# Flooding

# <u>General</u>

With its ability to roll boulders the size of cars, tear out trees, and destroy buildings and bridges, flooding is the leading cause of death among all types of natural disasters throughout the United States. Typically the result of heavy precipitation, snowmelts, and ice jams, major flood events can last several days or even weeks. Unfortunately, many homeowners fail to realize that the average insurance policy does not cover flooding. For this reason, floods are a costly and dangerous hazard.

A property's vulnerability to a flood depends on its location in the floodplain. The properties that reside 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 10-year flood zone is the area that has a 10 percent chance of being flooded every year. However, this label does not mean this area cannot flood more than once every 10 years. Rather, it

designates the probability of a flood of this magnitude every year. Further away from this area is the 50-year floodplain. This area includes all of the 10-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 to the right.

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

In the past, heavy rains have caused most of Huntingdon County's flood problems. Heavy rains cause small creeks and streams to overflow their banks leading to road closures. According to the National Weather Service, Huntingdon County has received from 33 to 41 inches of mean



annual precipitation from 1961 to 1990. The heaviest precipitation occurs at the extreme southern and northern tips of the County, which receive 39 to 40.9 inches, while portions of the northern, eastern, and southern edges of the County receive between 37 and 38.9 inches of

Source: FEMA

mean annual precipitation. The majority of the County typically receives between 35 and 36.9 inches per year, and the area around Shirleysburg receives the lowest amount, with 33 to 34.9 inches of annual precipitation.

Flooding poses the biggest threat to those who reside or conduct business in the floodplain. The most significant hazard exists for floodplain-based businesses that process, use, and/or store hazardous materials. A flood could potentially allow for hazardous materials to leak from these areas. As the water recedes, it would spread the hazardous materials throughout the area. Also threatened are the agricultural areas in the floodplain. 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.

Huntingdon County is prone to two types of floods:

- <u>Riverine Flood</u> Occurs in the floodplain of a river or stream when the amount of water and the rate at which it is moving increases.
- <u>Flash Flood</u> A type of riverine flood, this flood will occur after a heavy storm, when the ground cannot absorb the high amount of precipitation. This can occur when heavy precipitation falls on frozen or already saturated soil.

#### Flooding – Juniata River Subbasin

The Susquehanna River Basin encompasses much of Pennsylvania and portions of New York in the north, and Maryland in the south. It is composed of the Main Stem Susquehanna, North Branch Susquehanna, West Branch Susquehanna, Chemung Sub-basin, and Juniata Sub-basin. The Susquehanna River Basin is one of the most flood-prone watersheds in the entire nation. The main stem of the Susquehanna and its many tributaries drain 27,510 square miles of waterway in New York, Pennsylvania, and Maryland. Since the early 1800s, the main stem of the Susquehanna has flooded



Source: Mid-Atlantic River Forecasting Center

every 20 years, on average. The Susquehanna Basin also is vulnerable to frequent, localized flash floods every year. Since flood records were first kept in 1810, the Susquehanna River Basin's most devastating floods occurred in: 1936 (St. Patrick's Day Flood); 1955 (Hurricanes Connie and Diane); 1972 (Hurricane Agnes); 1975 (Hurricane Eloise); 1996 (January flooding); and 2004 (Tropical Storm Ivan). Hurricane Agnes in 1972 caused the worst recorded flooding in the Basin. The flooding caused 72 deaths and \$2.8 billion in damage Basin-wide. Flood levels exceeded the record levels of 1936 by as much as six feet in some places.

The Juniata River Sub-basin occupies the southwestern edge of the Susquehanna River Basin. The Juniata River Sub-basin consists of Aughwick Creek, Frankstown Branch Juniata River, Kishacoquillas Creek, Little Juniata River, Raystown Branch Juniata River, Tuscarora Creek, and the Juniata River and all associated tributaries. The Juniata River encompasses approximately 3,354 square miles and is a major geographical feature of Huntingdon County. Its confluence with the Susquehanna River is located in Perry County, just north of Harrisburg.



Source: Mid-Atlantic River Forecasting Center

The Mid-Atlantic River Forecasting Center (MARFC) is located in State College, Centre County. It is an office of the National Weather Service, part of the National Oceanic and Atmospheric Administration, an agency of the U.S. Department of Commerce. MARFC maintains four river forecasting points along waterways in the Juniata Sub-basin in Huntingdon County. Two are located along the Juniata River at Huntingdon and Mapleton Depot: a third is located along the Little Juniata River at Spruce Creek; and a fourth is located along Aughwick Creek, near Shirleysburg. These forecast points gather behavioral

data to provide historical records of past behavior, and allow for the timely and accurate prediction of both flood crest and flood duration. Data collected from these forecast points provides an analysis of these waterways.

An overview of the four river forecasting points in Huntingdon County indicates that the most flood-prone areas are the Little Juniata River at Spruce Creek in the west, and Aughwick Creek at Shirleysburg in the east. The least flood-prone area is the Juniata at Mapleton Depot. The frequency of flooding at each location is the result of many factors, some of which may include precipitation amounts, geography, topography, and existing flood mitigation structures.

Huntingdon County Juniata Basin Overview										
Site	Stream	Period of Record	Years	Latitude	Longitude	Drainage Area	Flood Stage	Total Floods	Floods per Year	Return Period
Huntingdon	Juniata	10/01/1941-12/31/2005	68.25	40 29 05	78 01 09	816 sq. mi	12'	10	0.16	6.43 yrs
Mapleton Depot	Juniata	10/01/1937-12/31/2005	68.25	40 23 32	77 56 07	2,030 sq. mi	20'	6	0.09	11.38 yrs
Shirleysburg	Aughwick	01/30/1990-12/31/2005	15.92	40 16 55	77 53 27	301 sq. mi.	10'	16	1.01	1.00 yrs
Spruce Creek	Little Juniata	06/04/1938-12/31/2005	67.58	40 36 45	78 08 27	220 sq. mi.	8'	65	0.96	1.04 yrs

Source: Mid Atlantic River Forecasting Center

The National Weather Service, which maintains historical records as early as the 1800s, lists the historic crests for the Juniata at Huntingdon as 22.50 ft on 06/01/1889, 21.87 ft on 03/18/1936, 20.03 ft on 06/23/1972, 17.78 ft on 09/18/2004, and 15.95 ft on 01/19/1996. Historic crests for the Juniata at Mapleton Depot are 38.20 ft on 03/18/1936, 33.07 ft on 06/23/1972, 26.40 ft on 11/25/1950, 23.76 ft on 09/18/2004, and 22.47 ft on 01/20/1996.

Historical crests for Aughwick Creek near Shirleysburg are 19.46 ft on 01/19/1996, 18.50 ft on 09/18/2004, 15.29 ft on 11/8/1997, 15.19 ft on 11/28/1993, and 13.52 ft on 12/11/2003. Historic crests for the Little Juniata River at Spruce Creek are 19.10 ft on 03/18/1936, 16.98 ft on 06/23/1972, 15.77 ft on 11/25/1950, 15.46 ft on 09/18/2004, and 14.08 ft on

Juniata Basin Flood History, 1930-2005									
Decade	Juniata	a River	Aughwick Creek	Little Juniata					
	Huntingdon	Mapleton Depot	Shirleysburg	Spruce Creek					
1930-1939	0	0	N/A	0					
1940-1949	0	1	N/A	11					
1950-1959	1	1	N/A	15					
1960-1969	0	0	N/A	10					
1970-1979	2	2	N/A	10					
1980-1989	1	0	N/A	2					
1990-1999	4	1	8	11					
2000-2005	2	1	8	6					
Total:	10	6	16	65					

Source: Mid Atlantic River Forecasting Center

and 14.08 ft on 04/16/1993. The Mid-Atlantic River Forecasting Center's four forecasting points maintain data from 1937. This data indicates significant flooding occurred in the Juniata Basin during the periods 1950-1959, 1970-1979, and 1990-1999, with significant floods occurring in 1950, 1972, 1993, 1996, and 2004. A history of the Juniata Basin from 1937-2006 is summarized in the table above. The historical record of flooding at each site allows for a prediction of future recurrence. The table below provides a predictive analysis of the probability of exceeding the flood stage at Huntingdon, Mapleton Depot, Shirleysburg, and Spruce Creek. It is expressed as a percentage of probability by time period.

