

## Priority Issue 4



### Flooding – the primary threat to life, properties, and communities throughout Lycoming County

**Back Story** Floods are the most common and costly natural catastrophe in the United States. Nationwide, hundreds of floods occur each year, making it one of the most ubiquitous hazards in all 50 states and U.S. territories. According to Munich Re, a global reinsurance firm, the frequency and severity of flooding has become alarming. During 2016, the U.S. experienced a total of 19 separate floods, the most in one single year since records began in 1980. To understand this phenomena, NOAA offers the following: “Perhaps this should not be unexpected, as heavy rainfall events and the ensuing flood risks are increasing due to the fact that (climate change) warming loads the atmosphere with more water vapor; which, over time, increases the potential for extreme rainfall events, which we have experienced more of in recent years.”<sup>16</sup>

In Pennsylvania, flooding can occur during any season of the year from a variety of sources. Every two to three years, serious flooding occurs along one or more of Pennsylvania's major rivers or streams, and it is not unusual for a flood disaster to occur several years in succession. Most injuries and deaths from flooding happen when people are swept away by flood currents and most property damage results from inundation by sediment-filled water.

Since flooding generally occurs in the floodplains adjacent to waterways, there is a correlation between the number of waterway miles and the amount of land that is vulnerable to flooding. It is worth noting that Pennsylvania has more stream miles than any other state, and many of its communities are located in floodplains. For waterfront communities, the level of risk constantly changes in response to unpredictable weather patterns and seasonal influences.

Beyond the climatic changes discussed above, there are at least three additional factors that determine the severity of floods. Each of these three factors can increase the volume of surface runoff and stormwater:

*Flooding is the costliest and most common [natural disaster](#) in the US, claiming lives, inflicting financial losses on households and businesses, and straining the government agencies that provide flood response and relief. From 1980 to 2013, flooding cost Americans more than \$260 billion in damage; from 2006 to 2015, federal flood insurance claims averaged [\\$1.9 billion annually](#). The pattern continued in 2016 with the federal government declaring 36 disasters involving floods or hurricanes.*

PEW Charitable Trust, 1 Feb 2017

<sup>16</sup> NCA, 2014

Rainfall intensity and duration— A large amount of rainfall over a short time span can result in flash flood conditions. A small amount of rain can also result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces.

Topography— Water runoff is greater in areas with steep slopes

Ground cover— Water runoff is also greater in areas with little or no vegetative ground cover—this is especially problematic for urban areas where asphalt and concrete are ubiquitous

### **Priority Issue Overview**

Lycoming County has in excess of 2,200 miles of river, streams, and creeks; this figure establishes Lycoming as having one of the highest amounts of waterways for a county in Pennsylvania. Major flood-prone areas include communities located in low-lying valleys of creeks, streams and tributaries. Unless protected by a levee, most population concentrations along the West Branch Susquehanna River have a high possibility of flooding. Unfortunately, this vulnerability is ever-present throughout the year.

In Lycoming County, there are seasonal differences in the causes of flooding. In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snowpack throughout contributing watersheds. Winter floods also have resulted from runoff of intense rainfall on frozen ground, and local flooding has been exacerbated by ice jams in rivers, streams, and creeks. The January 1996 flood was particularly devastating for Lycoming County in terms of loss of life, property and public infrastructure. Damages sustained exceeded \$100 million. Six lives were lost in the Lycoming Creek valley.



*Flooding aftermath along Lycoming Creek Road in January 1996*  
*Source: PCD*

Summer floods have occurred from intense rainfall on previously saturated soils. Summer thunderstorms that deposited large quantities of rainfall over a short period of time have also produced flash flooding. Hurricane Agnes (June 1972) devastated nearly every floodplain community in the County. In addition, Lycoming County has also experienced intense rainfalls from tropical storms in late summer and early fall. Tropical Storm Ivan (September 2004) and Tropical Storm Lee (September 2011) ravaged central and eastern Lycoming County.

Since 1955, Lycoming County has been a named entity in several Presidential Disaster Declarations. The financial impact from these events is staggering. The cumulative amount of estimated loss within Lycoming County associated with past flood events is in excess of \$100 million<sup>17</sup>. From Tropical Storm Lee, alone, 955 housing units sustained actual damage—836 of them (87.5%) are classified as owner occupied.

<sup>17</sup> NCDC May 2014.

A summary of flood events that have occurred in Lycoming County since the adoption of the 2006 Comprehensive Plan includes:

Location	Date	Flood Type
Muncy Creek Township	8/29/2006	Flash Flood
Muncy Creek Township	11/16/2006	Flash Flood
Muncy Borough	11/16/2006	Flash Flood
Cedar Run	3/5/2008	Flood
Jersey Shore Borough	7/23/2009	Flash Flood
Clarkstown	7/31/2009	Flash Flood
County-wide	1/25/2010	Flood
Jersey Shore	12/1/2010	Flood
Garden View	3/6/2011	Flood
Quiggleville	3/10/2011	Flood
Muncy Borough	3/11/2011	Flood
Muncy Borough	4/28/2011	Flood
Central/Eastern Areas	9/7/2011	Flood
Montgomery	9/28/2011	Flash Flood
Garden View	7/28/2012	Flash Flood
Cantral/Watsontown	10/21/2016	Flash Flood



*Newspaper article depicting children using a raft from debris following the 1889 flood  
 Source: Williamsport Sun Gazette*

**Table X: Summary of Flood Events since the Adoption of the 2006 Countywide Comprehensive Plan**

**Source:** [Lycoming County 2015 Hazard Mitigation Plan](#)

Total property and infrastructure damage attributed to these events exceeded: \$30 Million.

An analysis of historic trends shows that Lycoming County is expected to experience at least one flooding event per year. However, future development may affect the flood likelihood and intensity. For example, development often induces an increase in impervious surfaces, which can intensify and increase flooding events.

What’s at risk?

