sullivan County Comprehensive Plan in 2011.

The Sullivan County Planning Commission is responsible for maintaining and updating the Sullivan County Comprehensive Plan and many other regulatory tools. Technical assistance on community planning matters is provided to the Sullivan County Board of Commissioners through the Sullivan County Planning Commission. The planning commission administers the Sullivan County Comprehensive Plan. The planning commission also performs technical reviews of municipal subdivision and land development plans, municipal floodplain ordinances and other community planning and development matters.

The following outlines the integration of the 2011 Sullivan County Comprehensive Plan with the 2019 Sullivan County HMP:

- Information from chapter two of the 2011 Sullivan County Comprehensive plan was used to enhance the community profile is section 2.1 and 2.2.
- Chapter two, demographic characteristics of the 2011 Sullivan County Comprehensive plan were used to enhance section 2.3 of the 2019 Sullivan County Hazard Mitigation Plan.
- The Sullivan County water resources in figure 2-20 and watershed details in figure 2-21 was utilized in the development of figure 5, hydrologic features map in the 2019 Sullivan County HMP
- The community infrastructure, sewer and water facilities was utilized in the development of section 4.3.26, utilities interruptions of the 2019 Sullivan County HMP.
- Goal #1 – Natural and Historic Resources of the Sullivan County Comprehensive and all objectives were utilized in the development of the 2019 goals, objectives and actions for the mitigation strategy in section 6 of the 2019 Sullivan County HMP.
- Goal #2 – Economy and environment of the Sullivan County Comprehensive and all objectives were utilized in the development of the 2019 goals, objectives and actions for the mitigation strategy in section 6 of the 2019 Sullivan County HMP.
- Goal #3 – Community character of the Sullivan County Comprehensive and all objectives were utilized in the development of the 2019 goals, objectives and actions for the mitigation strategy in section 6 of the 2019 Sullivan County HMP.
- Goal #4 – State owned lands of the Sullivan County Comprehensive and all objectives were utilized in the development of the 2019 goals, objectives and actions for the mitigation strategy in section 6 of the 2019 Sullivan County HMP.
- Goal #5 – Population groups of the Sullivan County Comprehensive and all objectives were utilized in the development of the 2019 goals, objectives and actions for the mitigation strategy in section 6 of the 2019 Sullivan County HMP.
- Goal #6 – Transportation needs of the Sullivan County Comprehensive and all objectives were utilized in the development of the 2019 goals, objectives and actions for the mitigation strategy in section 6 of the 2019 Sullivan County HMP.
- Chapter 8 of the Sullivan County Comprehensive Plan recommends the implementation of Act 167 Stormwater Management with the assistance of the Sullivan County Conservation District and the municipalities of Sullivan County. This was utilized in the development and support of actions 2.3.1 and 1.6.7 in the 2019 mitigation strategy in section 6.4 of the 2019 Sullivan County HMP.

Sullivan County Emergency Operations

The Pennsylvania Emergency Management Services Code, 35 PA C.S. Sections 7701-7707, as amended, requires each county and municipality to prepare, maintain and keep

current an Emergency Operations Plan (EOP). Sullivan County Office of Emergency Services is responsible for preparing and maintaining the county's EOP, which applies to both the county and municipal emergency management operations and procedures.

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

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

EMA will consider the Sullivan County Hazard Mitigation Plan during its biennial review of the county EOP. Recommended changes to the HMP will then be coordinated with the hazard mitigation local planning team.

Other Resources and Interconnectivity

Other resources utilized in the planning process include the PA DEP 2015 Oil and Gas Annual Report, which provided valuable information about Pennsylvania and Sullivan County in the Environmental Hazards Profile (section 4.3.16). The USDA 2012 Census of Agriculture was referenced in the Drought Profile (section 4.3.1) to provide community information about Sullivan County. The PA West Nile Control Program, a collaboration between the PA DEP, PA DOH & the PA DOA, was a valuable resource for the Pandemic and Infectious Diseases Profile (4.3.9), providing background information and detailed past occurrence data for West Nile Virus in Sullivan County.

Plan Interrelationships

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

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

6. Mitigation Strategy

6.1. Update Process Summary

Mitigation goals are general guidelines that explain what the county wants to achieve. Goals are usually expressed as broad policy statements representing desired long-term results. Mitigation objectives describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date. There were five goals and eighteen objectives identified in the 2014 hazard mitigation plan. The 2019 Sullivan County Hazard Mitigation Plan Update has five goals and nineteen objectives. Objectives have been added and arranged in order to associate them with the most appropriate goal. These changes are noted in *Table 70 - 2014 Mitigation Goals and Objectives Review.* A list of these goals and objectives as well as a review summary based on comments received from stakeholders who participated in the HMP update process is included in *Table 70 - 2014 Mitigation Goals and Objectives Review.* These reviews are based on the five-year hazard mitigation plan review worksheet, which includes a survey on existing goals and objectives completed by the local planning team. Municipal officials then provided feedback on the changes to the goals and objectives via a mitigation strategy update meeting. Copies of these meetings and all documentation associated with the meetings are located in Appendix C.

Actions provide more detailed descriptions of specific work tasks to help the county and its municipalities achieve prescribed goals and objectives. There were thirty-four actions identified in the 2014 mitigation strategy. A review of the 2014 mitigation actions was completed by the local planning team. The results of this review are identified in *Table 71 - 2014 Mitigation Actions Review.* Actions were evaluated by the local planning team with the intent of carrying over any actions that were not started or continuous for the next five years.

Table 70 - 2014 Mitigation Goals and Objectives Review

Sullivan County 2014 Mitigation Goals and Objectives Review Worksheet		
GOAL Objective	**Description**	**Review**
GOAL 1	***Increase planning and emergency response efforts***	***Roll forward.***
Objective 1.1	Enhance public warning capabilities	Roll forward. Implementation of "Swift 911" successful.
Objective 1.2	Coordinate emergency response planning for evacuations	Change to: "coordinate emergency response planning within the county."