Juniata Basin Return Period Between Flood Stage Exceedence										
Site	Stream	Flood Stage	Years	Floods	Floods Per Year	Return Probability				
Huntingdon	Juniata	12'	64.3	10	0.16	6.43				
Mapleton Depot	Juniata	20'	68.3	6	0.09	11.38				
Shirleysburg	Aughwick	10'	15.3	16	1.05	0.96				
Spruce Creek	Little Juniata	8'	67.58	65	0.96	1.04				

Source: Mid Atlantic River Forecasting Center

#### Juniata River at Huntingdon

The Huntingdon forecasting point has recorded 10 floods since 1941, whereby the river crest exceeded the flood stage. This equates to an average of 0.16 floods occurring annually, with a return period of approximately once every 6.43 years. From 1990-1999, this site experienced the highest frequency of flooding over the 64-year recorded history, with four flood occurrences in 10 years. The highest were 1993 and 2004, which experienced two flood occurrences in one year. November, with three recorded floods (30%), and September, with two recorded floods (20%) were the months with the highest frequency of flooding, accounting for 50 percent of all flood events at this location over the 64-year period. With a flood stage of 12.0 feet, the Juniata at Huntingdon has experienced two minor, four moderate, and four major floods since 1941, with the highest crest reaching 20.03 feet (an 8.03foot overage).



Source: Mid-Atlantic River Forecasting Center

#### Juniata River at Mapleton Depot

The Mapleton Depot forecasting point has recorded six floods since 1937, whereby the river crest exceeded the flood stage. This equates to an average of 0.09 floods occurring annually, with a return period of approximately once every 11.38 years. From 1970-1979, this site experienced the highest frequency of flooding over the 68-year recorded history, with two flood occurrences in 10 years. No single year experienced more than one flood occurrence in a one-

year period. No single month experienced more than one flood occurrence in a one-month period. With a flood stage of 20.0 feet, the Juniata at Mapleton Depot has experienced four minor and two major floods since 1937, with the highest crest reaching 33.07 feet (a 13.07-foot overage).



Source: Mid-Atlantic River Forecasting Center

Juniata River at Mapleton Depot Categorical Floods, 1937-2004										
Minor Flood = 20.0 ft 23.99 ft Moderate Flood = 24.0 ft - 25.99 ft Major Flood = 26.0 ft or greater										
Date	Crest (ft)	Streamflow (cfs)	Date	Crest (ft)	Streamflow (cfs)	Date	Crest (ft)	Streamflow (cfs)		
12/31/1942	20.82	48,900	N/A	N/A	N/A	11/25/1950	26.4	76,800		
4/3/1970	20.76	48,700				6/23/1972	33.07	125,000		
1/20/1996	22.47	57,600								
9/18/2004	23.76	64,000								
Total: 4 Occurrences			Total: 0 Occurrences			Total: 2 Occurrences				

Source: Mid-Atlantic River Forecasting Center

#### Aughwick Creek at Shirleysburg

The Shirleysburg forecasting point has recorded 16 floods since 1990, whereby the river crest exceeded the flood stage. This equates to an average of 1.05 floods occurring annually, with a return period of approximately once every 0.96 years. From 1990-1999, this site experienced eight floods. While this period has the highest frequency of floods on record, the period from 2000-2005 also recorded eight floods. It can reasonably be ascertained that it will surpass the previous period as having the highest frequency of flooding over the 15-year recorded history. The highest single year was 2003, which experienced four flood occurrences in one year. November, with four recorded floods (25%) and



Source: Mid-Atlantic River Forecasting Center

September, with three recorded floods (19%), proved to be the months with the highest frequency of flooding, accounting for 44 percent of all flood events at this location over the 15-year period. With a flood stage of 10.0 feet, Aughwick Creek at Shirleysburg has experienced seven minor and seven moderate floods since 1990, with the highest crest reaching 19.46 feet (a 9.46-foot overage).

Aughwick Creek at Shirleysburg Categorical Floods, 1990-2004									
Minor F	lood = 10.	0 ft 11.99 ft	Moderate	e Flood = 1	2.0 ft - 19.99 ft	Majo	Major Flood = 20.0 ft or greater		
Date	Crest (ft)	Streamflow (cfs)	Date	Crest (ft)	Streamflow (cfs)	Date	Crest (ft)	Streamflow (cfs)	
10/24/1990	10.65	7,150	11/28/1993	15.19	11,500	N/A	N/A	N/A	
3/29/1993	11.83	8,210	1/19/1996	19.46	44,400				
6/27/1995	10.42	5,960	12/2/1996	12.41	9,900				
1/24/1999	11.5	7,780	11/8/1997	15.29	17,000				
1/2/2003	10.9	6,800	6/4/2003	12.6	9,980				
11/20/2003	10.68	6,500	12/11/2003	13.52	11,900				
9/9/2004	10.79	6,650	9/18/2004	18.5	Missing				
То	tal: 7 Occu	irrences	То	tal: 7 Occu	urrences		Total: 0 O	ccurrences	

Source: Mid-Atlantic River Forecasting Center

#### Little Juniata River at Spruce Creek

The Spruce Creek forecasting point has recorded 65 floods since 1938, whereby the river crest exceeded the flood stage. This equates to an average of 0.96 floods occurring annually, with a return period of approximately once every 1.04 years. From 1950-1959, this site experienced the highest frequency of flooding over the 67-year recorded history, with 15 flood occurrences in 10 years. The highest single year was 1993, which experienced five flood occurrences in one year. March, with 16 recorded floods (25%), proved to be the month with the highest frequency of flooding. With a flood stage of 8.0 feet, the Little Juniata at Spruce Creek has experienced 43 minor, 18 moderate, and four major floods since 1938, with the highest crest reaching 16.98 feet (a 8.98-foot overage).