As documented in the County’s 2015 Hazard Mitigation Plan, Lycoming County had over 5,500 structures located in the Special Flood Hazard Areas (aka regulatory floodplain areas or SFHA) with varying degrees of vulnerability for each structure. As a result of the County’s recent efforts to delineate the floodplain boundaries more accurately, the County has reduced the number of addressed structures to 4,188 (over 9% of all addressed structures in the county). Salladasburg Borough has the highest proportion of structures in the floodplain at over 75% of all structures vulnerable to flooding. Jersey Shore and Muncy Borough also have high percentage of structures in the SFHA. All critical

# OF ADDRESSED STRUCTURES IN COUNTY’S SFHA	# NFIP POLICIES	% POLICIES COMPARED TO # OF STRUCTURES IN SFHA
4,188	2405	57.4%

**Figure X: Addressed Structures in the SFHA**  
**Source:** [Lycoming County 2015 Hazard Mitigation Plan](#)

facilities in Shrewsbury Township are located in the SFHA. When looking at vulnerable structures by property type, the vast majority those structures are residential in nature. Over 3,045 of these 4,188 structures (or 73%) are residential dwellings.



*The flooding in Montoursville along Loyalsock Creek in Sept 2011 damaged businesses and destroyed LVRR's Railroad Bridge*  
Source: PCD

A particularly vulnerable type of structure in the County's floodplain areas includes mobile homes and commercial trailers, due to their lightweight and unanchored design. Each municipality's Floodplain Management Ordinance requires that manufactured homes be elevated and anchored to withstand flotation, collapse, and/or lateral movement. Nearly 17% of the mobile homes across the county are located in the SFHA.

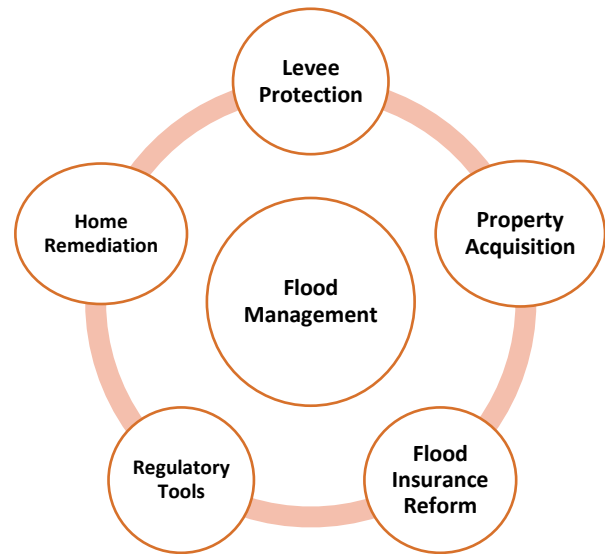
### **Lycoming County's Flood Risk Management Approach**

As regional floods increase in frequency and intensity, it is important for Lycoming County to undergo a proactive approach rather than remaining reactive in response to large flood disasters. As noted by author Don Watson in his book *Design for Flooding*, "the total average precipitation across the United States has increased on average over 5% over the past century...the amount of precipitation falling in the heaviest 1% of rain events has increased on average over 20%." Flooding in Lycoming County can be observed for a number of reasons: seasonal floods, particularly during the winter months cause the ground to freeze, which limits water filtration and adds to surface runoff. At any given time, the County is prone to flash floods, ice-jam floods, landslides, and mudslides.

The county is also affected by the residual effects of coastal storms. Located near the Mid-Atlantic Coast, the county's tributaries are directly tied to two of the largest U.S. estuaries: Delaware Bay and Chesapeake Bay. As cyclones, hurricanes, and tornadoes emerge off the coast, the County may experience high winds, heavy rain, flooding, high velocity flows, and storm-surges. Any area exhibiting these effects will most likely be in either the 500 or 100-year mapped floodplain. We can consider the floodplain as the flat area adjacent to a stream channel that is subject to inundation and flows in large events. After floodwaters recede, water may remain in floodplains and slowly infiltrate reducing the amount of water sent downstream.<sup>18</sup>

<sup>18</sup> Watson, Donald. 2011. John Wiley & Sons, Inc. *Design for Flooding*. Pgs. 54-58.

Lycoming County’s flood management response to this reoccurring hazard hinges upon five interrelated measures, as illustrated by Figure 1. In addition to these five mitigation measures, the County also operates a state-of-the-art flood warning system which, together with USGS, provides a vast system of stream/river level gauges that offers the maximum possible degree of warning to citizens and business owners located along the county’s water ways. The objective of this flood warning system is to save lives and enable transportable property to be moved out of harm’s way thus reducing the devastating impact of inevitable floods. Maintenance and operation of this system of gages and the public web site (Flood Ready) is skillfully managed by the County’s Department of Public Safety.



**Figure X: Floodplain Management Strategies**  
**Source: Lycoming County’s Floodplain Housing Remediation Program**

Nonstructural and Structural Flood Protection

There are many ways that planners and governments can seek to curb the effects of severe flooding. Such techniques should be considered in two categories: nonstructural and structural mitigation measures. A nonstructural mitigation activity is one that reduces flood risk but does not obstruct the floodplain within its existing environment. Nonstructural measures can be both physical (buyouts, relocation, elevation, wet-flood proofing) and nonphysical (floodplain mapping, flood warning systems, evacuation and preparedness plans, and land-use regulations). It is important to note that nonphysical nonstructural methods can be incredibly effective in raising public awareness and advising the public on reducing the consequences of flood disaster events. These risk communications allow planners to develop educational tools and hold workshops to inform municipal leaders and floodplain occupants<sup>19</sup>.

The second form of mitigation that should be considered is structural floodplain remediation. Structural mitigation is any action that physically changes the velocity of flow and depth of floodwaters in any given floodplain. These more traditional actions have taken shape in the form of reservoirs, dikes, levees, and parks.

Accordingly, government officials should view flood risk management as utilizing a combination of both structural and nonstructural measures. Each of these measures has their benefits and drawbacks. Structural mitigation activities have the added benefit of removing the threat of flooding altogether from the floodplain, but also must meet strict benefit-cost criteria to become eligible for grants. Structural projects such as a levee are generally going to be accompanied with a hefty price tag, which makes grants increasingly competitive and difficult to secure for smaller communities.