Sullivan County 2014 Mitigation Goals and Objectives Review Worksheet		
GOAL Objective	**Description**	**Review**
Objective 1.3	Protect critical facilities	Change to: "Identify, protect, and equip critical facilities."
Objective 1.4	Review all comprehensive plans to ensure incorporation of hazard mitigation planning goals, objectives and actions	Remove as an objective. Make it an action. Change to: Review emergency services planning, training, and exercise planning acquisitions.
GOAL 2	***Increase natural resource and open space protection from hazards***	***Roll forward.***
Objective 2.1	Inventory and map natural resources throughout the county	Map beaver dams throughout the county. Map private ponds/pods near major roadways. Make this an action, carry forward previous 2.1 as an objective.
Objective 2.2	Increase working relationships with county and state agencies that are dedicated to the preservation and restoration of natural areas and their natural functions	Dirt and gravel road program as an action to this objective. "Increase awareness of the dirt and gravel program."
Objective 2.3	Develop, implement and enforce stormwater management plans	"Develop, implement and enforce stormwater management plans".
GOAL 3	***Increase public awareness of existing hazards and conduct public outreach***	***Roll forward***
Objective 3.1	Utilize websites and other multimedia resources to disseminate public information in reference to hazard mitigation	Roll forward
Objective 3.2	Develop public displays with brochures at key locations throughout the county	Remove
Objective 3.3	Utilize newspapers and radio stations to conduct public service announcements	Remove. Duplication of objective 3.1
Objective 3.4	Publicize the hazard mitigation plan and encourage participation	Roll forward
GOAL 4	***Protect lives and properties from identified risk hazards***	***Roll forward***
Objective 4.1	Update existing and develop new zoning regulations for all hazards	Remove this objective.

Sullivan County 2014 Mitigation Goals and Objectives Review Worksheet		
GOAL Objective	**Description**	**Review**
Objective 4.2	Enforce uniform construction code at the municipal level	This is an action item. New 4.2: Utilize best practices to implement and execute specific ordinances, codes and resolutions
Objective 4.3	Utilize the FEMA buyout program to remove flood prone and repetitive loss properties from the floodplain	Roll forward
GOAL 5	***Reduce current and future risk from flooding and flash flooding***	***Roll forward to 2019 plan***
Objective 5.1	Encourage municipal participation in the National Flood Insurance Program	Roll forward to 2019 plan
Objective 5.2	Adopt new flood insurance rate maps as they become available	Roll forward to 2019 plan
Objective 5.3	Develop and implement flood plain management ordinances in accordance with the National Flood Insurance Program	Roll forward to 2019 plan
Objective 5.4	Conduct outreach to homeowners and business owners to encourage participation in the National Flood Insurance Program	Roll forward to 2019 plan

Table 71 - 2014 Mitigation Actions Review

2014 Sullivan County Mitigation Actions Review Worksheet						
Existing Mitigation Actions	***Status***					***Review Comments***
	No Progress / Unknown	**In Progress / Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
1.1.1 Encourage NOAA alert radio use by homeowners			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.1.1

2014 Sullivan County Mitigation Actions Review Worksheet						
Existing Mitigation Actions	***Status***					***Review Comments***
	No Progress / Unknown	**In Progress / Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
1.1.2 Improve severe weather warnings to residents/business owners with an emergency notification system.					**X**	No longer valid. This action has been replaced with new Action 1.1.2
1.1.3 Identify special needs groups and individuals for planning and emergency response			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.2.1
1.2.1 Improve emergency response procedures			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.2.4
1.2.2 Coordinate evacuation plans with major employers			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.2.2
1.2.3 Review high risk dam emergency plans annually			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.2.3
1.2.4 Conduct a commodity flow study to determine hazardous materials that are transported through Sullivan County			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.6.1
1.3.1 Encourage NOAA alert radio use by homeowners					**X**	No longer valid. The LPT reviewed and identified that this action should be removed from the 2019 HMP.
1.3.2 Support efforts to protect sewer, water, and critical facilities			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.3.1

2014 Sullivan County Mitigation Actions Review Worksheet						
Existing Mitigation Actions	***Status***					***Review Comments***
	No Progress / Unknown	**In Progress / Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
1.3.3. Incorporate hazard mitigation needs into capital investment plans			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.4.1
1.3.4 Make vulnerable critical facilities disaster resistant			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.3.2
1.3.5 Conduct outreach to educate the public to report suspicious activities around gas well sites and transmission gas lines.			**X**			LPT identified that this action is continuous. This will be 2019 Action 3.1.5
1.4.1 Adopt a community disaster plan that is sustainable			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.6.2
1.4.2 Incorporate hazard mitigation objectives into applicable plans that support the hazard mitigation planning process			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.4.2
2.1.1 Identify and map natural resources that will decrease the impact of hazards			**X**			LPT identified that this action is continuous. This will be 2019 Action 2.1.2
2.2.1 Identify developing areas and collect data on land development trends			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.6.7

2014 Sullivan County Mitigation Actions Review Worksheet						
Existing Mitigation Actions	***Status***					***Review Comments***
	No Progress / Unknown	**In Progress / Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
3.1.2 Promote natural functioning of floodplains			**X**			LPT identified that this action is continuous. This will be 2019 Action 3.1.6
3.1.3 Support multi-objective watershed management approach			**X**			LPT identified that this action is continuous. This will be 2019 Action 1.6.8
3.1.4 Develop and implement a storm water management plan					**X**	No longer valid. The LPT reviewed and identified that this action is no longer valid and will not be included in the 2019 plan
3.1.1 Promote safe sustainable community initiatives					**X**	No longer valid. The LPT identified numerous community initiatives for the 2019 HMP. This action is to be removed as it is too vague.
3.1.2 Educate the public about "what to do" in emergencies			**X**			LPT identified that this action is continuous. This will be 2019 Action 3.1.1
3.2.1 Develop a brochure to educate the public about the dangers of radon and the impacts in Sullivan County.			**X**			LPT identified that this action is continuous. This will be 2019 Action 3.1.7
3.2.2 Ensure maps are available at key tourist and recreational areas for public access to decrease disorientation.			**X**			LPT identified that this action is continuous. This will be 2019 Action 3.1.8

