Chapter 1. Introduction

When a major natural event strikes, it is often described as a natural disaster. Natural disasters and their aftermath have long affected humans and the built environment. Pre-disaster hazard mitigation is about preventing or minimizing the physical, financial, and human impacts of natural disasters. The Federal Emergency Management Agency (FEMA) describes hazard mitigation as "sustained actions taken to reduce or eliminate long-term risk from hazards and their effects."

The New River Valley Hazard Mitigation Plan 2011 update is a revision to the region's original plan, adopted and approved by FEMA in May 2005. In this updated plan, new data and analysis has improved the hazard identification and risk assessment used to determine mitigation strategies. All sections of this plan have been updated to include the newest information and data available. In the intervening five years, the participating local governments (Floyd, Giles, Montgomery, and Pulaski Counties, City of Radford, and the Towns of Blacksburg, Christiansburg, Glen Lyn, Narrows, Pearisburg, Pembroke, Pulaski, and Rich Creek) have completed several projects originally identified in the Hazard Mitigation Plan, including the organization of the New River Valley Swiftwater Association.

Events, both nationally and locally, in the past 10 years have shifted some of the focus of hazard mitigation to human-caused hazards. The Virginia Department of Emergency Management (VDEM) recognizes three main categories of human-caused hazards: accidental, criminal, and terrorism. In 2001, the entire nation was shaken by the terrorist acts of 9/11. In 2007, the New River Valley (NRV) region was intimately affected by the actions of a lone gunman on the campus of Virginia Tech. These events have called into the light the need to be ready to respond to events with significant physical, financial, and human impacts.

This plan will focus primarily on natural hazards: flooding, drought, wildfire, landslides, karst, rockfall, earthquake, winter weather, winds, and severe weather. An overview of potential human-caused hazards and preparedness for such events in the region will be presented.

1.1 Hazard Mitigation Planning

The purpose of this plan is to meet the requirements set forth in the Disaster Mitigation Act 2000 (DMA 2000). Specifically, the DMA 2000 requires state and local government to identify hazards, assess their risks and community vulnerability, and to describe actions to mitigate those risks and vulnerabilities. The plan is meant to be a framework for decreasing needs for post-disaster funds for recovery and reconstruction through pre-disaster actions.

Adoption of this plan and approval from FEMA is required for localities to remain eligible to apply for the five Hazard Mitigation Assistance (HMA) Programs. They include the four annual grant programs; Pre-Disaster Mitigation Program (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL) and the post-disaster Hazard Mitigation Grant Program (HMGP). Three of these programs (FMA, RFC, and SRL) are directly linked to the National Flood Insurance Program (NFIP). HMGP and PDM can also be used to fund tornado safe rooms, wildfire mitigation, etc.

There are two types of properties that are targeted for mitigation from flooding hazards: repetitive loss properties and severe repetitive loss properties. Repetitive loss properties are those buildings which have flood insurance from the NFIP and have filed two or more claims against that insurance in a rolling ten-year period. Severe repetitive loss property is a residential property that is covered under an NFIP flood insurance policy and has

a) at least four or more claims against an NFIP policy of over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

b) at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

As of September 2009, there are 28 repetitive loss properties in the NRV and three severe repetitive loss properties. Table 1-1 below more fully details these properties.

Table 1-1. Repetitive and Severe Repetitive Loss Properties by Locality

Locality	Repetitive Loss Properties	Severe Repetitive Loss Properties
Floyd County	1	1
Giles County	5	1
Montgomery County	15	1
Pulaski County	5	0
Town of Pulaski	2	0

There are four basic phases of emergency management: mitigation, preparedness, response, and recovery. Preparedness and mitigation measures occur prior to a disaster event. Preparedness refers to plans and strategies for efficiently handling disasters as they occur. Response and recovery occur during and after a disaster event, respectively, to return the community to normal operations as quickly as possible. Mitigation includes the long-term strategies determined to reduce risk to life and property from a disaster event.

The benefits of planning to mitigate for natural hazards include a systematic approach for identifying hazards, their risks, and strategies for minimizing those risks. In planning prior to a disaster, the high emotions and rushed environment are absent allowing a diverse group of stakeholders to collaborate to develop strategies from which the community derives the most benefits. The opportunities offered by approaching mitigation planning proactively allow local communities to shape not only post-disaster recovery, but also achieve additional community objectives, such as recreation and housing and economic development.

Implementation of mitigation strategies is the final step of these planning efforts. Mitigation strategies can take many forms, most commonly directed towards flooding, hurricanes, and earthquakes, three historically catastrophic events. The true community benefits of mitigation planning are not realized until the construction or installation of these projects is completed.

1.2 History of Hazard Mitigation Planning in the United States

When one thinks of natural disasters, one thinks of FEMA and the American Red Cross (ARCross) providing emergency food, water and shelter to victims. The sky-rocketing costs of these relief efforts have served as a costly reminder of the need to think more about prevention. In a word, "hazard mitigation" is prevention. The case for hazard mitigation rests solidly with the ounce-of-prevention-is-worth-a-pound-of-cure argument.

In the past, prevention resources have successfully been focused on life-saving mechanisms, such as building codes, warning systems and public education. Largely the emphasis was on preparedness rather than land use regulation. The one notable exception is the NIFP, which requires floodplain management regulation and includes Flood Insurance Rate Maps (FIRMs), which serve to establish risk levels. Now, new effort is being orchestrated nationally to prevent future property damage through improved land use planning and other means. In the range of emergency management activities (Figure 1-1) this signals FEMA's new commitment to focus not just on preparedness, response and recovery, but increasingly on planning and mitigation.

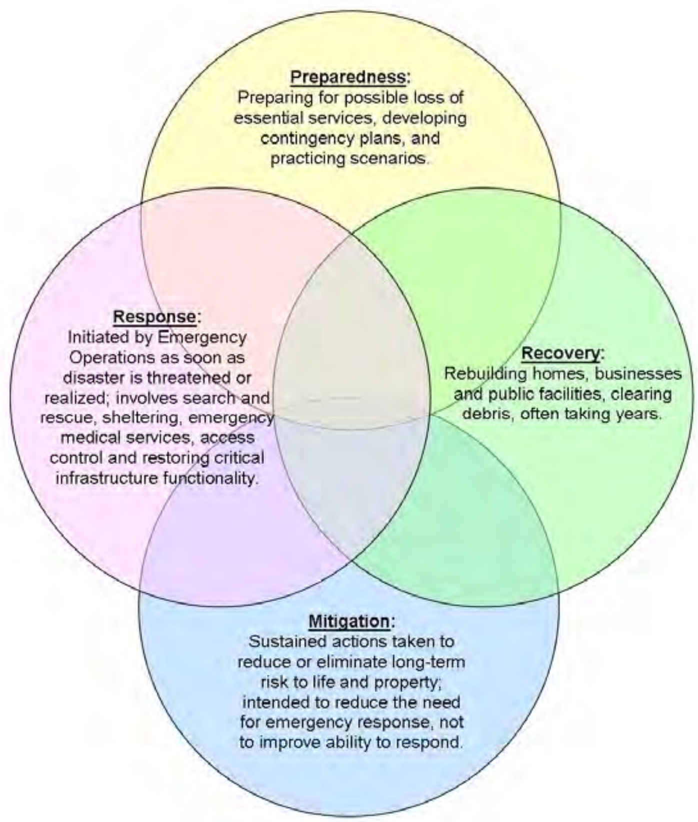


Figure 1-1. Emergency Management

Though it portends to be that long-range process incorporating multi-disciplines and forestalling future problems, local land use planning has largely failed to give adequate attention to natural hazards. Recent joint efforts by the American Planning Association and FEMA (including books and seminars) are addressing the issue. Theoretically, assessment, planning and mitigation actions could and should intervene in the historic build-flood-rebuild cycle.