As FEMA’s flood damage reduction training document points out:

<sup>19</sup> For more information please see the ASFPM Nonstructural Flood Proofing Pamphlet at [floods.org](http://floods.org)

“Flood modification (structural) measures acting alone leave a residual flood loss potential within the remaining floodplain and add the risk of rare but potentially devastating damages from structural failure or from uncontrolled flows of major storms. Unless accompanied by appropriate nonstructural measures, the structural measures could lead to a false sense of security and encourage floodplain landowners to develop inappropriate uses of their lands.”<sup>20</sup>

In order to prevent and reduce economic losses, threats to public health and safety, and to preserve the natural functions of floodplain, the County has structured its floodplain management approach to be as inclusive as possible. Relying solely on one flood management strategy is inefficient when attempting to reach the whole community. It is the mission of the County Planning Department’s Hazard Mitigation Division to understand and meet the actual needs of those community members affected by flooding and related hazards, to engage and empower all parts of the community, and to strengthen what works within in these communities on a daily basis.

The following sections provide an in-depth look at the five flood management approaches considered for this plan update:

#### **Structural Levee Protection**

The flood protection system in Lycoming County includes a series of levees which protect the City of Williamsport, South Williamsport Borough, as well as sections of Loyalsock Township and Old Lycoming Township. The major portion of the levee lies along the West Branch Susquehanna River and protects Williamsport, South Williamsport and the Faxon area of Loyalsock Township. It was authorized after the 1936 flood and completed in the 1955-1956 time frame by the US Army Corps of Engineers (USACE) in partnership with the local municipalities. Included in the original levee system were a set of tie-back structures along Lycoming Creek to protect the western side of the City as well as the southern floodplain areas of Old Lycoming Township. The system includes a series of earthen levees, flood walls, pump stations discharge facilities. Following Tropical Storm Agnes in 1972, the Bull Run Levee was constructed by the USACE to protect the area of Loyalsock east of Faxon, known as the Golden Strip.

The Bull Run Levee was built in conjunction with the design and construction of Interstate 180 through that area. The current levee system measures approximately 20 miles in length. In today’s dollars, the estimated construction cost for a system of this size would be around \$150 Million, not including land acquisition and relocation of utilities. If this system were constructed by the USACE today, the local share would be more that \$50 million.

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<sup>20</sup> FEMA Training Document Chapter 7 Flood Damage Reduction Strategies and Tools, <https://training.fema.gov>

The levee protects 40% of the \$2.7 billion in real estate in City of Williamsport, Old Lycoming Township, South Williamsport and Loyalsock Township, as determined by the 2004 County Assessment data. Borough, City and County governments are located in the protected floodplains as well as commercial and industrial areas. Maintaining the existing economic well-being of the County is dependent on preventing the West Branch Susquehanna River from causing potentially catastrophic damage. To avoid this situation the integrity and functioning of the Levee must be regularly inspected, maintained and periodically recertified.

The Non-Federal Sponsors, (the City of Williamsport, South Williamsport, and Loyalsock Township) must meet certification rules set forth by the Federal Emergency Management Agency (FEMA). There are also issues identified by USACE during regularly scheduled inspection that must be addressed. While annual maintenance has been satisfactorily performed, the



*A view from the Susquehanna Riverwalk showing the Williamsport Levee protecting downtown infrastructure*

*Source: PCD*

required levee recertification looms as a significant fiscal burden. The recertification of the levee system is estimated to cost between \$12-15 million. Should the levee become decertified, the implications for the area would be devastating. A non-accredited levee though FEMA would impact property owners in two ways: building requirements for future structures and mandatory purchase of flood insurance for existing structures. <sup>iv</sup>

Municipalities that are members of the Greater Williamsport Area (or GWA) have identified the recertification of the 20-mile long levee system as their single greatest threat to maintaining and pursuing economic resilience. Several of the County's top employers are located within the Williamsport metro area including UMPC Susquehanna, Pennsylvania College of Technology, Lycoming College, Williamsport Area School District, Aramark Facility Services, and Lycoming County government. In addition, according to the American Community Survey, the GWA contains approximately 45% of the County's total workforce as of 2015.

As factually illustrated by the four tables that follow, the impact of not completing the recertification process is staggering:

	City of Williamsport					
	All Properties		Levee Protected Area			
Occupant	Total number of properties	Total assessed value	Number of properties protected by levee system	Percent protected by levee system	Total assessed value behind levee system	Percent tax base protected by levee system
Apartments	321	\$78,179,620.00	249	77.6%	\$57,496,720.00	73.5%
Commercial	899	\$239,860,330.00	762	84.8%	\$204,940,150.00	85.4%
Industrial	74	\$68,681,210.00	61	82.4%	\$55,751,310.00	81.2%
Institutional/Other	426	\$403,998,790.00	334	78.4%	\$264,697,650.00	65.5%
Total Residential	7,762	\$577,329,740.00	3,287	42.3%	\$188,655,810.00	32.7%
Owner Occupied Residential	4,412	\$381,464,570.00	1,459	33.1%	\$94,473,720.00	24.8%
Other Residential	3,350	\$195,865,170.00	1,828	54.6%	\$94,182,090.00	48.1%
<b>TOTAL</b>	<b>9,482</b>	<b>\$1,368,049,690.00</b>	<b>4,693</b>	<b>49.5%</b>	<b>\$771,541,640.00</b>	<b>56.4%</b>

Table X: Total Assets Protected by the Levee in the City of Williamsport  
Source: PCD