2014 Sullivan County Mitigation Actions Review Worksheet						
Existing Mitigation Actions	***Status***					***Review Comments***
	No Progress / Unknown	**In Progress / Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
3.3.1 Develop public service announcements to utilize prior to storms during the winter season			**X**			LPT identified that this action is continuous. This will be 2019 Action 3.3.2
3.4.1 Place the county hazard mitigation plan on the county website and provide outreach identifying how to access the plan			**X**			LPT identified that this action is continuous. This will be 2019 Action 3.2.1
4.1.1 Ensure the zoning ordinance encourages higher densities outside of known hazard areas.			**X**			LPT identified that this action is continuous. This will be 2019 Action 4.1.2
4.2.1 Enhance construction codes in the floodplain			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.3.1
4.3.1 Identify and implement structural and property protection projects to reduce the impacts from flooding including flood proofing, acquisition, elevation, relocation and demolition and reconstruction projects.			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.5.1

2014 Sullivan County Mitigation Actions Review Worksheet						
Existing Mitigation Actions	***Status***					***Review Comments***
	No Progress / Unknown	**In Progress / Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
4.3.2 Support and assist municipal governments with the protection or removal of repetitive loss properties			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.5.2
5.1.1 Encourage municipalities to participate in the national flood insurance program.			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.1.1
5.2.1 Conduct outreach to municipalities upon the issuance of updated digital flood insurance rate maps to encourage review, comment and adoption of maps			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.2.1
5.3.1 Encourage increased floodplain management principles and practices			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.3.2
5.4.1 Establish and publicize a user friendly public accessible repository of flood insurance rate maps			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.4.1

2014 Sullivan County Mitigation Actions Review Worksheet						
Existing Mitigation Actions	***Status***					***Review Comments***
	No Progress / Unknown	**In Progress / Not Yet Complete**	**Continuous**	**Completed**	**Discontinued**	
5.4.2 Conduct National Flood Insurance Program community workshops to provide information and incentives for property owners to acquire flood insurance			**X**			LPT identified that this action is continuous. This will be 2019 Action 5.1.2

6.2. Mitigation Goals and Objectives

Based on results of the goals and objectives evaluation exercise and input from the local planning team, a list of four goals and fourteen corresponding objectives was developed. *Table 72 - 2019 Goals and Objectives* details the mitigation goals and objectives established for the 2019 Sullivan County Hazard Mitigation Plan.

Table 72 - 2019 Goals and Objectives

2019 Sullivan County Goals and Objectives	
GOAL Objective	***Description***
GOAL 1	**Increase planning and emergency response efforts.**
Objective 1.1	Enhance public warning capabilities.
Objective 1.2	Coordinate emergency response planning for evacuations.
Objective 1.3	Protect critical facilities.
Objective 1.4	Review all comprehensive plans to ensure incorporation of hazard mitigation planning goals, objectives and actions.
Objective 1.5	Enhance relationships with regional and local response personnel.

2019 Sullivan County Goals and Objectives	
GOAL Objective	***Description***
Objective 1.6	Develop and conduct various actions and projects to enhance hazard mitigation planning
GOAL 2	**Increase natural resource and open space protection from hazards.**
Objective 2.1	Inventory and map natural resources throughout the county.
Objective 2.2	Increase working relationships with county and state agencies that are dedicated to the preservation and restoration of natural areas and their natural functions.
Objective 2.3	Develop, implement and enforce stormwater management plans, projects, and outreach.
GOAL 3	**Increase public awareness of existing hazards and conduct public outreach.**
Objective 3.1	Utilize websites and other multimedia resources to disseminate public information in reference to hazard mitigation.
Objective 3.2	Publicize the hazard mitigation plan and encourage participation.
Objective 3.3	Develop procedures to utilize social media in prevention, response and mitigation efforts.
GOAL 4	**Protect lives and properties from identified risk hazards.**
Objective 4.1	Utilize best practices to implement and execute specific ordinances, codes and resolutions.
Objective 4.2	Remove or mitigate risks to homeowners and properties in hazard areas.
GOAL 5	**Reduce current and future risks from flooding and flash flooding.**
Objective 5.1	Encourage municipal participation in the National Flood Insurance Program.
Objective 5.2	Adopt new flood insurance rate maps as they become available.
Objective 5.3	Develop and implement flood plain management ordinances in accordance with the National Flood Insurance Program.
Objective 5.4	Conduct outreach to homeowners and business owners to encourage participation in the National Flood Insurance Program.
Objective 5.5	Acquire, elevate, demolish or demolish/reconstruct flood prone properties to remove or mitigate risks to homeowners and property.

6.3. Identification and Analysis of Mitigation Techniques

This section includes an overview of alternative mitigation actions based on the goals and objectives identified in Section 6.2. There are four general mitigation strategy techniques to reducing hazard risks:

- Local plans and regulations
- Structure and infrastructure
- Natural systems protection
- Education and awareness

Local Plans and Regulations: These actions include government authorities, policies or codes that influence the way land and buildings are developed and built. The following are some examples:

- Comprehensive plans
- Land use ordinances
- Subdivision regulations
- Development review
- Building codes and enforcement
- National Flood Insurance Program and Community Rating System
- Capital improvement programs
- Open space preservation
- Stormwater management regulations and master plans

The local plans and regulations technique will protect and reduce the impact of specific hazards on new and existing buildings by improving building code standards and regulating new and renovation construction. The improved building codes will decrease the impact of risk hazards. Subdivision and land development enhancements will also augment this process. Ensuring that municipalities participate in the National Flood Insurance Program and encourage participation in the Community Rating System will decrease the impact as well.

Structure and infrastructure implementation: These actions involve modifying existing structures and infrastructure or constructing new structures to reduce hazard vulnerability. The following are examples:

- Acquisitions and elevations of structures in flood prone areas
- Utility undergrounding
- Structural retrofits
- Floodwalls and retaining walls
- Detention and retention structures
- Culverts
- Safe rooms

Structure and infrastructure implementation is a technique that removes or diverts the hazard from structures or protects the structure from a specific hazard. The new or renovated structures are therefore protected or have a reduced impact of hazards.

Natural Resource Protection: These are actions that minimize damage and losses and also preserve or restore the functions of natural systems. They include the following:

- Erosion and sediment control
- Stream corridor restoration
- Forest management
- Conservation easements
- Wetland restoration and preservation

Natural resource protection techniques allow for the natural resource to be used to protect or lessen the impact on new or renovated structures through the management of these resources. Utilization and implementation of the examples above will protect new and existing buildings and infrastructure.