The turning point nationally was a rapid succession of major disasters with high relief and recovery costs. From 1989 to 1994, there were 294 Presidentially-declared disasters with a cost to the U.S. Treasury of over $34 billion. The total costs (to property owners, insurance companies and governments) of the seven largest events were overwhelming.

Table 1-2. Major US Disasters, 1989-1994

Year	Event	Location	Cost
1989	Hurricane Hugo	South Carolina	$9 billion
1989	Loma Prieta Earthquake	northern California	$7 billion
1991	East Bay Hills Wildfire	Oakland/Berkeley, California	$1.5 billion
1992	Hurricane Andrew	Florida and Louisiana	$30 billion
1992	Hurricane Iniki	Hawaii	$1.8 billion
1993	Midwest Floods	Upper Mississippi Valley	$12-16 billion
1994	Northridge Earthquake	southern California	$28 billion

Source: Planning for Post-Disaster Recovery and Reconstruction, APA/FEMA book

Since 1980, there have been 96 natural disasters with damages and costs exceeding $1 billion. These events range from periodic heat waves and drought during summer months and their resultant wildfires to hurricanes and winter weather events. Below is a listing of these events from the previous ten years. In addition to natural disasters, the events of September 11, 2001 have increased the awareness of and need for mitigation planning for human-cause disasters. 9/11 was the first human-caused disaster to receive significant attention and funding from the federal government. Specifically, the 9/11 attacks were the impetus for many planning projects around the county to mitigate for these types of events.

Table 1-3. Major Natural Disasters since 2000

Year	Event	Location	Cost (in billions)
2000	Drought/Heat Wave		$4.8
	Western Fires		$2.4
2001	Tropical Storm Allison	TX, LA, MS, FL, VA, PA	$5.6
	Midwest/Ohio Valley Hail/Tornadoes	TX, OK, KS, NE, IA, MO, IL, IN, WI, OH, KY, WV, PA	$2.2
2002	30-State Drought		$11
	Western Fires		$2.3
	Severe Weather/Tornadoes	NC, GA, VA, TX, AR, MO, MS, TN, IL, IN, KY, PA, MD, NY, OH, WV, KS	$1.9
2003	Severe Weather/Hail	TX	$1.8
	Severe Weather/Tornadoes	Midwest, MS Valley, OH/TN Valleys	$3.8
	Hurricane Isabel	NC, VA, MD, DE, WV, NJ, NY, PA	$5.6
	Southern California Wildfires	CA	$2.8
2004	Hurricane Charley	FL, SC, NC	$16.5
	Hurricane Frances	GA, SC, NC, NY	$9.9

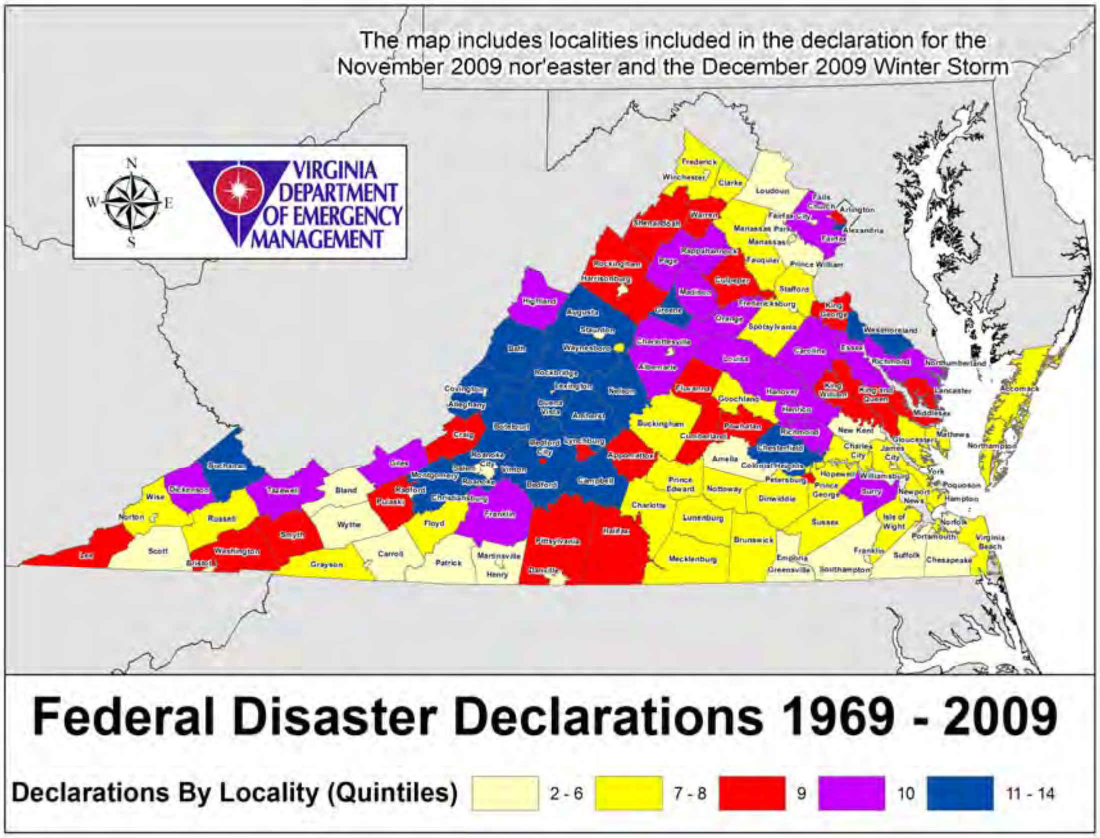
Year	Event	Location	Cost (in billions)
	Hurricane Ivan	GA, MS, LA, SC, NC, VA, WV, MD, TN, KY, OH, DE, NY, PA, NY	$15.4
	Hurricane Jeanne	GA, SC, NC, VA, MD, DE, NJ, PA, NY	$7.7
2005	Hurricane Dennis	GA, MS, TN	$2.2
	Hurricane Katrina	AL, MS, FL, TN, KY, IN, OH, GA	$133.8
	Hurricane Rita	AL, MS, LA, AR, TX	$17.1
	Midwest Drought	AR, IL, IN, MO, OH, WI	$1.1
	Hurricane Wilma	FL	$17.1
2006	Numerous Wildfires	AK, AZ, CA, CO, FL, ID, MT, NM, NV, OK, OR, TX, WA, WY	$1.0
	Widespread Drought	ND, SD, NE, KS, OK, TX, MN, IA, MO, AR, LA, MS, AL, GA, FL, MT, WY, CO, NM, CA	$6.2
	Severe Storms/Tornadoes	AL, AR, KY, MS, TN, TX, IN, KS, MO, OK	$1.0
	Northeast Flooding	NY, PA, DE MD, NJ, VA	$1.0
	Midwest/Southeast Tornadoes	OK, KS, MO, NE, KY, OH, TN, IN, MS, GA, AL	$1.5
	Midwest/Ohio Valley Tornadoes	IL, IN, IA, AR, MO, KY, TN	$1.1
2007	Great Plains East Drought	ND, SD NE, KS, OK, TX, MN, WI, IA, MO, AR, LA, MS, AL, GA, NC, SC, FL, TN, VA, WV, KY, IN, IL, OH MI, PA, NY	$5.0
	Western Wildfires	AK, AZ, CA, ID, UT, MT, NV, OR, WA	$1.0
	Spring Freeze	AL, AR, GA, IL, IN, IA, KS, KY, MS, MO, NE ,NC, OH, OK, SC, TN, VA, WV	$2.0
	East/South Severe Weather	CT, DE, GA, LA, ME, MD, MA, MS, NH, NJ, NY, NC, PA, RI, SC, TX, VT, VA	$1.5
	California Freeze	CA	$1.4
2008	Southeast/Midwest Tornadoes	AL, AR, IN, KY, MS, OH, TN, TX	$1.0
	Midwest/Ohio Valley Severe Weather/Tornadoes	IL, IM, IA, KS, MN, NE, OK, WY, CO	$2.4
	Midwest/Mid-Atlantic Severe Weather/Tornadoes	IA, IL IN, KS, NE, MI, MN, MO, OK, WI, MD, VA, WV	$1.1
	Midwest Flooding	IA, IL, IN MO, NM, NE, WI	$15.0
	US Wildfires	AK, AZ, CA, NM, ID, UT, MT, NV, OR, WA, CO, TX, OK, NC, FL	$2.0
	Hurricane Dolly	TX, NM	$1.2
	Hurricane Gustav	AL, AR, LA, MS	$5.0
	Hurricane Ike	TA, LA, AR, TN, IL, IN, KY MO, OH, MI, PA	$27.0