Source: Mid-Atlantic River Forecasting Center

Little Juniata River at Spruce Creek Categorical Floods, 1938-2005								
Minor Flo	Minor Flood = 10.0 ft 11.99 ft Moderate Flood = 12.0 ft - 19.99 ft						od = 20.0 ft	or greater
Date	Crest (ft)	Streamflow (cfs)	Date	Crest (ft)	Streamflow (cfs)	Date	Crest (ft)	Streamflow (cfs)
6/8/1940	8.44	4,440	3/31/1940	10.82	7,760	11/25/1950	15.77	23,100
6/5/1941	8.22	4,220	12/30/1942	10.48	7,310	6/23/1972	16.98	28,600
12/24/1941	8.25	4,220	6/14/1951	10.68	8,040	4/16/1993	14.08	19,470
3/7/1945	8.84	4,980	3/11/1952	10.24	7,150	9/18/2004	15.46	22,400
5/18/1945	9.75	6,280	3/1/1954	11.53	9,600			
5/27/1946	9.02	5,230	10/15/1954	10.77	8,230			
6/13/1946	8.13	4,160	2/26/1961	10.14	6,980			
4/12/1948	8.41	4,500	3/10/1964	11.42	9,440			
4/14/1948	9.70	6,140	9/28/1967	11.57	9,740			
3/30/1951	8.24	4,260	2/14/1984	10.17	9,770			
1/27/1952	8.10	4,140	3/29/1993	11.29	6,060			
11/22/1952	8.19	4,260	4/1/1993	10.48	5,200			
3/24/1953	9.32	5,700	4/27/1993	11.55	6,350			
5/31/1953	8.20	4,260	11/28/1993	11.95	13,600			
3/8/1956	8.76	5,000	1/19/1996	13.00	16,000			
5/13/1956	8.86	5,130	7/19/1996	10.15	9,930			
7/2/1956	9.67	6,320	11/8/1997	10.31	10,200			
2/10/1959	8.10	4,140	9/9/2004	12.94	15,800			
10/24/1959	8.26	4,380						
3/31/1960	9.28	5,700						
5/8/1960	8.40	4,500						
4/7/1962	8.01	4,020						
3/5/1964	8.43	4,540						
2/13/1966	9.14	5,470						
3/6/1967	8.50	4,620						
7/23/1969	9.68	6,290						
4/2/1970	9.54	6,060						
2/27/1971	8.19	4,250						
10/25/1971	8.45	4,560						
3/3/1972	9.71	6,340						_
4/17/1972	8.85	5,060						
9/26/1975	8.67	5,400						
6/21/1976	8.00	7,160						
5/15/1978	8.08	6,650						
3/5/1979	8.82	7,900						
4/5/1987	9.16	7,790						_
3/25/1994	8.64	7,130						
9/7/1996	9.68	9,020						
11/8/1996	8.00	6,090						
3/26/2002	8.04	6,150						
1/2/2003	8.60	7,060						
11/19/2003	9.43	8,540						
11/29/2005	8.74	Missing						
Total:	43 Occurre	nces	Tota	I: 18 Occurrer	nces	Tota	I: 4 Occurre	nces

Source: Mid-Atlantic River Forecasting Center

## Flooding – Municipal Hazard Analysis

#### History

The National Climatic Data Center has maintained a historical record of flooding in its Storm Event Database since 1993. This database measures all weather events from 1993-2005, except June-July 1993, which is missing. While this data differs slightly from that which was obtained from the MARFC, it allows for an analysis of the impact flooding has had on the County and its municipalities in recent years. According to the Storm Event Database, Huntingdon County has experienced 54 flood events since 1993. Of these, 30 events were categorized as flash floods and were caused by a variety of factors. The most significant occurrence of flooding is due to heavy rains. A summary of the flood history of Huntingdon County since November 1993 can be found on the table below.

Huntingdon County Flooding Event History										
Location	Date	Туре	Location	Date	Туре					
Rockhill	3/28/1993	Flood/Flash Flood	Alexandria	7/7/1998	Flash Flood					
Huntingdon	4/1/1993	Flood	North Portion	7/8/1998	Flash Flood					
Huntingdon	4/16/1993	Flood/Flash Flood	Countywide	1/23/1999	Flash Flood					
Countywide	11/28/1993	Flood/Flash Flood	Huntingdon	7/28/2000	Flash Flood					
Countywide	3/23/1994	Flood/Flash Flood	Huntingdon	1/20/2001	Flood					
Spruce Creek	3/25/1994	Flood	Huntingdon	2/20/2001	Flood					
Huntingdon	8/13/1994	Flash Flood	Dudley	5/28/2002	Flash Flood					
Huntingdon	1/15/1995	Flood/Flash Flood	Spruce Creek	1/1/2003	Flood					
Countywide	1/20/1995	Flood/Flash Flood	Shirleysburg	1/2/2003	Flood					
Muddy Creek	7/10/1995	Flood/Flash Flood	Shirleysburg	6/4/2003	Flood					
Countywide	10/21/1995	Flood/Flash Flood	Spruce Creek	9/27/2003	Flash Flood					
Countywide	1/19/1996	Flood	Huntingdon	11/19/2003	Flash Flood					
Countywide	1/19/1996	Flash Flood	Countywide	11/19/2003	Flood					
Southern	6/18/1996	Flash Flood	Spruce Creek	11/19/2003	Flood					
Shirleysburg	6/20/1996	Flash Flood	Shirleysburg	11/20/2003	Flood					
Huntingdon	7/2/1996	Flash Flood	Shirleysburg	12/11/2003	Flood					
Countywide	7/19/1996	Flash Flood	Hurricane Frances	9/8/2004	Flood					
Shade Gap	9/6/1996	Flash Flood	Spruce Creek	9/9/2004	Flood					
Entire Southeast	9/13/1996	Flash Flood	Huntingdon	9/9/2004	Flood					
Mount Union	10/19/1996	Flash Flood	Shirleysburg	9/9/2004	Flood					
Countywide	12/1/1996	Flash Flood	Hurricane Ivan	9/17/2004	Flood					
Countywide	12/13/1996	Flash Flood	Spruce Creek	9/17/2004	Flood					
Huntingdon	6/18/1997	Flash Flood	Mapleton Depot	9/18/2004	Flood					
Countywide	11/7/1997	Flash Flood	Shirleysburg	9/18/2004	Flood					
Countywide	1/8/1998	Flash Flood	Huntingdon	9/18/2004	Flood					
Countywide	4/19/1998	Flash Flood	Huntingdon	3/28/2005	Flood					
Countywide	4/26/1998	Flash Flood	Huntingdon	3/28/2005	Flood					

Source: National Climatic Data Center (NCDC)

According to PEMA, four of these recorded events resulted in a declared disaster. Extensive flooding in 1996, Hurricane Floyd in September 1999, and tropical depressions Frances and Ivan in September 2004 affected Huntingdon County and resulted in a Governor's Proclamation or President's Declaration of Major Disaster.

A further examination shows that the highest number of flood occurrences in a one-month period recurs in September. Since 1993, 12 of the 54 floods have occurred during this month. January was next, with nine flood occurrences; July and November each had six occurrences.

#### Vulnerability

The following municipal summaries detail flood threats in Huntingdon County. This analysis was taken from the Federal Emergency Management Agency (FEMA) – Flood Insurance Study. Additional information was added from the United States Census Bureau.



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#### Alexandria Borough

The Borough of Alexandria, situated in Porter Township in the western portion of Huntingdon County, has a total area of 0.1 square miles, all land. As of the 2000 census, there were 401 people, 149 households, and 106 families residing in this borough. The Borough experiences approximately 39.4 inches of annual precipitation and is affected by flooding from a segment of the Frankstown Branch Juniata River adjacent to the community. This stream flows south along the northwestern boundary of the community and has a drainage area of 395.0 square miles. South of the Borough, the Frankstown Branch flows eastward toward the Juniata River. The floodplain of the Frankstown Branch includes a portion of the Borough of Alexandria.

The past history of flooding on the Frankstown Branch of the Juniata River indicates that flooding may occur during any season of the year. The two worst floods occurred in March 1936 and June 1972. The flood in March 1936, the result of spring rains and snowmelt, was the largest recorded flood on the Frankstown Branch. The flood occurring in June 1972 was associated with Tropical Storm Agnes. The peak discharges for the Frankstown Branch Juniata River in cubic feet per second (cfs) are: 17,440 cfs (10-year); 27,800 cfs (50-year); 33,400 cfs (100-year); and 49,600 cfs (500-year). The estimated discharge for the 1936 flood was 38,000 (cfs); approximately a 200-year flood, and for the 1972 flood was 25,000 cfs; approximately a 35-year flood.