Education and Awareness: These are actions to inform and educate citizens, elected officials and property owners about hazards and potential ways to mitigate them and may also include participation in national programs. Examples of these techniques include the following:

- Radio and television spots
- Websites with maps and information
- Real estate disclosure
- Provide information and training
- NFIP outreach
- StormReady
- Firewise Communities

The education and awareness technique will protect and reduce the impact of specific hazards on new and existing buildings through education of citizens and property owners on the impacts that specific hazards could have on new or renovated structures. This information will allow the owner to make appropriate changes or enhancements that will lessen or eliminate the impact of hazards.

Table 73 - Sullivan County Mitigation Strategy Technique Matrix provides a matrix identifying the mitigation techniques used for all low, moderate and high-risk hazards in the county. The specific actions associated with these techniques are included in *Table 74 - 2019 Mitigation Action Plan*.

Table 73 - Sullivan County Mitigation Strategy Technique Matrix

Sullivan County Mitigation Strategy Technique Matrix				
HAZARD	**MITIGATION TECHNIQUE**			
	Local Plans and Regulations	**Structural and Infrastructure**	**Natural Systems Protection**	**Education and Awareness**
Drought	X		X	X
Earthquake	X			X
Extreme Temperatures	X	X		X
Flooding	X	X	X	X
Hurricane/Tropical Storm	X	X		X
Invasive Species	X		X	X
Landslides		X	X	X
Lightning Strike	X	X		X
Pandemic	X		X	X
Radon	X	X		X
Subsidence/Sinkholes		X		X
Tornados/Wind Storms	X	X		X
Wildfires	X	X		X
Winter Storms	X	X		X
Civil Disturbance	X			X
Dam Failure	X	X		X
Disorientation	X			X
Drowning	X			X
Emergency Services	X			X
Environmental Hazard: Natural Gas Exploration/Manure Spills	X	X		X
Opioid Epidemic	X			X
Structure/Building Collapse	X	X		X

Sullivan County Mitigation Strategy Technique Matrix				
HAZARD	MITIGATION TECHNIQUE			
	Local Plans and Regulations	Structural and Infrastructure	Natural Systems Protection	Education and Awareness
Terrorism	X			X
Transportation Accidents	X	X		X
Urban Fires/Explosions	X	X		X
Utility Interruptions	X	X		X

6.4. Mitigation Action Plan

The Sullivan County Hazard Mitigation Local Planning Team (LPT) immediately began work on the mitigation strategy section of the 2019 hazard mitigation plan (HMP) update after the risk assessment section was completed. The LPT started this section by reviewing the 2014 HMP mitigation strategy section. A review of the previous goals, objectives, actions and project opportunities documented in the 2014 HMP was conducted. The next step the LPT completed was the brainstorming of possible new actions based on new identified risks. The LPT compiled all this information for presentations to the municipalities.

MCM Consulting Group, Inc. completed municipality meetings at various time periods at the Sullivan County Emergency Management Agency. During all these meetings, an overview of mitigation strategy was presented and the municipalities were informed that they needed to have at least one hazard-related mitigation action for their municipality. All municipalities were invited to attend these meetings.

The municipalities were notified of draft mitigation actions and encouraged to provide new mitigation actions that could be incorporated into the plan. Municipalities were provided copies of their previously submitted mitigation opportunity forms and asked to determine if the projects were still valid. Municipalities were solicited for new project opportunities as well. All agendas, sign in sheets and other support information from these meetings is included in Appendix C.

Mitigation measures for the 2019 Sullivan County HMP are listed in the mitigation action plan. *Table 74 - 2019 Mitigation Action Plan* is the 2019 Sullivan County Mitigation Action Plan. This plan outlines mitigation actions and projects that comprise a strategy for Sullivan County. The action plan includes actions, a benefit and cost prioritization, a schedule for implementation, any funding sources to complete the action, a responsible agency

or department and an estimated cost. All benefit and cost analysis were completed using the Pennsylvania Emergency Management Agency recommended analysis tool. The completed analysis is located in Appendix H. *Table 75 - Municipal Hazard Mitigation Actions Checklist* is a matrix that identifies the county and/or municipalities responsible for mitigation actions in the new mitigation action plan.

Table 74 - 2019 Mitigation Action Plan

Sullivan County 2019 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Responsibility
1.1.1	Education and awareness	Encourage NOAA alert radio use by homeowners.	All Hazards	**X**			2019 - 2023	Local	County EMA
1.1.2	Education and awareness	Encourage public participation in the Sullivan County Swift 911 System.	All Hazards	**X**			2019 - 2023	Local	County EMA
1.2.1	Local plans and regulations	Identify special needs groups and individuals for planning and emergency response.	All Hazards		**X**		2019 - 2023	HMGP and Local	County EMA, Human Services, and Area Agency on Aging.
1.2.2	Education and awareness	Coordinate evacuation and continuity of operations plans with major employers.	All Hazards	**X**			2019 - 2023	Local	County EMA and Facility Owners
1.2.3	Local plans and regulations	Review high risk dam emergency plans annually.	Dam Failure		**X**		2019 - 2023	Local	County EMA/and County Planning Department
1.2.4	Local plans and regulations	Improve emergency response procedures.	All Hazards	**X**			2019 - 2023	Local	County EMA

Sullivan County 2019 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Responsibility
1.2.5	Local plans and regulations	Sullivan County and Bradford County continue to participate in a joint single county authority to monitor and enact the prevention and treatment program for alcohol or drugs.	Opioid Epidemic		**X**		2019 - 2023	PCCD and Local	Bradford/Sullivan Drug and Alcohol Advisory Board
1.2.6	Local plans and regulations	Sullivan County and municipalities will continue to meet with utility services to discuss tactics to decrease the impact from hazards prior to their occurrence.	Utility Interruptions		**X**		2019 - 2023	Local	County EMA/LPT
1.3.1	Structure and infrastructure	Support efforts to protect sewer, water, and critical facilities	Flooding, Utility Outage	**X**			2019 - 2023	Local	County EMA
1.3.2	Structure and infrastructure	Make vulnerable critical facilities disaster resistant.	All Hazards	**X**			2019 - 2023	PDM and HMGP	County EMA and Facility Owners
1.3.3	Structure and infrastructure	Install generators at critical facilities and functional needs facilities to decrease the impact of power outages.	Utility Outage		**X**		2019 - 2023	PDM and HMGP	County EMA and Facility Owners