Year	Event	Location	Cost (in billions)
	Widespread Drought	CA, TX, NC, SC, GA, TN	$2.0
2009	Southeast/Ohio Valley Severe Weather	TN, KY, OK OH, VA, WV, PA	$1.4
	Midwest/Southeast Tornadoes	NE, KS, OK, IA, TX, LA, MS, AL, GA, TN, KY	$1.0
	South/Southeast Severe Weather/Tornadoes	AL, AR, GA, KY, MO, SC, TN	$1.2
	Midwest, South, East Severe Weather	TX, OK, MO, NE, KS, AR, AL, MS, TN, NC, SC, KY, PA	$1.1
	Western Wildfires	CA, AZ, NM, TX, OK, UT	$1.0
	Southwest/Great Plains Drought	TX, OK, KS, CA, NM, AZ	$5.0

The DMA 2000 established a national, pre-disaster mitigation program, streamlining disaster relief efforts, and attempts to control the costs of federal assistance. The DMA 2000 placed dramatic new emphasis on pre-disaster mitigation, requiring local and state "all hazards" mitigation plans be completed by November 1, 2004. Without these approved plans, local and state governments would be ineligible for most FEMA assistance in the future. Localities without an approved plan remained eligible for limited public assistance and debris removal costs, but are ineligible for individual assistance and mitigation assistance. Approved plans must be updated and re-approved every five years to maintain eligibility for this additional FEMA assistance for planning and mitigation.

1.3 Hazard Mitigation Planning and the Commonwealth of Virginia

Between 1969 and 2009, natural hazards resulted in 51 Presidentially-declared disasters in Virginia (Figure 1-2 and Table 1-4). Disasters affected every county and jurisdiction in the Commonwealth at least once during the 41-year period. Presidentially-declared disasters are generally declared when the disaster is of such proportions as to outstrip both local and state resources.



Source: VERT Planning Section – GIS

Figure 1-2. Presidential Disaster Declarations (1964-2008)

Table 1-4. Presidential Disaster Declarations in Virginia Since 1969

Declaration Date	Event Description	Number of Jurisdictions	NRV Counties Included
August 1969	Hurricane Camille	27	
June 1972	Hurricane Agnes	106	
September 1972	Severe Storms, Flooding	3	
October 1972	Flood	31	
April 1977	Flash Flood	16	
November 1977	Flood	8	
July 1979	Flood	1	
September 1979	Flood	1	
May 1984	Flood	3	
November 1985	Flood	52	
October 1989	Flood	1	
April 1992	Flood	24	
March 1993	Snowstorm	43	

Declaration Date	Event Description	Number of Jurisdictions	NRV Counties Included
August 1993	Tornado	1	
February 1994	Ice Storm	71	
March 1994	Ice Storm	29	
June 1995	Flood	24	
January 1996	Blizzard	Statewide	
January 1996	Flood	27	
September 1996	Hurricane Fran	88	
August 1998	Hurricane Bonnie	5	
September 1999	Hurricane Dennis	1	
September 1999	Hurricane Floyd	48	
February 2000	Winter Storm	107	Floyd, Giles, Montgomery, Pulaski
July 2001	Flood	10	
September 2001	Pentagon Attack	1	
March 2002	Flood	10	
April/May 2002	Flood	2	
February 2003	Winter Storms/Flood	39	Floyd, Montgomery
September 2003	Hurricane Isabel	100	
November 2003	Flood	6	Giles
May 2004	Flood	3	
August 2004	Tropical Depression Gaston Flood	9	
September 2004	Tropical Depression Jeanne Flood	10	Floyd, Giles, Montgomery
July 2006	Severe Weather	13	Floyd
September 2006	Tropical Depression Ernesto	25	
November 2009	Nor'easter - flooding	12	
December 2009	Winter Storm	40	Montgomery

Hazard mitigation in the Commonwealth of Virginia is facilitated by the Virginia Department of Emergency Management (VDEM). Specifically, the Hazard Mitigation Program is housed in the Recovery and Mitigation Program at VDEM. VDEM's Hazard Mitigation Program is responsible for writing and updating the state hazard mitigation plan, providing assistance for local plans, as well as administering grant programs designed to mitigate for these hazards.

Virginia's Hazard Mitigation Plan is Volume II, Support Annex 3 of Commonwealth of Virginia Emergency Operations Plan. Previous versions of the plan were approved in 2001, 2004, and 2007 with the 2004 plan making changes to conform to new requirements within the DMA 2000. The plan was reapproved by FEMA after being re-adopted by the state on March 12, 2010.

1.3.1 State Plan Summary

The process for developing and approving the current Standard and Enhanced Hazard Mitigation Plan for Virginia began in 2007. The planning process took over two years to complete and included a complete revision of the Hazard Identification and Risk Assessment (HIRA) for critical facilities, state facilities, and individual jurisdictional vulnerability. The state plan identifies flooding (coastal and riverine), non-rotational wind (hurricane and thunderstorms), winter weather, tornadoes, drought, wildfire, earthquake, landslide, karst, and dam inundation as hazards that have the most impact on life and property in the Commonwealth. The risk levels indicated below are a product of the updated HIRA including rankings from all 27 local hazard mitigation plans. Though these risk levels are accurate as an average statewide, variations in hazard histories and risks differ notably even among New River Valley jurisdictions, as will be seen later.