	Borough of South Williamsport					
	All Properties		Levee Protected Area			
Occupant	Total number of properties	Total assessed value	Number of properties protected by levee system	Percent protected by levee system	Total assessed value behind levee system	Percent tax base protected by levee system
Apartments	27	\$8,830,030.00	14	51.9%	\$4,118,810.00	46.6%
Commercial	129	\$26,920,910.00	92	71.3%	\$14,722,170.00	54.7%
Industrial	18	\$6,690,990.00	14	77.8%	\$5,921,040.00	88.5%
Institutional/Other	64	\$33,354,510.00	36	56.3%	\$5,650,020.00	16.9%
Total Residential	2,361	\$208,127,870.00	543	23.0%	\$41,182,570.00	19.8%
Owner Occupied Residential	1,539	\$144,099,050.00	289	18.8%	\$22,743,070.00	15.8%
Other Residential	822	\$64,028,820.00	254	30.9%	\$18,439,500.00	28.8%
<b>TOTAL</b>	<b>2,599</b>	<b>283,924,310</b>	<b>699</b>	<b>26.9%</b>	<b>\$71,594,610.00</b>	<b>25.2%</b>

Table X: Total Assets Protected by the Levee in the Borough of South Williamsport  
Source: PCD



	Township of Old Lycoming					
	All Properties		Levee Protected Area			
	Total number of properties	Total assessed value	Number of properties protected by levee system	Percent protected by levee system	Total assessed value behind levee system	Percent tax base protected by levee system
<b>Occupant</b>						
Apartments	18	\$6,691,530.00	5	27.8%	\$1,814,350.00	27.1%
Commercial	100	\$27,201,300.00	54	54.0%	\$18,200,480.00	66.9%
Industrial	15	\$6,439,210.00	2	13.3%	\$1,189,350.00	18.5%
Institutional/Other	148	\$12,585,280.00	18	12.2%	\$3,981,240.00	31.6%
Total Residential	2,077	\$212,920,480.00	113	5.4%	\$7,533,270.00	3.5%
Owner Occupied Residential	1,544	\$174,556,130.00	56	3.6%	\$4,163,760.00	2.4%
Other Residential	533	\$38,364,350.00	57	10.7%	\$3,369,510.00	8.8%
<b>TOTAL</b>	<b>2,358</b>	<b>\$265,837,800.00</b>	<b>192</b>	<b>8.1%</b>	<b>\$32,718,690.00</b>	<b>12.3%</b>

Table X: Total Assets Protected by the Levee in the Township of Old Lycoming  
Source: PCD

	Township of Loyalsock					
	All Properties		Levee Protected Area			
	Total number of properties	Total assessed value	Number of properties protected by levee system	Percent protected by levee system	Total assessed value behind levee system	Percent tax base protected by levee system
<b>Occupant</b>						
Apartments	30	\$32,574,330.00	6	20.0%	\$1,428,630.00	4.4%
Commercial	246	\$146,879,150.00	128	52.0%	\$99,347,860.00	67.6%
Industrial	16	\$9,358,010.00	7	43.8%	\$6,574,670.00	70.3%
Institutional/Other	99	\$68,476,140.00	12	12.1%	\$879,160.00	1.3%
Total Residential	4,181	\$570,337,130.00	488	11.7%	\$55,109,780.00	9.7%
Owner Occupied Residential	3,079	\$462,569,210.00	354	11.5%	\$42,154,690.00	9.1%
Other Residential	1,102	\$107,767,920.00	134	12.2%	\$12,955,090.00	12.0%
<b>TOTAL</b>	<b>4,572</b>	<b>\$827,624,760.00</b>	<b>641</b>	<b>14.0%</b>	<b>\$163,340,100.00</b>	<b>19.7%</b>

Table X: Total Assets Protected by the Levee in the Township of Loyalsock  
Source: PCD

The table below shows the indirect economic loss depending on the percent of damage and the years it takes for local businesses to recover after a major disaster. The numbers below are the result of the estimated market values plugged into a formula by World Bank Finance and Markets Global Practice Group.

<b>Indirect Economic Losses From a Levee Breach</b>					
		<b>Percent of Damage</b>			
		<b>10% Damage</b>	<b>25% Damage</b>	<b>50% Damage</b>	<b>100% Damage</b>
<b>Total indirect (output) economic losses</b>	<b>Damage Amount</b>	<b>\$53,576,683.79</b>	<b>\$133,941,709.49</b>	<b>\$267,883,418.97</b>	<b>\$535,766,837.94</b>
	1 Year Recovery	\$7,031,939.75	\$17,579,849.37	\$35,159,698.74	\$70,319,397.48
	2 Year Recovery	\$14,063,879.50	\$35,159,698.74	\$70,319,397.48	\$140,638,794.96
	3 Year Recovery	\$21,095,819.24	\$52,739,548.11	\$105,479,096.22	\$210,958,192.44
	4 Year Recovery	\$28,127,758.99	\$70,319,397.48	\$140,638,794.96	\$281,277,589.92
	5 Year Recovery	\$35,159,698.74	\$87,899,246.85	\$175,798,493.70	\$351,596,987.40

*Table X: Indirect Economic Losses From a Levee Breach*  
 Source: PCD

Over the past several decades, the Boroughs of Jersey Shore, Muncy, and Montoursville have each explored the potential of securing a levee to protect the flood plain areas of their respective municipalities. All three of these municipalities have a common challenge—local creek flooding compounded by river flooding when both waterways rise concurrently. For any flood mitigation project, the USACE considers the value of structures flooded, damages sustained, as well as the frequency of those events occurring. Given these three factors, USACE computes a ratio of the economic benefits gained by a levee to the cost of design and construction. The ratio must be greater than 1.0. None of these three municipalities have been able to meet this requirement.

**Property Acquisition**

Historically, flood mitigation assistance has generally been related to a declared disaster event, which, in turn, dictates the geographic areas that may be eligible for any mitigation funding. FEMA’s hazard mitigation grant program (HMGP) grants have been exclusively limited to the acquisition of severe repetitively-flooded residential structures. Over the past twenty years, Lycoming County’s Planning Department has successively secured numerous HMGP grants. Together with matching state and local funds, these FEMA grants—totaling in excess of \$18M—have enabled the County to acquire close to 300 of severe repetitively-flooded homes and removed them from the floodplain. The majority of these acquisitions lie along three major creeks: Lycoming, Loyalsock, and Muncy.