Sullivan County 2019 Mitigation Action Plan									
Action Number	**Mitigation Actions**			**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**	**Hazard Vulnerability**	**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Responsibility**
1.4.1	Local plans and regulations	Incorporate hazard mitigation needs into capital improvement plans.	All Hazards		**X**		2019 - 2023	Local	County EMA
1.4.2	Education and awareness	Incorporate hazard mitigation objectives into plans that support the hazard mitigation planning process.	Emergency Services	**X**			2019 - 2023	Local	County EMA/School Districts
1.4.3	Education and awareness	Develop a strategy to utilize local school district for recruitment in emergency services.	Emergency Services	**X**			2019 - 2023	Local	Sullivan County Commissioners, County EMA and Local First Responders
1.4.4	Local plans and regulations	Continue to support the emergency services tuition reimbursement program.	Emergency Services	**X**			2019 - 2023	Local	Sullivan County Commissioners and municipalities
1.4.5	Education and awareness	Sullivan County Commissioners will continue to participate in the County Commissioners Association of Pennsylvania Taskforce to study EMS challenges in Pennsylvania.	Emergency Services		**X**		2019 - 2023	Local	Sullivan County Commissioners/County EMA

Sullivan County 2019 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Responsibility
1.5.1	Education and awareness	Sullivan County Commissioners will continue to meet with local governments to provide information and actions to decrease the emergency services crisis.	Emergency Services	**X**			2019 - 2023	Local	County EMA
1.5.2	Natural systems protection	Promote regionalization of emergency services in Sullivan County to enhance public safety.	Emergency Services	**X**			2019 - 2023	FMA, PDM, HMGP and Local	County EMA
1.6.1	Local plans and regulations	Conduct hazardous material commodity flow study to determine type and quantities of hazardous materials transported on Sullivan County roadways.	All-Hazards	**X**			2019 - 2023	HMEP and Act 165 Funds	Sullivan County Planning Department/County EMA
1.6.2	Structure and infrastructure	Adopt a community disaster recovery plan that is sustainable.	All-Hazards		**X**		2019 - 2023	Local	Sullivan County Conservation District and municipalities
1.6.3	Education and awareness	Regularly clean and maintain drainage culverts.	Flooding		**X**		2019 - 2023	Local	Sullivan County Conservation District/County EMA
1.6.4	Local plans and infrastructure	Map undersized culverts throughout the county.	Flooding		**X**		2019 - 2023	Local	County GIS

Sullivan County 2019 Mitigation Action Plan									
Action Number	**Mitigation Actions**			**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**	**Hazard Vulnerability**	**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Responsibility**
1.6.5	Local plans and infrastructure	Continue to support the Narcan program for the Sullivan County Ambulance Associations.	Opioid Epidemic	**X**			2019 - 2023	PCCD and Local	County EMA/Sullivan County Commissioners
1.6.6	Structure and infrastructure	Continue to remove dead ash trees from municipal and state right of ways to decrease the danger of falling trees and limbs.	Invasive species and Transportation Accidents		**X**		2019 - 2023	Local	DCNR
1.6.7	Local plans and regulations	Identify developing areas and collect data on land development trends and determine vulnerabilities.	Environmental Hazards and Transportation Accidents		**X**		2020 - 2022	HMEP or Local	County EMA
1.6.8	Local plans and infrastructure	Support multi-objective watershed management approach.	Flooding		**X**		2019 - 2023	Local	Sullivan County Conservation District
2.1.1	Local plans and regulations	Map beaver dams and private ponds throughout the county.	All-Hazards			**X**	2019 - 2023	FMA or Local	County GIS
2.1.2	Education and outreach	Identify and map natural resources that will decrease the impact of hazards.	All-Hazards		**X**		2019 - 2023	Local	Sullivan County Conservation District/County GIS

Sullivan County 2019 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Responsibility
2.2.1	Education and awareness	Increase awareness of the dirt and gravel program and how it can be used in the hazard mitigation program.	All-Hazards		**X**		2019 - 2023	Local	Penn State Extension/DCNR
2.3.1	Education and awareness	Sullivan Conservation District will conduct public and municipal outreach on stormwater management principles and actions.	Flooding	**X**			2019 - 2023	Local	Sullivan County Conservation District
3.1.1	Education and awareness	Educate the public about "what to do" during an emergency.	All-Hazards	**X**			2019 - 2023	Local	Sullivan County EMA
3.1.2	Education and awareness	Continue to leverage the Penn State Extension Office and DCNR to develop and maintain displays with public information and pamphlets on invasive species in Sullivan County.	Invasive Species		**X**		2019 - 2023	Local	Sullivan County EMA
3.1.3	Education and awareness	Sullivan County will conduct community outreach on preventative measures for lymes disease.	Infectious Disease			**X**	2019 - 2023	Local	Sullivan County EMA

Sullivan County 2019 Mitigation Action Plan									
Action Number	**Mitigation Actions**			**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**	**Hazard Vulnerability**	**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Responsibility**
3.1.4	Education and awareness	Continue to conduct the annual health fair in Sullivan County.	All Hazards	**X**			2019 - 2023	Local	
3.1.5	Education and awareness	Conduct outreach to educate the public to report suspicious activities around gas well sites and transmission gas lines.	Urban Fires/Explosions	**X**			2019 - 2023	Local	Sullivan County EMA
3.1.6	Education and awareness	Promote natural functioning of floodplains	Flooding	**X**			2019 - 2023	Local	Sullivan County Conservation District
3.1.7	Education and awareness	Develop a brochure to educate the public about the dangers of radon and the impacts in Sullivan County.	Radon	**X**			2019 - 2023	Local	Sullivan County EMA
3.1.8	Local plans and regulations	Ensure maps are available at key tourist and recreational areas for public access to decrease disorientation.	Disorientation	**X**			2019 - 2023	Local	Sullivan County Conservation District
3.1.9	Education and awareness	Sullivan County will utilize multimedia to disseminate and encourage the "Turn Around, Don't Drown" Program	Drowning		**X**		2019 - 2023	Local	Sullivan County EMA