Table 1-5. State Assessment of Relative Risk of Natural Hazards*

High	Medium-High	Medium	Medium-Low	Low	Negligible
Flood	Non-Rotational Wind Winter Weather	Tornado Drought Wildfire	Earthquake Landslide	Karst Dam Inundation	Erosion Thunderstorm Lightning Hail Extreme Heat Extreme Cold Tsunami

* Modified from Table 3.16-1 of Virginia's Hazard Mitigation Plan

For each hazard, the state plan outlined historical occurrences, a general description of the hazard and its impacts and measures of magnitude along with additional information, dependent on the hazard. Of all the hazards occurring within the state, flood, wind, and winter storms were identified as having the most impact. Data for this plan was gathered from all available state, federal, local, and university sources including all 27 local hazard mitigation plans and eight

Disaster Resistant University (DRU) plans. The overall statewide ranking that is listed above is a product of the comprehensive data sources.

1.3.2 Virginia's Hazard Mitigation Goal

Virginia's stated hazard mitigation vision is simply "**to reduce the impacts of natural hazards on human, economic, and natural resources throughout the state."** The four goals outlined in the state plan include:

- Identify and implement projects that will eliminate long-term risk, directly reduce impacts from hazards, and maintain continuity of operations.
- Incorporate mitigation concepts and objectives into existing and future policies, plans, regulations, and laws in the Commonwealth.

- Improve the quality of the data and analyses used in the hazard identification and risk assessment process.
- Through training, education and outreach, promote awareness of hazards and potential mitigation strategies in order to increase resiliency.

1.4 Virginia's New River Valley Hazard Mitigation History

In 2000, a summary-level hazard assessment was done of the three-state New River watershed by the non-profit New River Community Partners. That assessment, *New River All Hazards Mitigation Plan*, was generalized and did not involve assessment of special hazard areas, identification and assessment of key vulnerabilities, nor past, present or future mitigation priorities for local governments. While helpful in providing a snapshot of hazard data, that plan does not meet the DMA 2000 requirements for local governments.

In 2002, VDEM began funding the first round of local hazard mitigation plans, with all plans funded throughout the state by 2006. FEMA defined localities responsible for developing a hazard mitigation plan as "Any area or political subdivision within the Commonwealth of Virginia as defined by the Code of Virginia that has authority to create, adopt and/or enforce land use, zoning, or subdivision ordinances and regulations for the areas within its boundaries." While planning district commissions do not have the authority to enforce or implement plans that they assist their member localities to draft, it was the intent of VDEM to combine as many of the local plans into regional plans using the expertise of the PDCs.

The preparation of the *New River Valley Hazard Mitigation Plan* is a joint effort of the local governments within the region and the New River Valley Planning District Commission (NRVPDC). The first New River Valley Hazard Mitigation Plan meeting the DMA 2000 was completed in December 2004, approved by FEMA in May 2005. The adoption dates for participating localities are indicated in Table 1-6. This update to the original New River Valley Hazard Mitigation Plan is the continuation of coordination between the localities to mitigate the impacts of natural hazards, building upon past efforts and studies.

Table 1-6. NRV Adoption of Previous Hazard Mitigation Plan

Locality	Adoption Date
Floyd County	March 8, 2005
Floyd Town	March 10, 2005
Giles County	March 3, 2005
Glen Lyn	N/A
Narrows	March 21, 2005
Pearisburg	March 8, 2005
Pembroke	March 11, 2005
Rich Creek	March 14, 2005
Montgomery County	April 25, 2005
Blacksburg	March 8, 2005
Christiansburg	March 15, 2005
Pulaski County	March 28, 2005
Dublin	N/A

Locality	Adoption Date
Pulaski	March 1, 2005
City of Radford	March 14, 2005

All NRV localities do long range land-use planning and regulation, which is a mitigation action. Additionally, most New River Valley jurisdictions participate in the National Flood Insurance Program, and thus have requisite floodplain regulations. Some local jurisdictions have also sought federal assistance from the US Army Corps of Engineers for floodplain studies. Additionally, some local governments have partnered with the FEMA, USDA and the state to implement mitigation activities such as housing relocation and stream modification.

Following the Presidential Disaster Declaration for Tropical Depression Gaston and its associated flooding in 2004, Giles County conducted a flooding mitigation project. During this project, the County acquired a home in Pembroke that was frequently flooded by Little Stony Creek. This property was turned to green space to avoid flooding impacts to the residents and their property. The photos below show the property before and after the mitigation actions.

Figure 1-3. Before and After Photos from Giles County Property Acquisition

Many documents were reviewed in the preparation of this plan. First, the comprehensive plans for all jurisdictions were reviewed. Additionally, all available flood insurance studies and Digital Flood Insurance Rate Maps (DFIRMs) by FEMA or the U.S. Department of Housing and Urban Development were reviewed. All pertinent regional and special studies, such as Army Corps of Engineer studies and private engineering firm studies provided by local governments were reviewed.

Both universities in the region, Virginia Tech and Radford University, have completed and adopted their own multi-hazard plans. These universities have been recognized by VDEM and FEMA as Disaster Resistant Universities. Virginia Tech's Hazard Mitigation Plan was approved in October 2006 and includes sections on flooding, winter and severe storms, wind (hurricane and tornado), drought, karst/sinkhole, landslide, wildfire, and earthquakes. Virginia Tech's plan also includes information about the human-caused hazards of arson/building fire, hazardous materials, and terrorism. Radford University's Hazard Mitigation Plan was also approved in

October 2006. Radford University's plan included many of the same hazards as Virginia Tech's plan, but also included lightning and dam failure.

1.5 Hazard Mitigation: Links to Sustainability

Though hazard mitigation has not gotten great attention in the past, it is compatible with and even essential for "sustainability." The concept of sustainability has grown out of the heightened environmental consciousness during the past 20 years. Sustainability seeks to balance natural, economic and social needs. According to FEMA (*Planning for a Sustainable Future*, 2000) a "sustainable community," is one which enhances quality of life while also ensuring that people "live within an eco-system's carrying capacity." One example of an important link between hazard mitigation and "sustainable development" is the function and value of forests and wetlands for water retention and quality. There is also potential for dual purpose, joint actions such as conservation easements to limit future development in critical areas.

Sustainable or "disaster resistant" communities demonstrate results including saved lives, reduced physical damage and economic loss, and shorter recovery period. They are, thus, much more attractive to individuals and businesses.

Planning and Public Policy Principles for Local Government:

- Limit practice of subsidizing risks in hazard areas
- Build and share a base of knowledge about nature of risks and sustainable ways of living with hazards
- Develop a commitment and capacity to change the way hazardous areas are managed
- Coordinate and integrate policies to manage exposure to hazards with policies to accomplish economic, social and environmental objectives

Source: *Natural Hazards: Land Use Planning for Sustainable Communities*

1.6 New River Valley Hazard Mitigation Plan-2011

The remaining chapters of this plan have been organized as follows

- Chapter Two, Community Profile: The Community Profile section outlines a physical and demographic description of the New River Valley region.
- Chapter Three, Planning Process: The Planning Process section describes how the plan was revised, the stakeholder involvement and public outreach, and review and incorporation of other plans and studies during the revision of this plan.
- Chapter Four, Hazard Identification and Risk Assessment: The Hazard Identification and Risk Assessment section evaluates the natural hazards and some human-caused hazards that are likely to affect the New River Valley. Additionally, data is analyzed to determine the impacts these hazards would have on the communities in the region.
- Chapter Five, Mitigation Strategies: The Mitigation Strategies section lists goals, objectives, and strategies identified by a stakeholder committee to address the hazards and risks

previously identified as well as the capability assessment for each jurisdiction and the region as a whole.