*An aerial view of Lycoming Township showing the devastation inflicted by the Jan 1996 Flood on this community by Lycoming Creek*  
 Source: PCD

As required by FEMA, the County’s Hazard Mitigation Planner follows the below process:

- Home acquisition is strictly voluntary
- County purchases the property at appraised value for pre-flood condition
- Purchase price is reduced by an amount equal to any previous FEMA assistance given to the owner(s)
- County arranges for removal/demolition of the structure
- Ownership of the land parcel reverts back to the governing municipality
- Land itself must be permanently retained as open space

The following diagram depicts the buyout process:



**Figure X:** Buyout Process Diagram

**Source:** PCD

While this approach does reduce the municipal tax base, this process has successfully removed flood-prone properties which are often of decreased value, distressed or blighted and have been prone to repeated damage by future flood events. There are two challenges to the acquisition/demolition process: it is extremely lengthy and can require up to two years to complete -- and the funding is only available after a disaster has occurred and in relatively small amounts.

### **Flood Insurance Reform**

The need for a flood insurance policy is triggered by the location of a property in proximity to a body of water. If the property is situated within the regulatory floodplain (aka 100-year floodplain) then flood insurance is generally required by the mortgage or lending institutions. There are three inherent challenges to the flood insurance discussion and each should be carefully addressed since millions of dollars in insurance policy premiums are at stake. Moreover, Biggert-Waters 2012 legislation has created a revised cost sharing plan for flood insurance in which home owners will be covering a greater share of the true cost of an NFIP policy's premium over the next 15-20 years.

#### *Flood Insurance Reform Challenge #1—Getting the Maps Right.*

In 1968, Congress formed the National Flood Insurance Program (NFIP) to address some of the shortcomings of the traditional means of dealing with the growing flood insurance problem facing America. The aim of the NFIP was to transfer the cost of the program to those who benefited, cover those who had damage in smaller

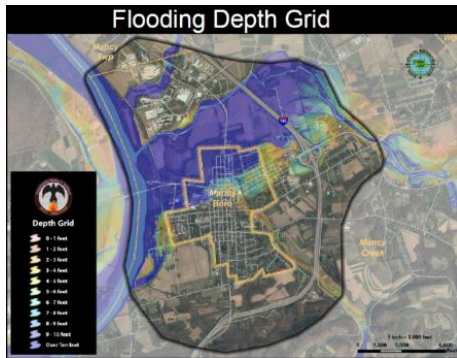


Figure X: Flooding Depth Grid  
Source: PCD

flooding events, discourage development in the hazard areas, and provide a means of requiring new construction to minimize future damage. This would be accomplished by mapping the flood hazard areas, and requiring municipalities to enact minimum floodplain ordinances to participate in subsidized insurance.

This initiative did not gain momentum until after Tropical Storm Agnes in 1972. As a result of the extensive damage and cost of recovery, Congress required banks offering federally backed mortgages to require flood insurance. The NFIP objective is to reduce the impact of flooding on private and public structures. It does so by providing affordable

insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations.

These regulations would be defined in municipal ordinances and would be based on mapping of the flood hazard areas. FEMA embarked on nationwide flood mapping. Flood Insurance Rate Maps (FIRMS) are the official maps used by NFIP, insurance companies, lending institutions and municipalities when determining flood risks for property owners.

The maps are based on Flood Insurance Studies (FIS) which determine the flood potential at any location in the mapped area. FIS are conducted for municipalities under the supervision of FEMA. The actual studies are done by the United States Geological Survey (USGS), the Army Corps of Engineers, and engineering firms subcontracting to FEMA. Originally, flood maps were produced on a municipal by municipal basis. This method contributed to errors within a watershed between municipalities if different datum or scale was utilized in the study.

With the advent of digital geographic information systems, FEMA began producing Digital Flood Rate Maps (DFIRM) on a county wide basis. The first phase of this program, called Flood Map Modernization, operated from 2003 to 2008, and a subsequent phase, called Risk Mapping Assessment and Planning (Risk MAP) commenced in 2009.

The central issue for Lycoming County involves the accuracy of the DFIRMs for any given municipality. If local survey data and accurate GIS information conflict with a DFIRM map representation, then the County can retain a registered Surveyor/Engineer to prepare a letter of map amendment (LOMA) request as eligible for approved County grant funding guidelines. If FEMA accepts the proposed adjustment, then revised maps can be issued. This entire process can be time-consuming and expensive, so the County has to carefully consider which challenges to pursue.

#### *Flood Insurance Reform Challenge #2—Base Flood Elevation Matters*

Maps that show only floodplain boundaries have the disadvantage of implying that every building in a designated flood zone may flood and that every building outside the zone is safe. Providing floodplain residents with the elevation of structures relative to the expected height of a number of floods offers a better way to

define graduated risk (from low risk to high risk). Where the necessary data is available (e.g., structure elevation, base flood elevations, flood protection structure performance), a geographic information system could be used to personalize flood risk to individual addresses.<sup>21</sup>

The base flood elevation (or BFE) at a structure together with the topography of the property provides a more accurate estimated measurement of water depth, if and when flooding should occur. The height of the lowest enclosed space (basement) must be 18 inches above BFE. If NFIP insurance rates considered both the horizontal location of a property relative to floodplain boundaries and the BFE or water depth relative to the structure, then a more accurate assessment of risk could be determined. Simply stated, the flood insurance premium could consider a graduated level of risk (and graduated cost) based upon the actual BFE at the property site.

Another missing factor in the risk equation is the frequency of flooding experienced by a structure. Structures in a flood fringe area may have actually experienced flooding at greatly different intervals yet are still classified the same for NFIP insurance premium determination. Again, premium costs could reflect this factor.

*Flood Insurance Reform Challenge #3—We're in this together*

There is an argument to be made that every structure in the US is, in fact, vulnerable to one form of natural disaster or another—flooding, wind damage, tornado, earthquake, wild fire, blizzard-related damage, etc. If a national “hazard insurance” requirement was instituted that would cover every property in the nation, then the insurance pool size would dwarf the number of policy holder of NFIP insurance. Due to the enormity of this hazard insurance pool the cost increase for adding such a provision to any particular policy would be de Minimis.