The 100-year floodplain illustrated on the following page has expanded past Canal Street in Alexandria Borough, as evident by more recent flooding like that shown in the pictures below. These flooding events outside of the outdated 100-year floodplain mapping often do not carry flood insurance, and therefore go unreported.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Alexandria Borough could cause more than \$388,000 in structural damage. Of that total assessment, more than \$288,000 in damage could occur to residential structures.



Source: Huntingdon County EMA Main Street Alexandria Borough during Hurricane Ivan, 2004



Source: Huntingdon County EMA Alexandria Borough and Southside during Hurricane Ivan, 2004



#### Barree Township

Barree Township has a total area of 24.1 square miles. Of this total, 23.9 square miles is land and 0.1 square miles is water. As of the 2000 census, there were 460 people, 178 households, and 132 families residing in the Township. Lake Perez forms the source of Shaver's Creek, which flows through Barree Township.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Barree Township could cause more than \$94,000 in damages to structures. Agricultural structures within the 100-year floodplain equate to more than \$57,000 and residential structures in the 100-year floodplain equal more than \$37,000.



#### **Birmingham Borough**

Birmingham Borough has a total area of 0.1 square miles, all land. As of the 2000 census, there were 91 people, 39 households, and 24 families residing in Birmingham Borough. It is situated just beyond the floodplain of the Juniata River.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Birmingham Borough could cause more than \$51,000 in structural damages. All of the structures located within the 100-year floodplain in Birmingham Borough are residential structures.



## **Brady Township**

Brady Township is located in the east-central part of Huntingdon County, approximately seven miles southeast of Huntingdon. It is bordered by Miller Township to the northwest, Henderson Township to the west, Union Township and Mapleton Borough to the southwest, Shirley Township and Mount Union Borough to the south, Wayne Township to the southeast, Oliver Township to the east, and Menno Township to the northeast. The Township has a total area of 31.6 square miles. Of this total, 31.4 square miles of it is land and 0.2 square miles is water.

As of the 2000 census, there were 1,035 people, 376 households, and 291 families residing in Brady Township. It is affected primarily by the Juniata River, Saddler Creek, and Mill Creek. Major floods along these streams cause localized inundation of structures, primarily along the Juniata River and Saddler Creek. Flooding along the Juniata River is reduced by the dam on Raystown Branch. At Mapleton, 100-year flood levels are reduced approximately 4.8 feet.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Brady Township could cause more than \$1.6 million in structural damages. Of that \$1.6 million, more than \$1.1 million is in residential structures located within the 100-year floodplain in Brady Township.



## **Broad Top City Borough**

Broad Top City Borough has a total area of 0.6 square miles, all land. As of the 2000 census, there were 384 people, 162 households, and 117 families residing in the Borough. Broad Top City Borough is located outside the 100-year floodplain.

According to the potential loss analysis in Section 2 of the HMP, there are no structures within the 100-year floodplain of Broad top City Borough.



## **Carbon Township**

Carbon Township is located in the southwestern portion of Huntingdon County, approximately 20 miles southwest of Huntingdon. It is bordered by Hopewell Township to the northwest, Broad Top City Borough to the east, Broad Top Township to the southwest, Wood Township to the southeast, and Todd Township to the northeast. The Township has a total area of 18.6 square miles, all land. As of the 2000 census, there were 428 people, 167 households, and 120 families residing in the Township. It is affected by Shoup Run, Sugarcamp Run, Coal Bank Run, and an unnamed tributary to Shoup Run. Major floods cause localized inundation of structures along Shoup and Sugarcamp Runs.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Carbon Township could cause more than \$265,000 in structural damages. Every structure within the 100-year floodplain in Carbon Township is a residential structure.



#### Cass Township

Cass Township has a total area of 32.6 square miles, all land. As of the 2000 census, there were 1,062 people, 404 households, and 324 families residing in the Township. Little Trough Creek has a broad floodplain, but it affects only a few homes in Cass Township.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Cass Township could cause more than \$431,000 in structural damages. Every structure within the 100-year floodplain in Cass Township is a residential structure.



#### Cassville Borough

Cassville Borough has a total area of 0.6 square miles, all land. As of the 2000 census, there were 152 people, 65 households, and 46 families residing in the Borough. Limited flood data is available for Cassville Borough.

According to the potential loss analysis in Section 2 of the HMP no structures in Cassville Borough are within the 100-year floodplain.



#### **Clay Township**

Clay Township is located in the southern part of Huntingdon County. It is bordered by Wood and Todd Townships to the east, Cass Township to the north, Cromwell Township to the northeast, Springfield Township to the east, and Taylor Township to the south. The Township has a total area of 28.2 square miles, all land.

As of the 2000 census, there were 920 people, 370 households, and 283 families residing in Clay Township. It is affected by Three Springs Creek, North Spring Branch, Sideling Hill Creek, and Spring Creek. Major floods cause localized inundation of structures along Three Springs Creek and to a lesser extent, along Spring Creek, North Spring Branch, and Sideling Hill Creek.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Clay Township could cause more than \$548,000 in structural damage. More than \$500,000 of damage could occur to residential structures located within the 100-year floodplain in Clay Township.



#### **Coalmont Borough**

The Borough of Coalmont is located approximately 22 miles southwest of Huntingdon in the southwestern part of Huntingdon County. It is bordered by Carbon Township on all sides. The Borough has a total area of 0.1 square miles, all land. As of the 2000 census, there were 128 people, 50 households, and 37 families residing in the Borough.

Coalmont Borough is primarily affected by Shoup Run, Coal Bank Run, and an unnamed tributary to Shoup Run. Major floods cause localized inundation of structures along these streams. The primary hazard area along Shoup Run is upstream from the downstream corporate limits to approximately 1,500 feet upstream of State Route 913. The primary hazard area for Coal Bank Run is from its confluence with Shoup Run to approximately 660 feet upstream. The primary hazard area for the unnamed tributary to Shoup Run is from its confluence with Shoup Run to downstream of the corporate limits.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Coalmont Borough could cause more than \$484,000 in structural damages. Of that total damage assessment, more than \$300,000 could occur to residential structures located within the 100-year floodplain of Coalmont Borough.



## **Cromwell Township**

Cromwell Township is located in the southern portion of Huntingdon County. It is bordered by Cass Township to the northwest, Shirley Township to the north, Tell Township to the east, and Dublin, Springfield, and Clay Townships and Three Springs Borough to the south. The Township has a total area of 50.8 square miles, all land. As of the 2000 census, there were 1,632 people, 580 households, and 436 families residing in the Township. It is affected by Aughwick Creek, Three Springs Creek, Shade Creek, Blacklog Creek, and Jordan Run. Major floods cause localized inundation of structures along Blacklog Creek and Jordan Run. It has been ascertained that the levee along the west bank of Blacklog Creek may not protect the community from rare events, such as the 100-year flood.

The criteria used to evaluate protection against the 100-year flood are: adequate design, including freeboard; structural stability; and proper operation and maintenance. The levee along the west bank of Blacklog Creek has a maximum of 1.5 feet of freeboard for the 100-year flood from the point at which this levee crosses Water Street, approximately 270 feet upstream of S.R. 994, to a point approximately 900 feet downstream of S.R. 994. FEMA specifies that all levees must have a minimum of three feet of freeboard against 100-year flooding to be considered a safe flood protection structure. This levee does not meet FEMA guidelines.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Cromwell Township could cause more than \$1.2 million in structural damages. More than \$791,000 in damages could occur to the residential structures located within the 100-year floodplain in Cromwell Township.