- Chapter Six, Community Summaries: The Community Summaries section identifies hazards and mitigation strategies that are specific to each community.
- Chapter Seven, Plan Maintenance: The Plan Maintenance section outlines the process to have this update adopted by participating localities, as well as the implementation of the strategies and future maintenance of the regional plan.
- Appendices: The appendices include supplemental information to this plan which includes
  - Appendix 1: Meeting Documentation
  - Appendix 2: Adoption Resolutions
  - Appendix 3: Public Involvement Documentation
  - Appendix 4: Mitigation Projects
  - Appendix 5: Acronyms

Chapter 2. Community Profile

Virginia's New River Valley Planning District is comprised of the Counties of Floyd, Giles, Montgomery and Pulaski, as well as the City of Radford. Additionally, there are ten towns: Floyd in Floyd County; Dublin and Pulaski in Pulaski County; Blacksburg and Christiansburg in Montgomery County; and Glen Lyn, Narrows, Pearisburg, Pembroke, and Rich Creek in Giles County. There are also two state universities, Virginia Tech and Radford University, as well as a major federal facility, the Radford Army Ammunition Plant. The following sections provide background on the NRV, concerning its physical characteristics, population, economy, and housing. Much of the following information was adapted from the New River Valley Regional Databook, maintained by the NRVPDC.

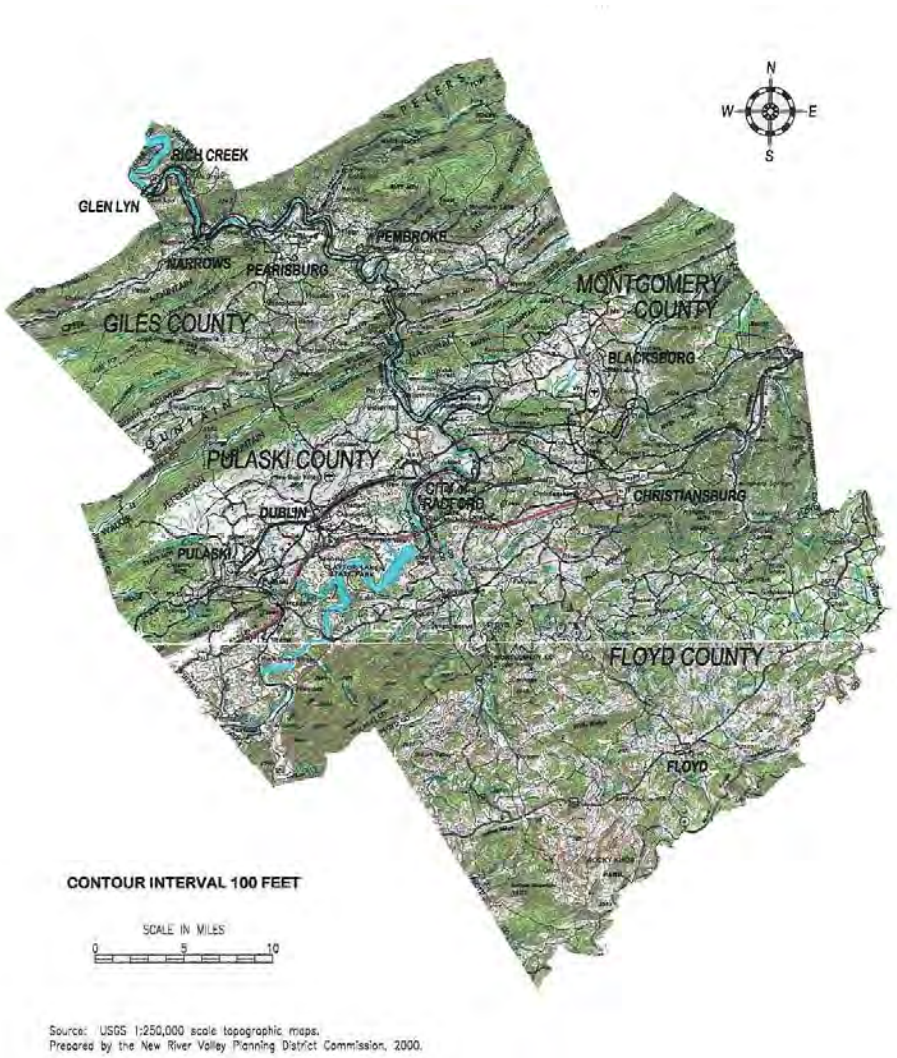
Figure 2-1.Virginia's New River Valley

2.1 Natural Features

2.1.1 Physiography

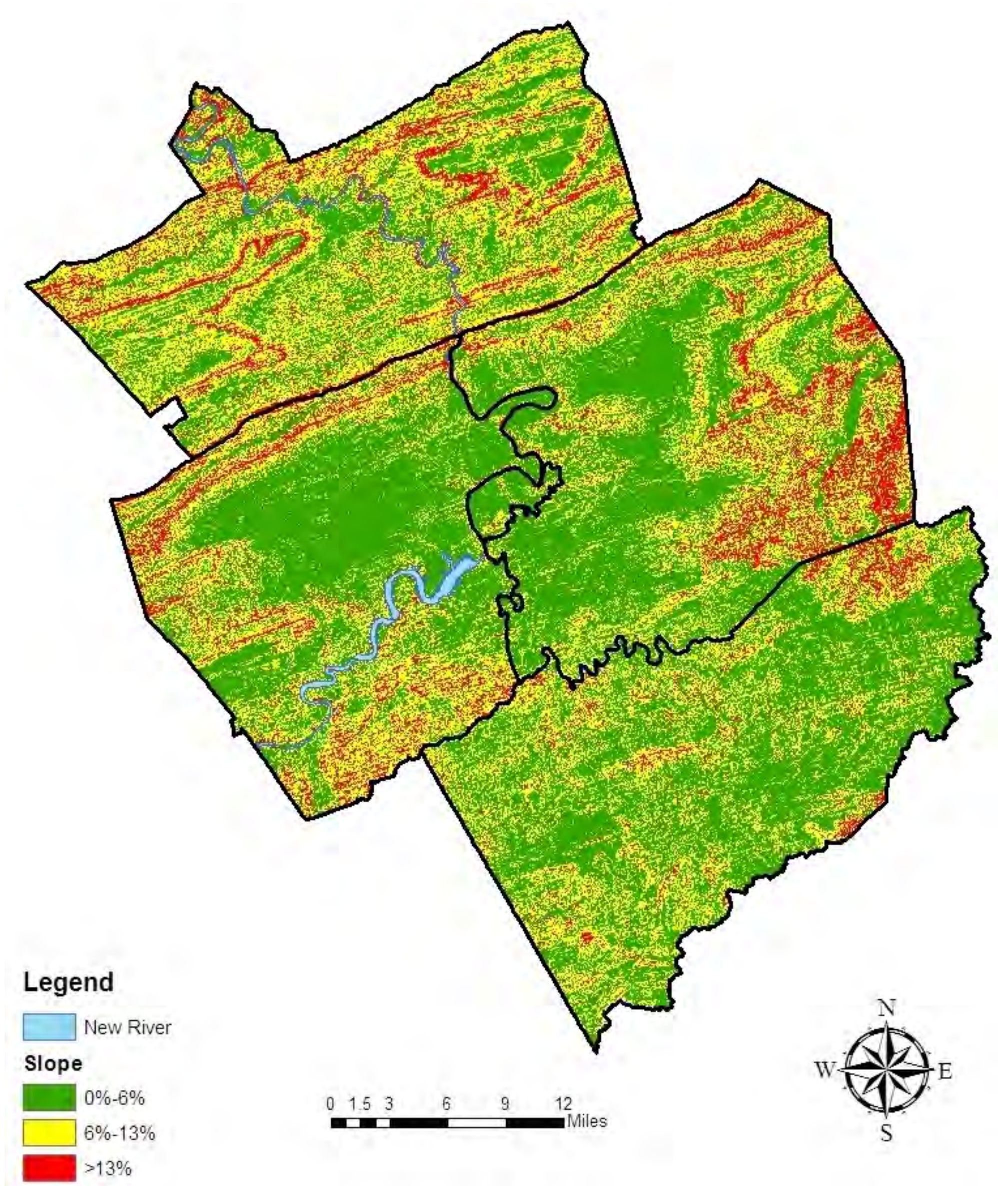
The New River Valley falls within three distinct physiographic provinces: the Blue Ridge Province (Floyd County), the Valley and Ridge Province (Pulaski County, Montgomery County, most of Giles County, and the City of Radford), and the Appalachian Plateau (in a small part of Giles County).