Sullivan County 2019 Mitigation Action Plan									
Action Number	Mitigation Actions			Prioritization			Implementation		
	Category	Description/ Action Items	Hazard Vulnerability	High	Medium	Low	Schedule	Funding	Responsibility
3.2.1	Local plans and regulations	Place the county hazard mitigation plan on the county website and provide outreach identifying how to access the plan.	All-Hazards	**X**			2019 - 2023	Local	Sullivan County EMA
3.3.1	Education and awareness	Sullivan County EMA will utilize social media to disseminate emergency information.	All-Hazards	**X**			2019 - 2023	Local	Sullivan County EMA
3.3.2	Education and awareness	Develop public service announcements to utilize prior to storms during the winter season.	Winter Storms		**X**		2019 - 2023	Local	Sullivan County EMA
4.1.1	Local plans and regulations	Enforce the municipal floodplain ordinance regulations.	Flooding		**X**		2019 - 2023	Local	Sullivan County Municipalities
4.1.2	Local plans and regulations	Ensure the zoning ordinance encourages higher densities outside of known hazard areas.	All-Hazards		**X**		2019 - 2023	Local	Dushore Borough, Laporte Borough and Eagles Mere Borough
4.1.3	Local plans and regulations	Enforce uniform construction code at the municipal level.	All-Hazards		**X**		2019 - 2023	Local	Sullivan County Municipalities
4.2.1	Structural and Infrastructure	Assist in relocation of historically significant structures.	All-Hazards		**X**		2019 - 2023	PDM or HMGP Grants	County EMA/Municipalities

Sullivan County 2019 Mitigation Action Plan									
Action Number	**Mitigation Actions**			**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**	**Hazard Vulnerability**	**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Responsibility**
4.2.2	Structural and Infrastructure	Seek funding to retrofit flood prone homes and businesses.	Flooding		**X**		2019 - 2023	PDM, FMA or HMGP Grants	County EMA/and County Planning Department
5.1.1	Education and awareness	Encourage municipalities to participate in the national flood insurance program.	Flooding	**X**			2019 - 2023	Local	County EMA/and County Planning Department
5.1.2	Education and awareness	Conduct National Flood Insurance Program community workshops to provide information and incentives for property owners to acquire flood insurance.	Flooding		**X**		2019 - 2023	Local	County EMA/and County Planning Department
5.2.1	Education and awareness	Conduct outreach to municipalities upon the issuance of updated digital flood insurance rate maps to encourage review, comment and adoption of maps	Flooding	**X**			2019 - 2023	Local	County GIS/Sullivan County Planning Department
5.3.1	Local plans and regulations	Enhance the construction codes in the floodplain.	Flooding and Hurricane/Tropical Storms		**X**		2019 - 2023	Local	Sullivan County Municipalities
5.3.2	Education and awareness	Encourage increased floodplain management principles and practices.	Flooding		**X**		2019 - 2023	Local	Sullivan County EMA

Sullivan County 2019 Mitigation Action Plan									
Action Number	**Mitigation Actions**			**Prioritization**			**Implementation**		
	Category	**Description/ Action Items**	**Hazard Vulnerability**	**High**	**Medium**	**Low**	**Schedule**	**Funding**	**Responsibility**
5.4.1	Local plans and regulations	Establish and publicize a user friendly public accessible repository of flood insurance rate maps	Flooding		**X**		2019 - 2023	Local	County GIS
5.5.1	Local plans and regulations	Identify and implement structural and property protection projects to reduce the impacts from flooding including flood proofing, acquisition, elevation, relocation and demolition and reconstruction projects.	All-Hazards	**X**			2019 - 2023	HMGP, PDM and Local	Sullivan County EMA and Municipalities
5.5.2	Structure and infrastructure	Support and assist municipal governments with the protection or removal of repetitive loss properties.	Flooding		**X**		2019 - 2023	HMGP, PDM and Local	Sullivan County EMA and Municipalities

Funding acronym definitions:

FMA: Flood Mitigation Assistance Grant Program, administered by the Federal Emergency Management Agency

HMGP: Hazard Mitigation Grant Program, administered by the Federal Emergency Management Agency

PDM: Pre-Disaster Mitigation Grant, administered by the Federal Emergency Management Agency

EMPG: Emergency Management Performance Grant, administered by the Federal Emergency Management Agency

HSGP: Homeland Security Grant Program, administered by the Federal Emergency Management Agency

HMEP: Hazardous Material Emergency Planning Grant, administered by the Pennsylvania Emergency Management Agency

HMRF: Hazardous Material Response Fund, administered by the Pennsylvania Emergency Management Agency