#### **Dublin Township**

Dublin Township has a total area of 36.7 square miles of which 0.03 percent is water. As of the census of 2000, there were 1,280 people, 478 households, and 364 families residing in the Township. Flooding problems in Dublin Township are minimal.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Dublin Township could cause more than \$569,000 in structural damages. Of that total damage assessment, more than \$360,000 in damage could occur to residential structures.


## **Dudley Borough**

Dudley Borough has a total area of 0.4 square miles, all land. As of the 2000 census, there were 192 people, 79 households, and 54 families residing in the Borough. While along the headwaters of Shoup Run, most of Dudley Borough lies outside the floodplain.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Dudley Borough could cause more than \$187,000 in structural damages. Of that total damage assessment, more than \$140,000 in damages could occur to residential structures.



## Franklin Township

Franklin Township has a total area of 31.7 square miles, of which 31.7 is land and 0.03% is water. Spruce Creek is the major source of flood events in the Township.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Franklin Township could cause more than \$4.3 million in structural damages. Of that total damage assessment, more than \$1.7 in damages could occur to residential structures.



#### Henderson Township

Henderson Township is located in north-central Huntingdon County. It is bordered by Oneida Township and Huntingdon to the northwest, Smithfield Township to the west, Juniata Township to the southwest, Union Township to the south, Mill Creek to the southeast, Brady Township to the east, and Miller Township to the northeast. It has a total area of 26.0 square miles, of which 25.9 square miles is land and 0.3 square miles is water. As of the 2000 census, there were 972 people, 395 households, and 293 families residing in the Township.

It is principally affected by the Juniata River, Sugar Grove Run, Numer Hollow, and Murray Run. Major floods along the Juniata River cause localized inundation of structures in the area. Flooding on the Juniata River downstream of its confluence with the Raystown Branch of the river is reduced by Raystown Dam and reservoir.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Henderson Township could cause more than \$1.8 million in structural damages. Of that total damage assessment, more than \$1.7 million in damages could occur to residential structures.



## **Hopewell Township**

Hopewell Township is located in the southwestern portion of Huntingdon County, approximately 19 miles southwest of Huntingdon. It is bordered by: Huston Township to the northwest, North Woodbury Township to the west, Liberty Township to the southwest, Carbon Township to the southeast, Todd Township to the east, and Lincoln Township to the northeast. The Township has a total area of 16.6 square miles, of which15.1 square miles is land and 1.4 square miles is water. As of the 2000 census, there were 587 people, 240 households, and 180 families residing in the Township.

It is affected by Raystown Branch Juniata River, Shoup Run, and Shy Beaver Creek. Major floods cause localized inundation of structures along Shoup Run. Privately held lands that were subject to flooding by Raystown Lake recently have been acquired by the U.S. government.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Hopewell Township could cause more than \$624,000 in structural damages. Of that total damage assessment, more than \$413,000 in damages could occur to residential structures.



#### **Huntingdon Borough**

The Borough of Huntingdon, situated in a narrow valley area along the Juniata River in the ridge and valley physiographical area of central Pennsylvania, is surrounded by steep wooded slopes and contains many narrow stream valleys and gentle upland slopes. It has a total area of 3.5 square miles. As of the 2000 census, there were 6,918 people, 2,626 households, and 1,491 families residing in the Borough. The primary streams affecting the Borough include the Juniata River, Standing Stone Creek, and Muddy Run. Precipitation averages approximately 42 inches annually. The Juniata River and Standing Stone Creek are the principal sources of flood problems within the community, while Muddy Run is a minor source of flooding. The most notable past floods are those of March 1936 and June 1972. An intensive storm water management program has mitigated flooding along Muddy Run.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Huntingdon Borough could cause more than \$17.5 million in structural damages. Of that total damage assessment, more than \$10.8 million in damages could occur to residential structures.



Source: Huntingdon County EMA Huntingdon Borough Water Filtration Plant



Source: Huntingdon County EMA Stone Creek in Huntingdon Borough flooding the Aldelphia Cable building during Hurricane Ivan, 2004



Source: Huntingdon County EMA Huntingdon Borough 4<sup>th</sup> Street Bridge



Source: Huntingdon County EMA Penn Street Underpass in Huntingdon Borough during Hurricane Ivan, 2004

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# Jackson Township

Jackson Township is located in the northeastern part of Huntingdon County, approximately 14 miles northeast of Huntingdon. It is bordered by Harris Township to the north, Ferguson Township to the northwest, Barree Township to the west, Miller Township to the southwest, Menno Township to the southeast, Union Township to the southeast, Brown Township to the east, and Potter Township to the northeast. The Township has a total area of 72.5 square miles, of which 72.5 square miles is land and 0.1 square miles is water. As of the 2000 census, there were 882 people, 346 households, and 269 families residing in the Township.

It is affected by Standing Stone Creek, East Branch Standing Stone Creek, and Laurel Run. Major floods cause localized inundation of structures along Standing Stone Creek and East Branch Standing Stone Creek.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Jackson Township could cause more than \$2 million in structural damages. Of that total damage assessment, more than \$1.2 million in damages could occur to residential structures.



## Juniata Township

Juniata Township is located in west-central Huntingdon County, approximately two miles southeast of Huntingdon. It is bordered by: Smithfield Township to the north, Walker Township to the northwest, Penn Township to the southwest, Union Township to the southeast, and Henderson Township to the northeast. It has a total area of 20.1 square miles, of which 16.5 square miles is land and 3.6 square miles is water. As of the 2000 census, there were 553 people, 224 households, and 163 families residing in the Township.

It is affected by the Juniata River and Raystown Branch Juniata River. Major floods cause localized inundation of structures along the Juniata River. Flooding on the Juniata River, downstream of the confluence of the Raystown Branch of the river, is reduced by the Raystown Dam and reservoir.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Juniata Township could cause more than \$501,000 in structural damages. Of that total damage assessment, more than \$433,000 in damages could occur to residential structures.



## Lincoln Township

Lincoln Township has a total area of 21.1 square miles, of which 18.9 square miles is land and 2.2 square miles is water. Flooding from Raystown Lake is mitigated by large areas of federal land that surround the lake.

According to the potential loss analysis in Section 2 of the HMP, no structures lie within the 100year floodplain of Lincoln Township.



## Logan Township

Logan Township is located in the northwestern part of Huntingdon County, approximately six miles north of Huntingdon. It is bordered by: Franklin Township to the northwest, Spruce Creek Township to the west, Porter Township to the southwest, Oneida Township to the southeast, and West Township to the northeast. The Township has a total area of 22.8 square miles, of which 22.7 square miles is land and 0.2 square miles is water. As of the 2000 census, there were 703 people, 273 households, and 202 families residing in the Township.

It is affected by the Juniata River, Little Juniata River, and Shaver Creek. Major floods cause localized inundation of structures along Shaver's Creek, the Little Juniata River, and the Juniata River.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Logan Township could cause more than \$2 million in structural damages. Of that total damage assessment, more than \$469,000 in damages could occur to residential structures. Additionally, more than \$937,000 in damages could occur to governmental structures and more than \$506,000 in damages could occur to agricultural structures.



## Mapleton Borough

Mapleton Borough has a total area of 0.2 square land miles; 0.04 square miles is water. Portions of the Borough are impacted by the Juniata River floodplain. However, Raystown Dam has reduced flood damage there since 1972.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Mapleton Borough could cause more than \$823,000 in structural damages. Of that total damage assessment, more than \$771,000 in damages could occur to residential structures.