**Regulatory Tools**

In order to gain access to the affordable, federally subsidized insurance available through the NFIP, individual municipalities needed to enact ordinances which met the NFIP requirements. Motivated by this entrance requirement, communities began to strengthen floodplain management by reviewing current codes and ordinances and by strongly enforcing their floodplain codes on new development to avoid aggravating further flooding. These preventive activities keep problems from getting worse. These activities have been outlined in the County’s 2010 Hazard Mitigation Plan and its 2015 Update.

The use and development of the floodplain and its contributing watershed are limited through planning, land acquisition, or regulation. These activities are usually administered by building, zoning, planning, and/or code enforcement officials. Since every community is downstream of another, it is imperative to understand the impact of land management decisions on both the local area as well as neighboring lands downstream. In Lycoming County, significant residential growth in the outlying rural townships has the potential to increase the likelihood for flash flooding if floodplain development and stormwater management are not properly regulated.

One of the most significant tools to reducing the potential of flooding is the County’s stormwater management plan. Impervious surfaces created by development, such as parking lots, roads, and roofs, can substantially

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<sup>21</sup> David R. Maidment, Ph.D., Chair, Committee on Floodplain Mapping Technologies and Chair, Committee on FEMA Flood Maps, National Research Council, The National Academies

increase runoff within a watershed. Lycoming County has developed a Stormwater Management Plan that sets the stage for municipal stormwater ordinances for designated watersheds. The plan evaluates existing drainage problems within the basin, considers potential impacts of flood control projects and land development regulations upon the hydrologic system, and makes recommendations for minimizing accelerated runoff. Each municipality can implement this plan via a stormwater ordinance. Additional initiatives for municipal officials to consider include:

- Assess the capacity of drainage culverts, pump stations, etc. to handle current stormwater needs and to accommodate future growth and development in their municipalities
- Specify limits on development and encroachment within mapped floodplains (land use density, intensity, elevations, location), including areas of shallow flooding and alluvial soils
- Establish policies and standards for dealing with and minimizing land use and floodplain conflicts
- Retain and preserve floodplains for open-space and recreation where undeveloped
- Prohibit incompatible floodway uses and specify low-density allowable uses within floodway fringe area
- Adopt flood hazard zoning including: conservation open space zoning of floodways, reduced densities in floodplain areas, riparian buffers, design standards that limit lot coverage and impervious surfaces and “no basement zones”
- Enact floodplain management standards as part of the subdivision ordinance

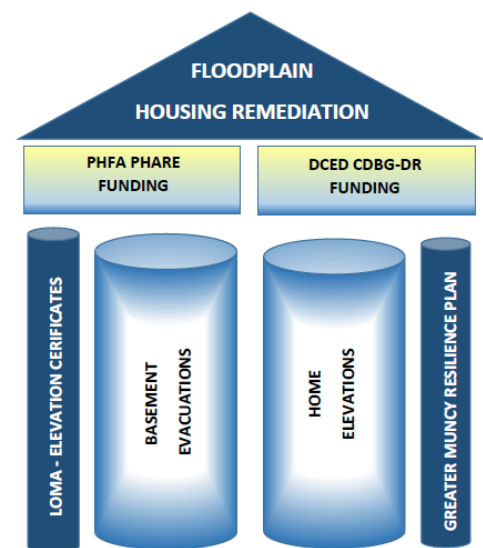
Encourage compatible agricultural uses and practices with habitat conservation

**Home Remediation**

The County has over 4,000 structures located in the Special Flood Hazard Areas (aka regulatory floodplains) with varying degrees of vulnerability for each structure. Nearly 73% are residential dwellings. Funding to remediate or mitigate floodplain-vulnerable structures has historically been exceptionally limited. The need greatly exceeds potential funding sources, thus targeting and leveraging of multiple revenue streams is critical to moving forward.

During 2016, the County developed a Floodplain Housing Remediation (FHR) Program to address the mitigation of residential structures located in eligible floodplain areas of eastern and central Lycoming County.

Mitigation measures such as utility elevation have the advantage of reducing the impact of future high water damage to a home, and hopefully resulting in a reduction in flood insurance cost. Mitigation also improves the potential resale value of the dwelling and drives an overall improvement to the integrity of the neighborhood.

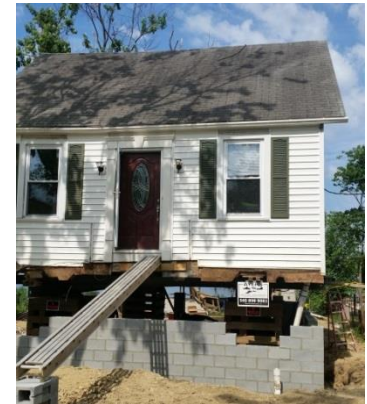


**Figure X:** Overall Funding Strategy  
**Source:** Lycoming County’s Floodplain Housing Remediation Program

The effectiveness of flood mitigation measures depends on the location of the property within the floodplain and the BFE at the structure's perimeter. Remediation measures may include, basement evacuation (filling it in), utility elevation, and structural elevation.

While these steps can be undertaken independently by the homeowner, they are generally beyond the financial resources of the majority of citizens. Federal and state programs targeted to home mitigation represent a proactive and intelligent investment of public funds since the outcome yields a number of distinct advantages to both the owner as well the surrounding community:

- *Retains the residential structure and associated tax base contribution*
- *Reduces risk of structural foundation damage from future flooding*
- *Eliminates risk of utility damage or loss due to future flooding*
- *Eliminates the first enclosed (basement) floor and raises height of first habitable (living) floor to 18" above BFE*
- *Results in significant level of NFIP insurance premium reduction*
- *Helps homeowner avoid or minimize the nuisance of flood-related cleanup of their structure*
- *Helps stabilize or improve the market value of the house*
- *Helps improve the quality of life for both the selected neighborhoods and their municipalities*



*A home being elevated to protect from future floods and to reduce insurance*  
Source: PCD

As a cautionary note, it is important to recognize that should the cost to mitigate exceed 50% of the structure's value, then FEMA's "substantial improvement" requirement is triggered. The cost of these "induced" improvements may prove to be prohibitive to the owner.