The Blue Ridge Province is characterized by irregular topography and is generally classified as moderately-sloped (i.e., slopes ranging from 5-20%). The Valley and Ridge Province exhibits parallel-running ridges with accompanying valleys and is considered to be steep-sloped (slopes greater than 20%). The small portion of Giles County lying within the Appalachian Plateau Province is also steep-sloped. Overall, the land area in the New River Valley is classified as 47.9% moderately sloped, and about 7.5% as level. These are illustrated in Figure 2-2 and Figure 2-3.



Source: US Geological Survey

Figure 2-2. Topography of the New River Valley

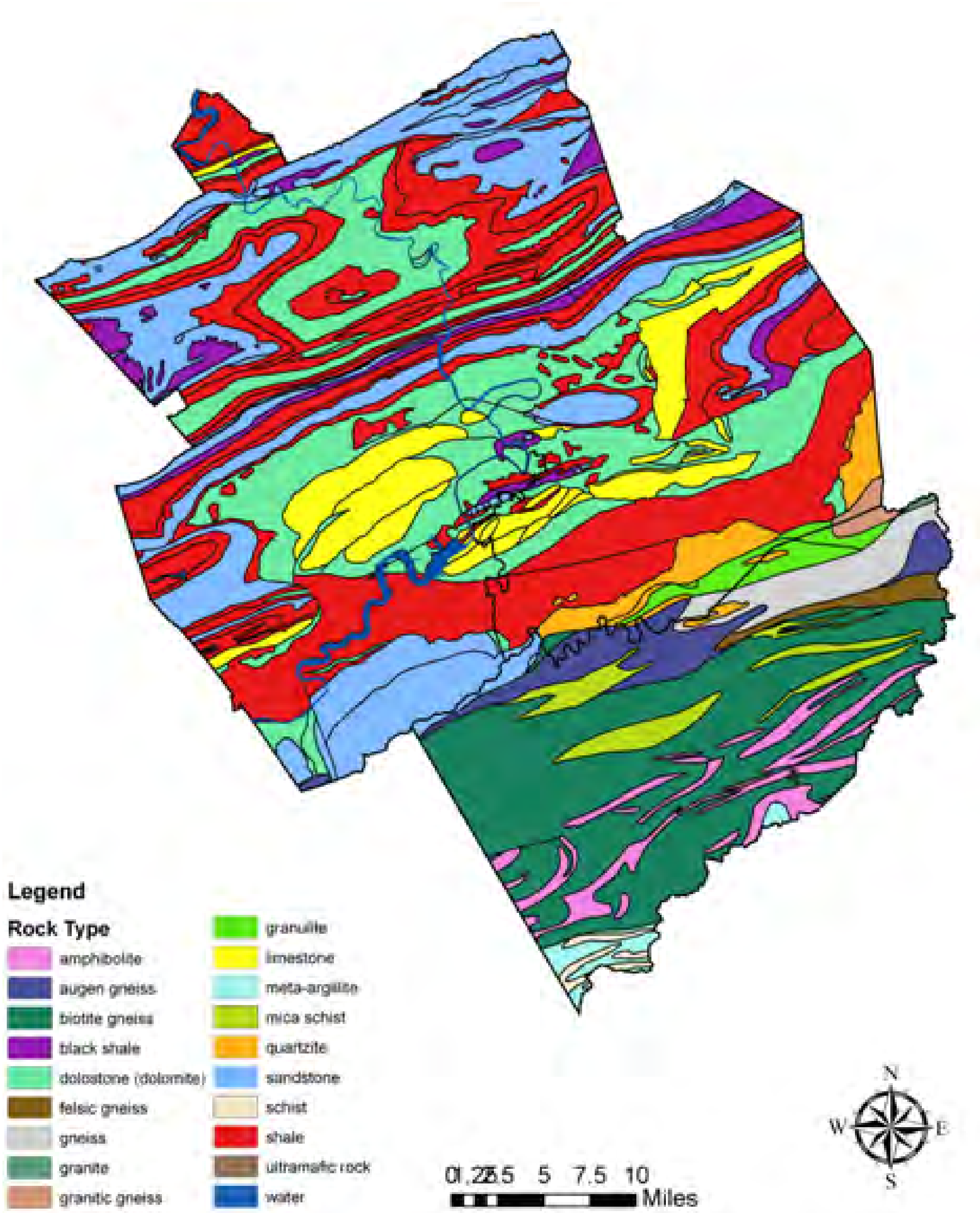


Source: US Geological Survey

Figure 2-3. Slopes of the New River Valley

2.1.2 Geology

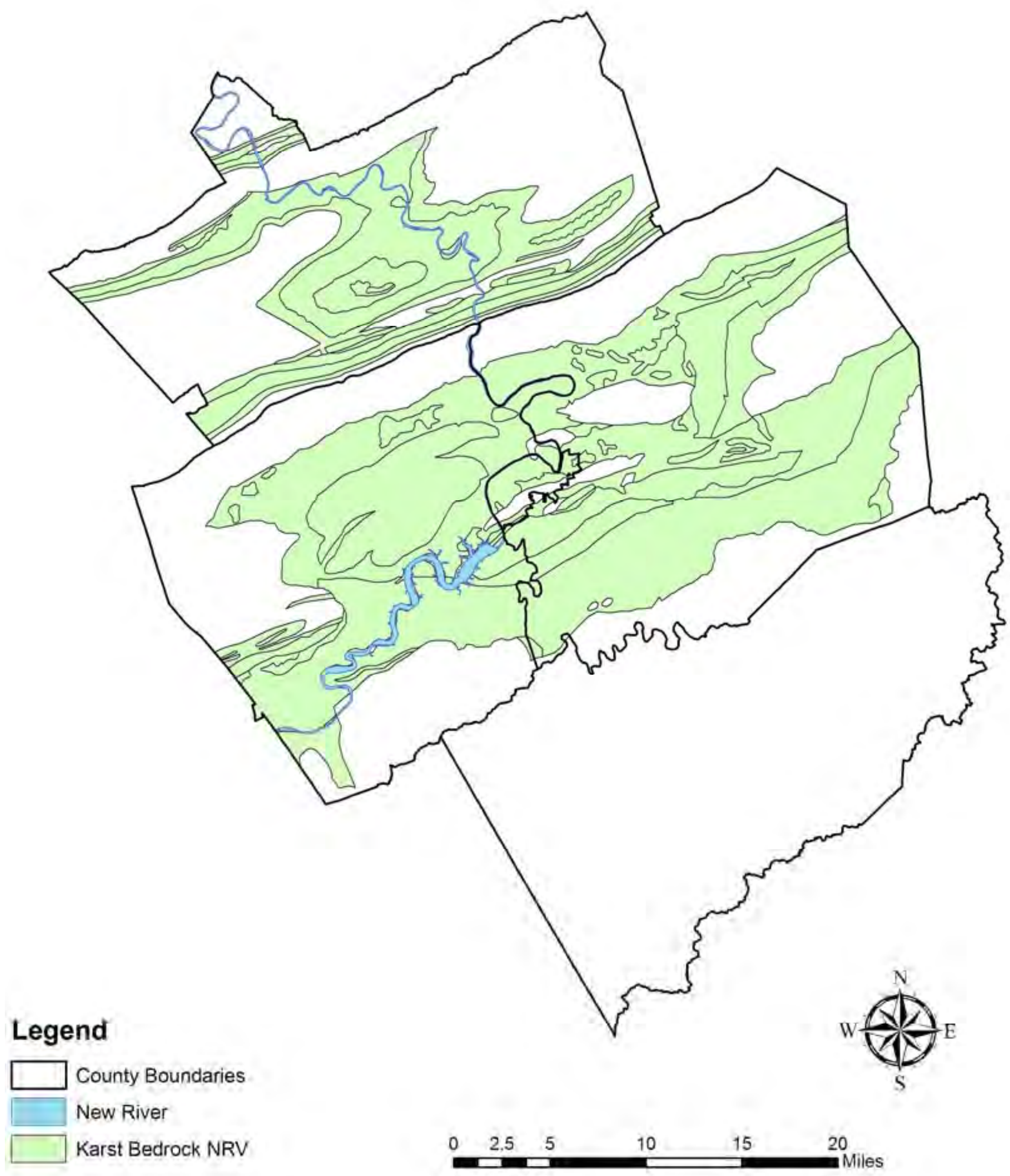
Each province has very different geological characteristics (see Figure 2-4). Giles, Pulaski, and Montgomery Counties are mainly located in the Valley and Ridge Province which is characterized by sedimentary rocks such as limestone, shale, sandstone and dolomites (i.e., karst). Historically, limestone has been mined for agriculture use and sandstone for building purposes. Floyd County is located in the Blue Ridge Province, which is characterized by metamorphic rocks such as gneiss and schist. Metamorphic rocks are generally harder rocks and have been mined for use in road construction.