#### Marklesburg Borough

Marklesburg Borough has a total area of 0.9 square miles, all land. As of the 2000 census, there were 216 people, 89 households, and 63 families residing in the Borough. While no homes are affected, a small portion of the Borough is affected by the flood impoundment of Raystown Dam.

According to the potential loss analysis in Section 2 of the HMP, no structures are in Marklesburg Borough are within the 100-year floodplain.



## Mill Creek Borough

The Borough of Mill Creek is located in the east-central part of Huntingdon County, approximately six miles southeast of Huntingdon. It is bordered on the north, east, and south by Brady Township, Henderson Township is to the northwest, and Union Township is to the southwest. The Borough has a total area of 0.4 square miles, all land. As of the 2000 census, there were 351 people, 126 households, and 98 families residing in the Borough.

It is affected primarily by the Juniata River. Major floods cause localized inundation of structures along the river. Raystown Dam and Reservoir provides some flood protection, reducing the stage of the 100-year flood by approximately 4.8 feet.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Mill Creek Borough could cause more than \$729,000 in structural damages. Of that total damage assessment, more than \$620,000 in damages could occur to residential structures.



## Miller Township

Miller Township is located in the northeastern portion of Huntingdon County, approximately 10 miles northeast of Huntingdon. It is bordered by Barree Township to the northwest, Oneida Township to the west, Henderson Township to the southwest, Brady Township to the southeast, Menno Township and Mifflin County to the east, and Jackson Township to the northeast. The Township has a total area of 22.4 square miles, all land. As of the 2000 census, there were 514 people, 199 households, and 153 families residing in the Township.

It is affected by Standing Stone Creek and East Branch Standing Stone Creek. Major floods cause localized inundation of structures along Standing Stone Creek.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Miller Township could cause more than \$1.1 million in structural damages. Of that total damage assessment, more than \$631,000 in damages could occur to residential structures.



## Morris Township

Morris Township has a total area of 12.1 square miles, all land. As of the 2000 census, there were 416 people, 138 households, and 117 families residing in the Township. The Frankstown Branch of the Juniata River forms the eastern boundary of the Township.

According to the potential loss analysis in Section 2 of the HMP, no structures in Morris are within the 100-year floodplain.



## **Mount Union Borough**

The Borough of Mount Union is located in Shirley Township on the west bank of the Juniata River in east central Huntingdon County, and is situated in the Appalachian Ridge and Valley Province. The Borough has a total area of 1.2 square miles. Of this, 1.1 square miles is land and 0.04 square miles is water. As of the 2000 census, there were 2,504 people, 1,166 households, and 684 families residing in the Borough. It is primarily affected by the Juniata River and Hill Valley Creek, and averages 37 to 40 inches of annual precipitation. The Juniata River flows past the Borough, curving from an easterly to a southerly direction, and forms the northern and eastern boundaries of the Borough. Hill Valley Creek flows eastward to the Juniata River through the southern part of the Borough.

Located on the flood plain of the Juniata River, Mount Union has experienced damages to flood plain development during a number of past floods. The most notable of these occurred in 1936 and 1972. The 1972 flood, which is the maximum flood of record, had a recurrence interval on the Juniata River at Mount Union of approximately 130 years. In 1952, a flood protection levee was constructed along the Juniata River upstream from the U.S. Route 522 bridge. This levee was raised and upper end extended in 1974. It protects the areas between Filbert Street, North Washington Street, and the levee from the 100-year flood on the Juniata River. The Raystown Dam on the Raystown Branch upstream of Mount union reduces the 100-year flood elevation from the Juniata River at Mount Union by an average of 2.5 feet.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Mount Union Borough could cause more than \$665, 000 million in structural damages, all of which are residential structures.



# Oneida Township

Oneida Township is located in north central Huntingdon County, approximately one mile north of Huntingdon. It is bordered by: Barree Township on the north, Miller Township on the east, Huntingdon Borough on the south, Henderson Township on the southeast, and Logan and Porter Townships on the west. The Township has a total area of 17.6 square miles, of which 17.6 square miles is land and 0.04 square miles is water. As of the 2000 census, there were 1,129 people, 466 households, and 358 families residing in the Township.

The Township is affected by the Juniata River, Standing Stone Creek, Murray Run, and Chilcoat Run. Major floods cause localized inundation of structures along Standing Stone Creek.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Oneida Township could cause more than \$1.4 million in structural damages. Of that total damage assessment, more than \$1.1 million in damages could occur to residential structures.



# **Orbisonia Borough**

The Borough of Orbisonia is located in the southern portion of Huntingdon County. It is bordered on all sides by Cromwell Township, and has a total area of 0.1 square miles, all land. As of the 2000 census, there were 425 people, 198 households, and 109 families residing in the Borough. It is primarily affected by Blacklog Creek. While most of Orbisonia Borough is not affected by flooding due to its elevated nature, flooding can cause localized inundation of structures along Blacklog Creek. It has been ascertained that the levee along the west band of Blacklog Creek may not protect the community from rare events, such as the 100-year flood.

The criteria used to evaluate protection against the 100-year flood are: adequate design, including freeboard; structural stability; and proper orientation and maintenance. This levee has a maximum of 1.5 feet freeboard for the 100-year flood from the point at which this levee crosses Water Street, approximately 270 feet upstream of S.R. 994 (Elliot Street), to a point approximately 900 feet downstream of S.R. 994. FEMA specifies that all levees must have a minimum of three-foot freeboard to be considered a safe flood protection structure against 100-year flooding. This levee does not meet FEMA guidelines.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Orbisonia Borough could cause more than \$1.9 million in structural damages. Of that total damage assessment, more than \$1.3 million in damages could occur to residential structures.



## Penn Township

Penn Township has a total area of 34.3 square miles. While 28.2 square miles of the Township is land, the other 6.1 square miles is part of Raystown Lake.

According to the potential loss calculations, Penn Township has structures with a market value totaling more than \$36 million lying within the 100-year floodplain. A majority of the market value is residential properties within the 100-year floodplain; totaling more than \$29 million.

According to the potential loss analysis in Section 2 of the HMP, no structures in Penn are within the 100-year floodplain.


### **Petersburg Borough**

The Borough of Petersburg is located in the northwestern part of Huntingdon County, approximately six miles north of Huntingdon. It is bordered by the Township of Logan on all sides. The borough has a total area of 0.4 square miles, all land. As of the 2000 census, there were 455 people, 177 households, and 132 families residing in the borough. Petersburg is primarily affected by Shaver's Creek, which is influenced by the Juniata River. Major floods on the Juniata River cause inundation of structures along Shaver's Creek, particularly in Liverpool.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Petersburg Borough could cause more than \$557,000 in structural damages. Of that total damage assessment, more than \$535,000 in damages could occur to residential structures.



### **Porter Township**

Porter Township is located in the western portion of Huntingdon County. It is bordered by Logan Township to the northeast, Oneida to the east, Walker to the south and southeast, Catherine to the southwest, Morris to the west, and Spruce Creek to the northwest. The Township has a total area of 35.6 square miles; 35.4 square miles of it is land and 0.2 square miles is water. It has an average annual precipitation of 39.4 inches. The Township's significant concentrations of development are located adjacent to the Borough of Alexandria and at Barree. The Township is primarily affected by the Juniata River, Little Juniata River, Frankstown Branch Juniata River, Robinson Run, Emma Creek, and three small unnamed tributaries.