The potential of moving or relocating a structure entirely out of the floodplain could be considered in a selected number of cases. While the cost of this option can be fairly steep and the logistics complex, relocation may prove to be the best course of action particularly when the structure is historical thus making other mitigation measures unacceptable.

### **Key Implications**

In summary, each of the five domains described above has a set of significant implications that must be thoughtfully evaluated and considered. A levee breach or failure, for instance, could happen at any time. Ongoing maintenance of the system is vital to its stability and reliability. As the levee ages, it is important to ensure it operates optimally. If the levee is not recertified, many homes and businesses in the Williamsport Central Business District and beyond would be forced to pay for costly flood insurance. Additionally, in the event of a levee breach or failure, the federal government would have no obligation to assist in financing recovery efforts for thousands of homeowners.

Indirect costs of levee failure would be devastating to GWA. In Williamsport City alone there are over 14,000 people employed. During clean up and repair of the city, many of these people may be unemployed and the city would lose income on taxes as well. The loss of sales to local employers could range from 7 million to 70 million

each year, depending on the percent of damage, if they have to close due to flood damage. The levee protects local businesses from this loss every time there is a flood and has done so since 1956.

Even if employers are not directly affected they may temporarily lose workers due to damage to their homes. Damage to essential businesses, such as grocery stores, could create issues for people in the area. These indirect costs do not include the potential damage to utilities or infrastructure in the city and these damages could greatly increase the time it takes for the city to recover.

Beyond the urbanized GWA region, there are a significant number of properties extremely vulnerable to either river flooding, flash flooding from one the county's major creeks, or both. The likelihood of USACE designing and constructing a fold protection levee anywhere in Lycoming County is exceedingly remote. Structures situated in the floodway may be better candidates for the acquisition and demolition program while homes located in flood fringe areas may be better served by targeted remediation efforts. Both of these efforts are aimed at providing permanent solutions to the flooding issue. With 4,188 homes around the county on property identified as floodplain, it is now more urgent than ever to tackle the flooding issue in a more proactive and aggressive manner.

The onset of NFIP premium increases, driven by BW2012 legislation, prompts even more immediate action on this issue. Working in partnership with FEMA, the County needs to ensure the DFRIM maps are accurate. Equally important, it's imperative to reform (improve) the manner in which flood insurance rates are calculated.

Collectively, the concerns described in the five domains, listed above, could potentially have a direct or indirect impact on approximately 50 percent or more of the residential, commercial and industrial parcels in the County. In a very real sense, the economic well-being of Lycoming County and all of its citizens is tied to getting this issue resolved.

## **Projects of Countywide Significance for this Issue**

### **LEVEE CERTIFICATION**

This project is multiphase and is intended to meet the FEMA Certification Requirements and address USACE identified deficiencies in the levee system. Phase one examines the USACE deficiencies in each section of the levee and charts a plan to seek funding to remediate each issue. Phase two addresses any deficiencies identified in the FEMA Certification process. Phase three involves a study to consider future management configurations of how the levee can be best maintained going forward. Completion of this project is paramount to ensuring the financial livelihood of Lycoming County.

### **FLOODPLAIN HOUSING REMEDIATION**

Remediate the maximum number of floodplain residential structures in the grant eligible areas of Lycoming County to include utility elevation, basement evacuation and/or structure elevation. Assist homeowners in securing revised Elevation Certificates that help provide for reductions in flood insurance premiums. Project requires diligent attention to the allowable mix of income levels (medium, low and very low) of eligible homeowners that each grant source may require.



**DFIRM MAPPING**

The flood mapping can be challenged when new digital data becomes available and it appears to be in conflict with the existing flood insurance rate map. This project involves the re-delineation of floodplain boundaries to increase the accuracy of the mapped floodplain in all areas of the county. The proposed DFIRM mapping project builds upon the June 2016 Risk Mapping, Assessment, and Planning (Risk MAP) project completed by Lycoming County Planning and seeks to ensure that flood insurance requirements are accurately and fairly applied to those areas of the county that have not been previously updated. Prior to the recent June 2016 update, the County possessed roughly 5,500 addressed structures in the SFHA, however since the update, the County has removed over 1,000 structures from the floodplain through accurate and updated mapping methods conducted by Risk MAP. Future mapping projects should continue to accurately re-delineate the County’s floodplain maps.

Risk MAP is a Federal Emergency Management Agency (FEMA) Program that provides communities with flood information and tools they can use to enhance their mitigation plans and take action to better protect their citizens. Through more precise flood mapping products, risk assessment tools, and planning and outreach support, Risk MAP strengthens local ability to make informed decisions about reducing risk. (FEMA Risk MAP Bulletin).

**ACQUISITION & DEMOLITION**

Residential structures located in the floodway section of the regulatory floodplain and houses that have experienced severe repetitive flooding may be better candidates for acquisition and demolition than remediation. While the County has successfully “bought-out” over 300 homes to date, hundreds more may be eligible and deserving. Since the average per unit cost is approximately \$115,000 to acquire the property and an additional \$35,000 to demolish the structure and cover all ancillary expenses, any HMGP funds secured by the County may be able to address only a few homes at a time. The County should continue to maintain a prioritized list of qualified residential structures and aggressively pursue any federal and state funding associated with declared flooding disaster events. The County should continue to promote its Hazard Mitigation Opportunity form – available on the County website.

**REGULATORY TOOLS**

Update the 2015 Lycoming County Hazard Mitigation Plan by 2020.

Ensure that the County floodplain ordinance is updated to remain consistent with the County Comprehensive Plan Update as well as the 2020 Hazard Mitigation Plan. Ensure that municipal floodplain ordinances are similarly updated. Continue to administer the municipal floodplain ordinances, providing assistance to local zoning officers regarding floodplain regulations and land development.

Assist municipalities in developing and implementing stormwater ordinances that reflect the best management practices documented in the County’s stormwater management plan.