Table 75 - Municipal Hazard Mitigation Actions Checklist

Municipal Hazard Mitigation Actions Checklist										
Municipality	**1.1.1**	**1.1.2**	**1.2.1**	**1.2.2**	**1.2.3**	**1.2.4**	**1.2.5**	**1.2.6**	**1.3.1**	**1.3.2**
Cherry Township					X	X		X	X	X
Colley Township					X	X		X	X	X
Davidson Township					X	X		X	X	X
Dushore Borough					X	X		X	X	X
Eagles Mere Borough					X	X		X	X	X
Elkland Township					X	X		X	X	X
Forks Township					X	X		X	X	X
Forksville Borough					X	X		X	X	X
Fox Township					X	X		X	X	X
Hillsgrove Township					X	X		X	X	X
Laporte Borough					X	X		X	X	X
Laporte Township					X	X		X	X	X
Shrewsbury Township					X	X		X	X	X
Sullivan County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**1.3.3**	**1.4.1**	**1.4.2**	**1.4.3**	**1.4.4**	**1.4.5**	**1.5.1**	**1.5.2**	**1.6.1**	**1.6.2**
Cherry Township	X	X	X	X	X		X	X	X	X
Colley Township	X	X	X	X	X		X	X	X	X
Davidson Township	X	X	X	X	X		X	X	X	X
Dushore Borough	X	X	X	X	X		X	X	X	X
Eagles Mere Borough	X	X	X	X	X		X	X	X	X
Elkland Township	X	X	X	X	X		X	X	X	X
Forks Township	X	X	X	X	X		X	X	X	X
Forksville Borough	X	X	X	X	X		X	X	X	X
Fox Township	X	X	X	X	X		X	X	X	X
Hillsgrove Township	X	X	X	X	X		X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**1.3.3**	**1.4.1**	**1.4.2**	**1.4.3**	**1.4.4**	**1.4.5**	**1.5.1**	**1.5.2**	**1.6.1**	**1.6.2**
Laporte Borough	X	X	X	X	X		X	X	X	X
Laporte Township	X	X	X	X	X		X	X	X	X
Shrewsbury Township	X	X	X	X	X		X	X	X	X
Sullivan County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**1.6.3**	**1.6.4**	**1.6.5**	**1.6.6**	**1.6.7**	**1.6.8**	**2.1.1**	**2.1.2**	**2.2.1**	**2.3.1**
Cherry Township	X		X	X			X	X	X	
Colley Township	X		X	X			X	X	X	
Davidson Township	X		X	X			X	X	X	
Dushore Borough	X		X	X			X	X	X	
Eagles Mere Borough	X		X	X			X	X	X	
Elkland Township	X		X	X			X	X	X	
Forks Township	X		X	X			X	X	X	
Forksville Borough	X		X	X			X	X	X	
Fox Township	X		X	X			X	X	X	
Hillsgrove Township	X		X	X			X	X	X	
Laporte Borough	X		X	X			X	X	X	
Laporte Township	X		X	X			X	X	X	
Shrewsbury Township	X		X	X			X	X	X	
Sullivan County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**3.1.1**	**3.1.2**	**3.1.2**	**3.1.3**	**3.1.4**	**3.1.5**	**3.1.6**	**3.1.7**	**3.1.8**	**3.2.1**
Cherry Township					X	X	X	X	X	
Colley Township					X	X	X	X	X	
Davidson Township					X	X	X	X	X	
Dushore Borough					X	X	X	X	X	
Eagles Mere Borough					X	X	X	X	X	
Elkland Township					X	X	X	X	X	
Forks Township					X	X	X	X	X	
Forksville Borough					X	X	X	X	X	
Fox Township					X	X	X	X	X	
Hillsgrove Township					X	X	X	X	X	

Municipal Hazard Mitigation Actions Checklist										
Municipality	**3.1.1**	**3.1.2**	**3.1.2**	**3.1.3**	**3.1.4**	**3.1.5**	**3.1.6**	**3.1.7**	**3.1.8**	**3.2.1**
Laporte Borough					X	X	X	X	X	
Laporte Township					X	X	X	X	X	
Shrewsbury Township					X	X	X	X	X	
Sullivan County	X	X	X	X	X	X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**3.3.1**	**3.3.2**	**4.1.1**	**4.1.2**	**4.1.3**	**4.2.1**	**4.2.2**	**5.1.1**	**5.1.2**	**5.2.1**
Cherry Township			X	X	X	X	X	X	X	X
Colley Township			X	X	X	X	X	X	X	X
Davidson Township			X	X	X	X	X	X	X	X
Dushore Borough			X	X	X	X	X	X	X	X
Eagles Mere Borough			X	X	X	X	X	X	X	X
Elkland Township			X	X	X	X	X	X	X	X
Forks Township			X	X	X	X	X	X	X	X
Forksville Borough			X	X	X	X	X	X	X	X
Fox Township			X	X	X	X	X	X	X	X
Hillsgrove Township			X	X	X	X	X	X	X	X
Laporte Borough			X	X	X	X	X	X	X	X
Laporte Township			X	X	X	X	X	X	X	X
Shrewsbury Township			X	X	X	X	X	X	X	X
Sullivan County	X	X	X	X		X	X	X	X	X

Municipal Hazard Mitigation Actions Checklist										
Municipality	**5.3.1**	**5.3.2**	**5.4.1**	**5.4.2**	**5.5.1**	**5.5.2**				
Cherry Township	X	X	X	X	X	X				
Colley Township	X	X	X	X	X	X				
Davidson Township	X	X	X	X	X	X				
Dushore Borough	X	X	X	X	X	X				
Eagles Mere Borough	X	X	X	X	X	X				
Elkland Township	X	X	X	X	X	X				
Forks Township	X	X	X	X	X	X				
Forksville Borough	X	X	X	X	X	X				

Municipal Hazard Mitigation Actions Checklist										
Municipality	**5.3.1**	**5.3.2**	**5.4.1**	**5.4.2**	**5.5.1**	**5.5.2**				
Fox Township	X	X	X	X	X	X				
Hillsgrove Township	X	X	X	X	X	X				
Laporte Borough	X	X	X	X	X	X				
Laporte Township	X	X	X	X	X	X				
Shrewsbury Township	X	X	X	X	X	X				
Sullivan County	X	X	X	X	X	X				

National Flood Insurance Program (NFIP) Related Mitigation Actions

The Federal Emergency Management Agency (FEMA) requires that every participating jurisdiction that either participates in the NFIP or has identified Special Flood Hazard Areas (SFHAs) have at least one specific action in its mitigation action plan that relates to continued compliance with the NFIP. Action numbers 4.1.1 and all actions under goal 5 comply for Sullivan County and all its municipalities.

Evaluate and Prioritize Mitigation Actions

Mitigation Action Evaluation:

Evaluating mitigation actions involves judging each action against certain criteria to determine whether or not it can be executed. The feasibility of each mitigation action is evaluated using the ten evaluation criteria set forth in the Mitigation Action Evaluation methodology as outlined in the Commonwealth of Pennsylvania's All-Hazard Mitigation Planning, Standard Operating Guide. The methodology solicits input on whether each action is highly effective or feasible and ineffective or not feasible for the criteria. These criteria are listed below and aid in determining the feasibility of implementing one action over another.

- Life Safety: Will the action be effective in promoting public safety?
- Property Protection: Will the action be effective in protecting public or private property?
- Technical: How effective will the action be in avoiding or reducing future losses?
- Political: Does the action have public and political support?
- Legal: Does the community have the authority to implement the proposed measure?
- Environmental: Will the action provide environmental benefits and will it comply with local, state and federal environmental regulations?
- Social: Will the action be acceptable by the community or will it cause any one segment of the population to be treated unfairly?
- Administrative: Is there adequate staffing and funding available to implement the action in a timely manner?