The Frankstown Branch Juniata River, which flows east through the Township, has a drainage area encompassing 395 square miles. The Little Juniata River, which flows southeast through the northern portion of the Township, has a total drainage area of 343 square miles. At the eastern boundary of the Township, the Frankstown Branch and Little Juniata River meet to form the Juniata River. Robinson Run, a tributary of the Frankstown Branch, and Emma Creek, a tributary of Robinson Run, flow through the southern portion of the Township. Flooding may occur during any season of the year. The two worst floods occurred in March 1936 and June 1972. Floodwaters from these two floods caused considerable damage to buildings and property in the Township. Flooding occurring on Robinson Run and Emma Creek is elevated by backwater from the Frankstown Branch Juniata River. A sudden downpour can cause flooding on Robinson Run and Emma Creek, independent of the backwater effects of the Frankstown Branch Juniata River.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Porter Township could cause more than \$7.4 million in structural damages. Of that total damage assessment, more than \$4.2 million in damages could occur to residential structures.



# **Rockhill Furnace Borough**

Rockhill Furnace Borough, located in the southern portion of Huntingdon County, is completely surrounded by Cromwell Township. The Borough has a total area of 0.3 square miles, all land. As of the 2000 census, there were 414 people, 173 households, and 119 families residing in the Borough. It is affected by Blacklog Creek and Jordan Run. Major floods cause localized inundation of structures along Blacklog Creek and Jordan Run. It has been ascertained that the levee along the west bank of Blacklog Creek may not protect the community from rare events such as the 100-year flood.

The criteria used to evaluate protection against the 100-year flood are: adequate design, including freeboard; structural stability; and proper operation and maintenance. The levee does not prevent backwater flooding for Jordan Run during a flood event. Further, along the west bank of Blacklog Creek, the levee has a maximum of 1.5 feet of freeboard for the 100-year floodplain from the point at which this levee crosses Water Street, approximately 270 feet upstream of S.R. 994, to a point approximately 900 feet downstream of S.R. 994. FEMA specifies that all levees must have a minimum of a three-foot freeboard against 100-year flooding to be considered a safe flood protection structure. This levee does not meet FEMA guidelines.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Rockhill Furnace Borough could cause more than \$4.5 million in structural damages. Of that total damage assessment, more than \$3.6 million in damages could occur to residential structures.



### Saltillo Borough

Saltillo Borough has a total area of 0.3 square miles, all land. As of the 2000 census, there were 343 people, 135 households, and 100 families residing in the Borough. Portions of the Borough are affected by Spring Creek flood events.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Saltillo Borough could cause more than \$399,000 in structural damages. Of that total damage assessment, more than \$342,000 in damages could occur to residential structures.



#### Shade Gap Borough

Shade Gap Borough has a total area of 0.1 square miles, all land. As of the 2000 census, there were 97 people, 38 households, and 25 families residing in the Borough. Shade Gap Borough is not located within the 100-year floodplain.

According to the potential loss analysis in Section 2 of the HMP, no structures in Shade Gap Borough are within the 100-year floodplain.



#### Shirleysburg Borough

Shirleysburg Borough has a total area of 0.2 square miles, all land. As of the 2000 census, there were 140 people, 61 households, and 38 families residing in the Borough. While the Aughwick Creek impacts the Borough, that portion is undeveloped and no homes are affected.

According to the potential loss analysis in Section 2 of the HMP, no structures in Shirleysburg Borough are within the 100-year floodplain.



### **Shirley Township**

Shirley Township is located in the southeastern portion of Huntingdon County, approximately 14 miles southeast of Huntingdon. It is bordered by: Wayne and Brady Townships and Mount Union Borough to the north, Lack Township to the north and east, Tell Township to the southeast, Cromwell Township to the south, Cass Township to the southwest, and Union Township to the northwest. The Township has a total area of 58.5 square miles, of which 58.2 square miles is land and 0.3 square miles is water. As of the 2000 census, there were 2,526 people, 988 households, and 728 families residing in the Township.

It is primarily affected by the Juniata River, Aughwick Creek, and Blacklog Creek. Major floods cause localized inundation of structures along the Juniata River, Aughwick Creek, and Blacklog Creek.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Shirley Township could cause more than \$3.4 million in structural damages. Of that total damage assessment, more than \$1.8 million in damages could occur to residential structures and more than \$1 million in damages to commercial structures.



Source: Huntingdon County EMA Aughwick Creek flooding in Shirley Township



### **Smithfield Township**

Smithfield Township is located in the central portion of Huntingdon County. It is bordered by the Borough of Huntingdon to the north and east, Oneida Township to the northeast, Henderson Township to the east, Juniata Township to the south, Walker Township to the southwest, and Porter Township to the northwest. The Juniata River forms the Township's northern and eastern boundaries. The Township is located in a rural setting comprised of the Juniata River Valley and surrounding wooded hills and a scattering of open farmland. The Township has a total area of 5.8 square miles, of which 5.6 square miles is land and 0.1 square miles is water. As of the 2000 census, there were 4,466 people, 601 households, and 366 families residing in the Township. The Township is primarily affected by the Juniata River, Crooked Creek, and Henderson Hollow Creek.

The 100-year floodplain along the Juniata River, upstream of the Crooked Creek confluence, is a strip of developed land that includes the village of Smithfield and is bounded by the river and step hillsides and levees. Downstream of the Crooked Creek confluence, the river floodplain consists of an extensive, primarily developed area that includes a shopping center, agricultural land, municipal sewage treatment facilities, recreation areas, and several residential, commercial, and industrial structures. The Crooked Creek 100-year floodplain consists of an extensive corridor of largely undeveloped land, but includes all types of land uses. The Henderson Hollow Creek 100-year floodplain area includes a narrow corridor of land, including some scattered residential structures.

The Juniata River and Crooked Creek are the principal sources of flooding in the township. Several other minor streams, including Henderson Hollow Creek, cause additional localized flooding. Most notable and severe were the floods of March 1936 and June 1972. These floods have a recurrence interval for this area of approximately 100 years and 60 years, respectively. Levees constructed along the Juniata River and Crooked Creek protect the community from the 100-year flood. These levees meet the FEMA specification

for a minimum of three feet freeboard against 100-year flooding. In addition, an upstream retention reservoir and pressure conduit system on Lily Creek has reduced



Source: Huntingdon County EMA Emergency retention dam along the Pennsylvania Avenue levee

the flood hazards on that waterway through the developed areas of the Township. Land use regulations control building within areas with high flooding risks.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Smithfield Township could cause more than \$14.8 million in structural damages. Of that total damage assessment, more than \$3.4 million in damages could occur to residential structures and more than \$11.1 million in damages to commercial structures.



## Springfield Township

Springfield Township has a total area of 27.9 square miles, all land. As of the 2000 census, there were 612 people, 241 households, and 180 families residing in the Township. Aughwick Creek runs through a primarily rural area.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Springfield Township could cause more than \$377,000 million in structural damages. Of that total damage assessment, more than \$107,000 in damages could occur to residential structures and more than \$269,000 in damages to agricultural structures.



### Spruce Creek Township

Spruce Creek Township, located in the northwestern part of Huntingdon County, approximately 12 miles northwest of Huntingdon, is bordered by Warriors Mark Township to the northwest, Franklin Township to the north, Logan Township to the east, Porter Township to the southeast, Morris Township to the south, and Tyrone Township to the southwest. The township has a total area of 8.2 square miles, of which 8.2 square miles is land and 0.1 square miles is water. As of the census of 2000, there were 263 people, 117 households, and 76 families residing in the Township. Major floods cause localized inundation of structures along the Little Juniata River and Spruce Creek.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Spruce Creek Township could cause more than \$2.9 million in structural damages. Of that total damage assessment, more than \$2.3 million in damages could occur to residential structures.