Source: USGS Geologic Map of Virginia, 2003

Figure 2-4. NRV Geology

Karst-forming bedrock is commonly found in three of the four counties in the NRV (see Figure 2-5). Karst is formed when carbonate rock formations are weathered by dissolution. This dissolution occurs as slightly acidic precipitation and groundwater moves through fractures in the carbonate bedrock. Characteristics of karst include caves, sinking streams that disappear into holes in the bedrock, and sinkholes formed by the collapse of subsurface voids.

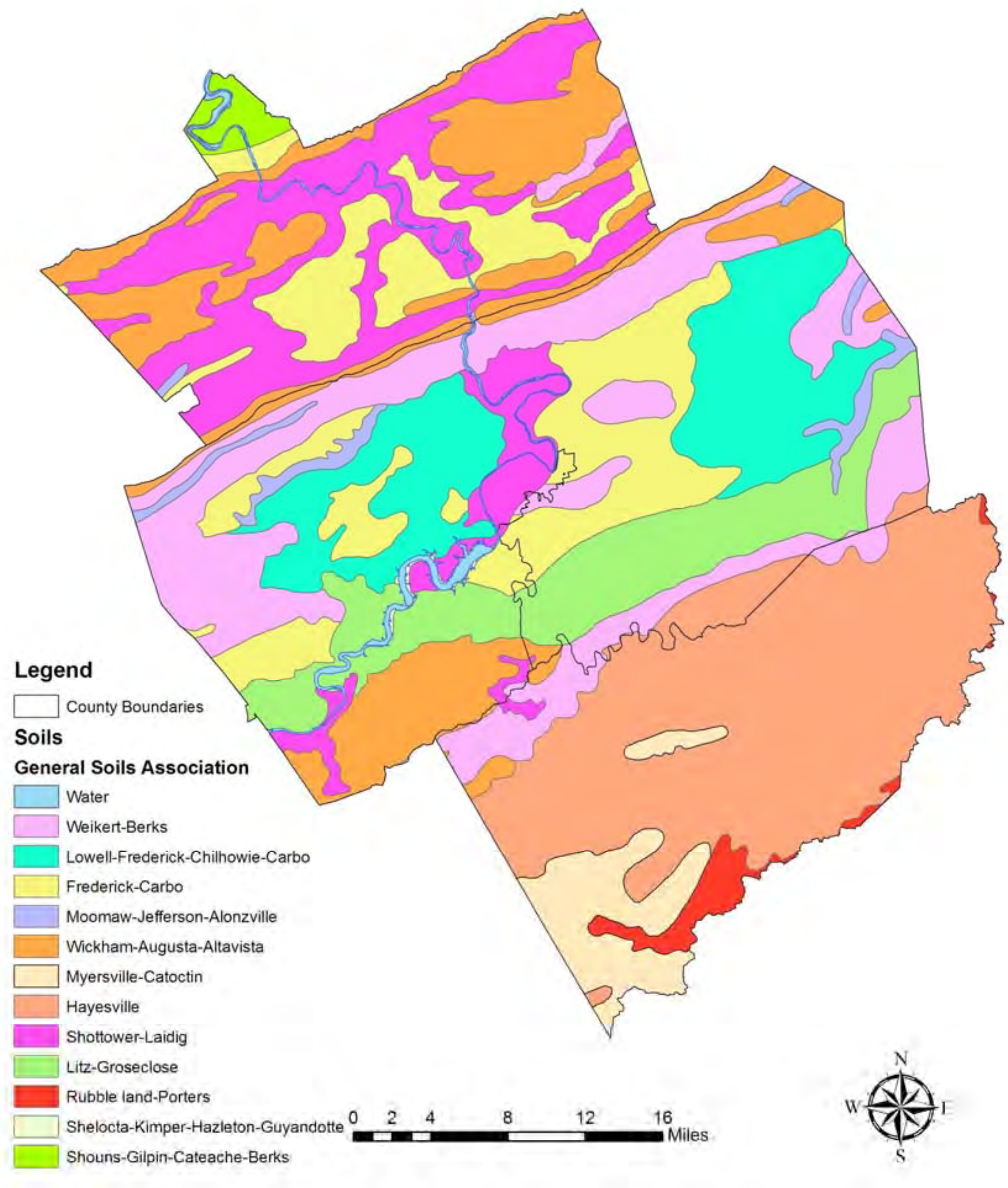


Source: Virginia DCR Karst Program, 2009

Figure 2-5. Karst Formations in the New River Valley

2.1.3 Soils

Soils in the region are generally derived from limestone and shale in many places and alluvial along the streams. Colluvial soils, formed from weathering of limestone with some shale and sandstone, are found in the foothills paralleling the Valley (of the Valley and Ridge Province). Generally soils are moderately deep to very deep, with a depth of bedrock to ten feet; however, 100 feet depths have been noted. There are shrink-swell soils in the Counties of Giles, Montgomery and Pulaski. General soil types are illustrated in Figure 2-6.