### **FLOOD INSURANCE REFORM**

Advocate for the creation of a national disaster provision funded uniformly across USA to include all types of events. For flooding premiums, the cost should factor in both geographic location and structure's elevation relative to the BFE.

### **HAZARD PLAN UPDATE**

Lycoming County Planning updates the countywide All Hazard Mitigation Plan (HMP) once every five years. The implementation actions within this HMP apply to Lycoming County and any municipalities that adopt the HMP as their own. However, only those municipalities that have participated in the plan update process will remain eligible for state and federal hazard mitigation funding through the HMP. This Hazard Mitigation Plan examines a risk assessment of potential hazard profiles across the county and develops comprehensive mitigation strategies as a response.

### **HAZUS MODELING**

In 2016, planning staff worked with Michael Baker, Inc. on a HAZUS modeling to enhance the 2015 All Hazard Mitigation Plan. HAZUS-MH can be a valuable tool in estimating damage and loss of functionality from floods, earthquakes, and hurricanes, and the benefits from the implementation of select mitigation measures. The Hazus run examined the economic loss due to a potential 100-year flood occurring countywide:

- Hazus estimates that there are 46,093 buildings in the region which have an aggregate total replacement value of \$7,427,019 (2014 dollars).
- For essential facilities, there are 4 hospitals in the region, 51 schools, 39 fire stations, 17 police stations, and 5 emergency operation centers.
- Hazus estimates that about 1,174 buildings will be at least moderately damaged. This is over 61% of the total number of buildings in the scenario. There are an estimated 240 buildings that will be completely destroyed.

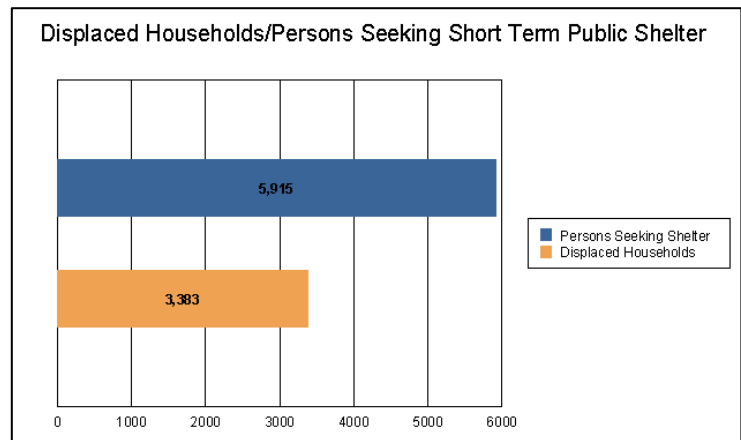
The model estimates that a total of 84,260 tons of debris will be generated:

- Of the total amount, Finishes comprises 27% of the total
- Structure comprises 42% of the total.
- If the debris tonnage is converted into an estimated number of truckloads, it will require 3,370 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Additionally, Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 3,383 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 5,915 people (out of a total population of 116,111) will seek temporary shelter in public shelters.

The total economic loss estimated for the flood is 597.40 million dollars, which represents 27.15 % of the total replacement value of the scenario buildings.

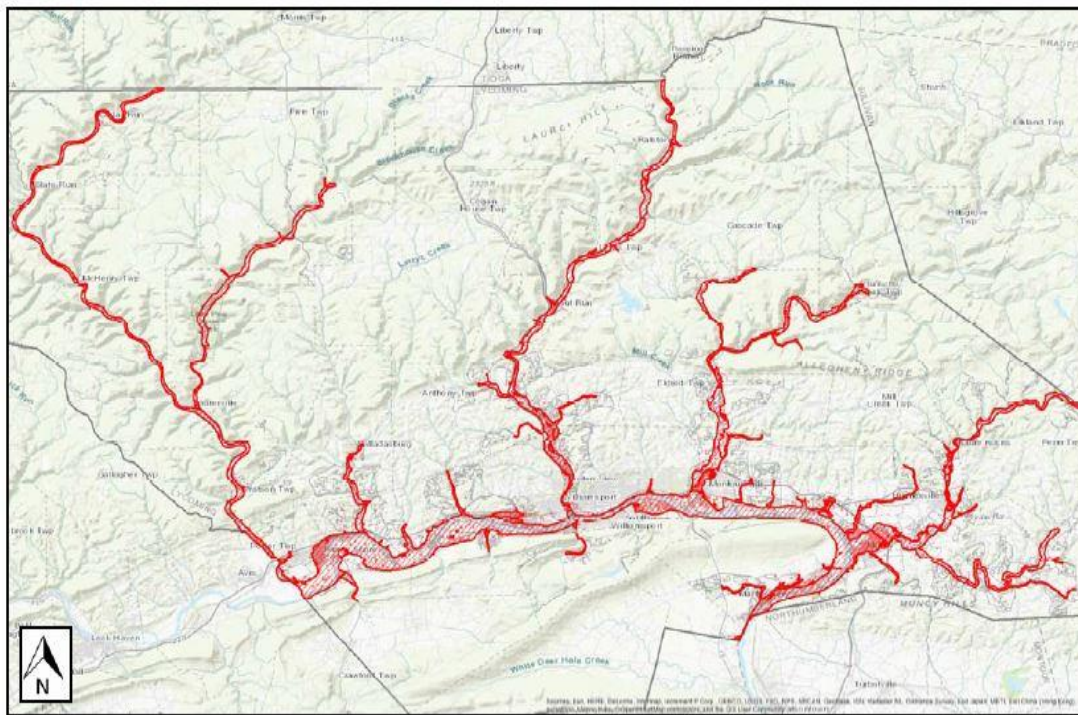
The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood building-related losses were 592.13 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 31.90% of the total loss.



**Figure X: Displaced Households/Persons Seeking Short Term Public Shelter**

**Source:** [Lycoming County 2015 Hazard Mitigation Plan](#)

The County will continue to implement these innovative evaluation strategies during the next All Hazard Mitigation Plan Update in 2020.



**Figure X: Countywide 100-Year Flood Overview Map**

**Source:** [Lycoming County 2015 Hazard Mitigation Plan](#)