### Tell Township

Tell Township has a total area of 42.5 square miles, all land. As of the census of 2000, there were 648 people, 238 households, and 179 families residing in the Township. Flooding in the Township comes as a result of the Tuscaroras Creek and its tributaries.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Tell Township could cause more than \$825,000 million in structural damages. Of that total damage assessment, more than \$651,000 in damages could occur to residential structures.



### Three Springs Borough

Three Springs Borough has a total area of 1.2 square miles, all land. As of the 2000 census, there were 445 people, 200 households, and 127 families residing in the Borough. Portions of the Borough, including the municipal pool, are flooded by Spring Creek.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Three Springs Borough could cause more than \$303,000 million in structural damages. Of that total damage assessment, more than \$175,000 in damages could occur to residential structures.



# **Todd Township**

Todd Township is located in the southwestern portion of Huntingdon County, approximately 16 miles south of Huntingdon. It is bordered by Penn Township to the north, Lincoln Township to the northwest, Hopewell Township to the west, Carbon Township to the southwest, Wood Township to the south, Clay Township to the southeast, and Cass Township to the northeast. The Township has a total area of 44.8 square miles, of which 44.8 square miles is land and 0.02% is water. As of the 2000 census, there were 1,004 people, 343 households, and 270 families residing in the Township.

It is primarily affected by the Yellow Branch, Great Trough Creek, an unnamed tributary to Great Trough Creek, Sugar Creek, and several unnamed tributaries to Sugar Creek. Major floods cause localized inundation of structures along Yellow Branch and along the unnamed tributary to Great Trough Creek at the village of Todd.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Todd Township could cause more than \$426,000 million in structural damages. Of that total damage assessment, more than \$338,000 in damages could occur to residential structures.



## **Union Township**

Union Township is located in the central part of Huntingdon County, approximately seven miles southeast of Huntingdon. It is bordered by Henderson Township to the north, Juniata Township to the northwest, Penn Township to the west, Cass Township to the south, Shirley Township to the east, and Brady Township and the Boroughs of Mill Creek and Mapleton to the northeast. The Township has a total area of 39.4 square miles, of which 39.2 square miles is land and 0.2 square miles is water. As of the 2000 census, there were 1,005 people, 398 households, and 306 families residing in the Township.

It is affected by the Juniata River, Hares Valley Creek, Little Trough Creek, and Smith Run. Major floods cause localized inundation of structures along the Juniata River. Raystown Dam and reservoir provides some flood protection and reduces the 100-year flood stage on the Juniata River by approximately 4.8 feet.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Union Township could cause more than \$236,000 million in structural damages. Of that total damage assessment, more than \$115,000 in damages could occur to residential structures.



### Walker Township

Walker Township has a total area of 18.8 square miles, all land. As of the 2000 census, there were 1,747 people, 683 households, and 523 families residing in the Township. Crooked Creek runs through Walker Township.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Walker Township could cause more than \$4.6 million in structural damages. Of that total damage assessment, more than \$2.6 in damages could occur to residential structures and more than \$1.4 million in damages to agricultural structures.



### Warriors Mark Township

Warriors Mark Township is located in the northwestern part of Huntingdon County, approximately 14 miles northwest of Huntingdon. It is bordered by Snyder Township to the west, Taylor Township to the north, Half Moon and Ferguson Townships to the northeast, Franklin Township to the east, Spruce Creek Township to the southeast, Tyrone Township to the southwest, and Birmingham Borough to the southwest. The Township has a total area of 29.5 square miles, all land. As of the 2000 census, there were 1,635 people, 618 households, and 480 families residing in the Township.

It is affected by the Little Juniata River, Warriors Mark Run, and East Branch Warriors Mark Run. Major floods cause localized inundation of structures along Warriors Mark Run, East Branch Warriors Mark Run, and Little Juniata River.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Warriors Mark Township could cause more than \$2.8 million in structural damages. Of that total damage assessment, more than \$1.6 million in damages could occur to residential structures.



### West Township

West Township has a total area of 31.0 square miles, of which 31.0 square miles is land and 0.04 square miles is water. Shaver's Creek runs through West Township.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in West Township could cause more than \$883,000 in structural damages. Of that total damage assessment, more than \$712,000 in damages could occur to residential structures.



### Wood Township

Wood Township has a total area of 16.4 square miles, all land. As of the 2000 census, there were 713 people, 277 households, and 206 families residing in the Township. Trough Creek runs though Wood Township.

According to the potential loss analysis in Section 2 of the HMP, a flooding event in Wood Township could cause more than \$186,000 in structural damages. Of that total damage assessment, more than \$90,000 in damages could occur to residential structures and more than \$96,000 in damages to agricultural structures.


## **Probability**

The probability of a flooding event occurring in Huntingdon County is high, as this hazard is an annual event. Flooding is a frequent problem throughout Pennsylvania. While Huntingdon County can experiences some degree of flooding throughout the year, the threat of flooding is compounded in the late winter and early spring months, as melting snow can overflow streams, rivers, and tributaries.

## Maximum Threat

Flooding impacts can range from very low to catastrophic depending on the type and location of the flooding event. Huntingdon County has a large number of streams, lakes, and rivers that create a high vulnerability to flooding. The maximum threat to Huntingdon County lies along the floodplains of the Juniata River, which flows into Raystown Lake.

According to the estimated potential loss analysis completed in Section 2 of this plan, 17 Huntingdon County municipalities have more than \$1 million worth of structure market value located



Source: Huntingdon County EMA Hurricane Francis. 2004

within the floodplain. Of those, 14 municipalities have more than \$1 million worth of residential structure market value located within the floodplain. Huntingdon Borough and Smithfield Township have the greatest total structure market value situated within the floodplain, at approximately \$17.6 million and \$14.9 million respectively. Both of these municipalities are affected by flooding of the Juniata River.

The potential for loss of life and injuries to occur in these areas may be high at times of flooding. Additionally, the long-term impact severe flooding could have to the health and safety of citizens is high. Depending on the scope and magnitude of the flooding event, the likelihood of longterm economic disruption is possible. Flooding may have a moderate to high impact on property, facilities, and infrastructure, with varying levels of damage to structures in the affected areas. Mobile homes are especially threatened. Government operations are expected to continue without disruption. The environmental impact should be minimal, unless hazardous materials are released as a result of flooding.

## Secondary Effects

Power failures are the most common secondary effect associated with flooding. Coupled with a shortage of critical services and supplies, power failures can cause a public health emergency.

Disruption in traffic flow may cause a transportation accident. Flooding also has the potential to cause other hazards, such as landslides, hazardous material spills, and dam failures.

Industrial, commercial, and public infrastructure facilities can become inundated with flood waters that also threaten the continuity of government. The special needs population, which is often homebased, must be tracked and identified in flooding situations.

Severe flooding can have long-term secondary effects on the population, economy, and infrastructure of Huntingdon County. Escalating costs of damages to private structures and the frequency of flooding can cause permanent population displacement. Small



Source: Huntingdon County EMA Hurricane Ivan, 2004

businesses that contribute to the local economy may close if they are unable to recover from the disaster. Disruption to commerce and/or transportation modes can have an adverse effect on municipal economies in affected areas. Critical infrastructure, such as sewage and water treatment facilities, can be irreparably damaged.