- Local Champion: Is there local support for the action to help ensure its completion?
- Other Community Objectives: Does the action address any current or future community objectives either through municipal planning or community goals?

To evaluate the mitigation actions, each action is identified as highly effective or feasible; ineffective or not favorable and no cost or benefit. For each criterion, the prioritization methodology assigns a "+" if the action was highly effective or feasible, a "-" if the action was ineffective or not feasible, and a "N" if no cost or benefit could be associated with the suggested action or the action was not applicable to the criteria.

Mitigation Action Prioritization:

Actions should be compared with one another to determine a ranking or priority by applying the multi-objective mitigation action prioritization criteria. Scores are assigned to each criterion using the following weighted, multi-objective mitigation action prioritization criteria:

- Effectiveness (weight: 20% of score): The extent to which an action reduces the vulnerability of people and property.
- Efficiency (weight: 30% of score): The extent to which time, effort, and cost is well used as a means of reducing vulnerability.
- Multi-Hazard Mitigation (weight: 20% of score): The action reduces vulnerability for more than one hazard.
- Addresses High Risk Hazard (weight: 15% of score): The action reduces vulnerability for people and property from a hazard(s) identified as high risk.
- Addresses Critical Communications/Critical Infrastructure (weight: 15% of score): The action pertains to the maintenance of critical functions and structures such as transportation, supply chain management, data circuits, etc.

Scores of 1, 2, or 3 are assigned for each multi-objective mitigation action prioritization criterion where 1 is a low score and 3 is a high score. Actions are prioritized using the cumulative score assigned to each. Each mitigation action is given a priority ranking (Low, Medium, and High) based on the following:

- Low Priority: 1.0 – 1.8
- Medium Priority: 1.9 – 2.4
- High Priority: 2.5 – 3.0

The cumulative results of the prioritization of mitigation actions is identified in the mitigation action evaluation and prioritization tool. The results for the mitigation action evaluation and prioritization are located in Appendix H of this plan.

7. Plan Maintenance

7.1. Update Process Summary

Monitoring, evaluating and updating this plan, is critical to maintaining its value and success in Sullivan County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continued basis. The Sullivan County HMP Local Planning Team decided to alter the current maintenance procedures. The 2019 HMP update establishes a review of the plan within 30 days of a disaster event in addition to continuing with an annual plan evaluation. This HMP update also defines the municipalities' role in updating and evaluating the plan. Finally, the 2019 HMP Update encourages continued public involvement and how this plan may be integrated into other planning mechanisms in the county.

7.2. Monitoring, Evaluating and Updating the Plan

Hazard mitigation planning in Sullivan County is a responsibility of all levels of government (i.e., county and local), as well as the citizens of the county. The Sullivan County Local Planning Team will be responsible for maintaining this Multi-Jurisdictional HMP. The Local Planning Team will meet annually and following each emergency declaration to review the plan. Every municipality that has adopted this plan will also be afforded the opportunity to provide updated information or information specific to hazards encountered during an emergency or disaster. Each review process will ensure that the hazard vulnerability data and risk analysis reflect current conditions of the county, that the capabilities assessment accurately reflects local circumstances and that the hazard mitigation strategies are updated based on the county's damage assessment reports and local mitigation project priorities. The HMP must be updated on a five-year cycle. An updated HMP must be completed and approved by the end of the five-year period. The monitoring, evaluating and updating of the plan every five years will rely heavily on the outcomes of the annual HMP Planning Team meetings.

The Sullivan County Local Planning Team will complete an annual Hazard Mitigation Progress Report to evaluate the status and accuracy of the Multi-Jurisdictional HMP and record the local planning team's review process. The Sullivan County Department of Emergency Services will maintain a copy of these records and place them in Appendix J of this plan and will provide PEMA and FEMA with copies of the annual updates. Sullivan County will continue to work with all municipalities regarding hazard mitigation projects, especially those municipalities that did not submit projects for inclusion in this plan.

7.3. Continued Public Involvement

The Sullivan County Department of Emergency Services will ensure that the 2019 Sullivan County Hazard Mitigation Plan is posted and maintained on the Sullivan County website and will continue to encourage public review and comment on the plan. The Sullivan County website that the plan will be located at is as follows: https://www.sullivancounty-pa.us/offices/emergency-services/

The public will have access to the 2019 HMP through their local municipal office, the Sullivan County Planning Department, or the Sullivan County Department of Emergency Services. Information on upcoming events related to the HMP or solicitation for comments will be announced via newsletters, newspapers, mailings, and the County website.

The citizens of Sullivan County are encouraged to submit their comments to elected officials and/or members of the Sullivan County HMP Local Planning Team. To promote public participation, the Sullivan County Local Planning Team will post a public comment form as well as the Hazard Mitigation Project Opportunity Form on the county's website. These forms will offer the public various opportunities to supply their comments and observations. All comments received will be maintained and considered by the Sullivan County Hazard Mitigation Planning Team.

8. Plan Adoption

8.1. Resolutions

In accordance with federal and state requirements, the governing bodies of each participating jurisdiction must review and adopt by resolution, the 2019 Sullivan County Hazard Mitigation Plan. Copies of the adopting resolutions are included in this plan in Appendix K. FEMA Region III in Philadelphia is the final approval authority for the Hazard Mitigation Plan. PEMA also reviews the plan before submission to FEMA.

9. Appendices

APPENDIX A: References

APPENDIX B: FEMA Local Mitigation Review Tool

APPENDIX C: Meetings and Support Documents

APPENDIX D: Municipal Flood Maps

APPENDIX E: Critical and Special Needs Facilities

APPENDIX F: 2019 HAZUS Reports

APPENDIX G: 2019 Mitigation Project Opportunities

APPENDIX H: 2019 Mitigation Action Evaluation & Prioritization

APPENDIX I: Dam Failure Profile

APPENDIX J: Annual Review Documentation

APPENDIX K: Sullivan County & Municipal Adoption Resolutions