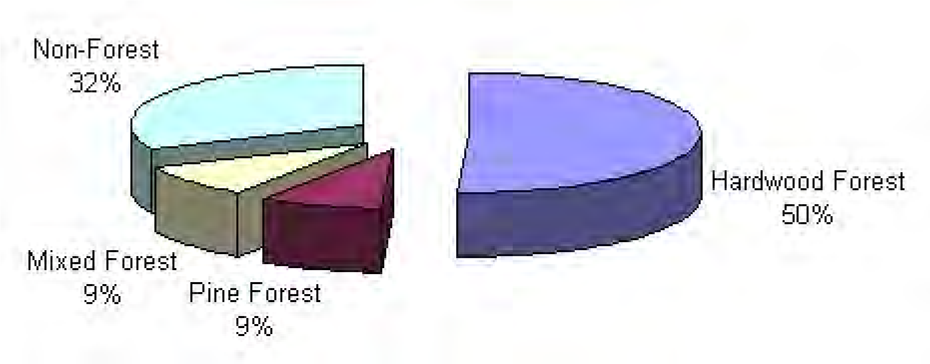


Source: Soil Survey Geographic (SSURGO), 2009

Figure 2-6. General Soils Associations in the NRV

2.1.4 Forestry

All counties in the New River Valley are quite similar with regards to type of land class. The majority of land within the region is considered timberland. It covers 68% of all land within the New River Valley (Figure 2-7). The only county in the region with a different forestry profile would be Giles where 76% of the total area is considered forest land (a significant amount of which is in the Jefferson National Forest).



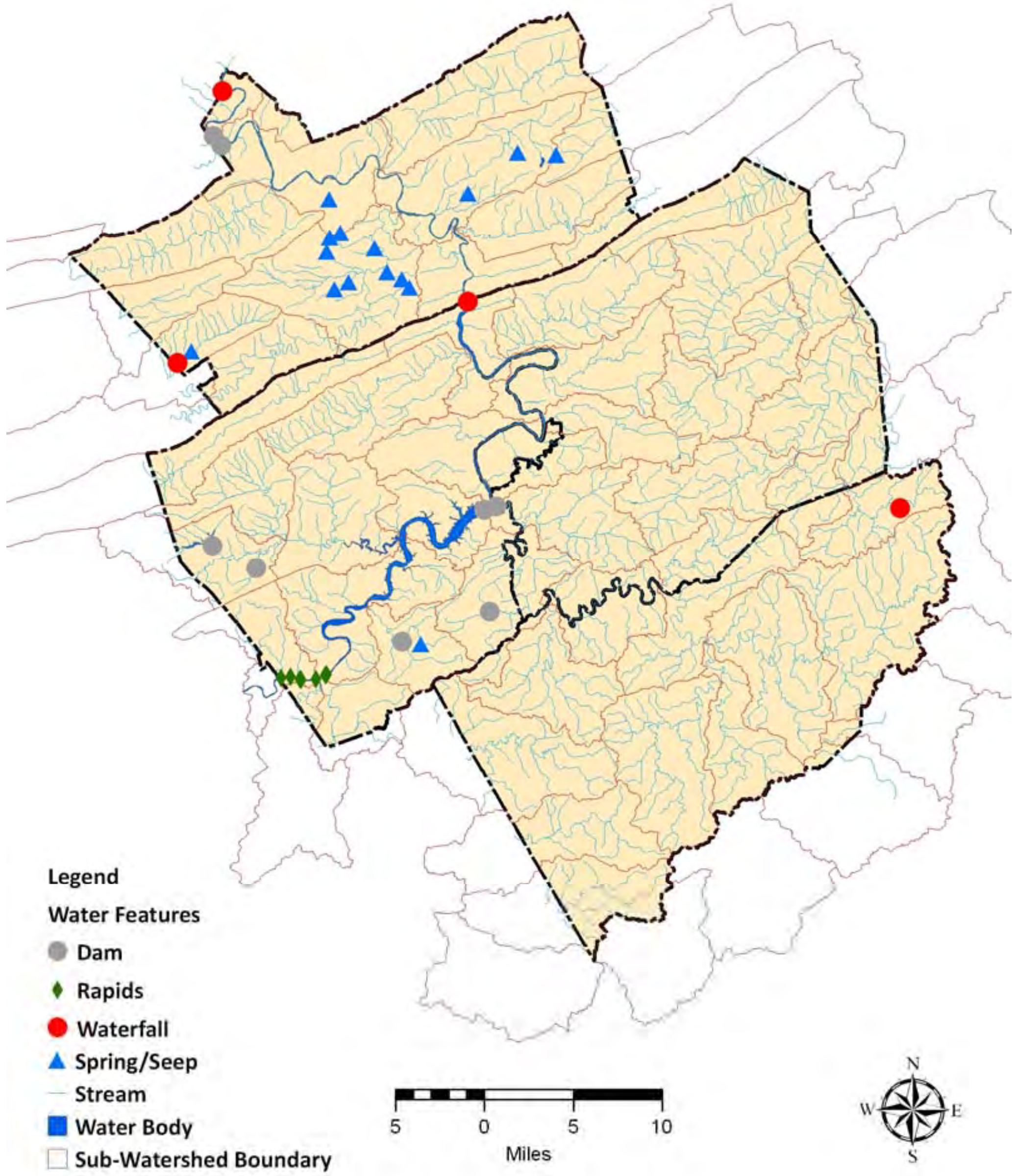
Source: VDOF Virginia Forest Cover 2005 data

Figure 2-7. Land Classification in the NRV

2.1.5 Elevation and Drainage

The average elevation of the NRV is about 2,500 feet. Elevations range from 1,470 feet above mean sea level at Glen Lyn to 4,348 feet at Bald Knob on Salt Pond Mountain in Giles County. Mountain Lake, also located on Salt Pond Mountain, is one of two natural lakes in Virginia and is reportedly the highest natural lake east of the Rocky Mountains.

The New River runs through the Counties of Pulaski, Montgomery, and Giles, and the City of Radford, thus giving the region its name. Little River, Peak Creek, Big Walker Creek, and Dodd's Creek are a few of the tributaries of the New River. A small portion of eastern Montgomery and Floyd Counties are in the Roanoke River basin, while a small portion of Giles County and the Craig Creek watershed in Montgomery County drain into the James River. Figure 2-8 below shows the overall hydrology of the NRV, including important water features and sub-watershed boundaries.



Source: National Hydrography Dataset

Figure 2-8. NRV Hydrology

2.1.6 Climate

The climate of the New River Valley is classified as "moderate continental," characterized by moderately mild winters and warm summers. The average annual temperature is 53°F, with a record high of 103°F and a record low of -30°F. The mean annual precipitation is 40 inches. Snowfall in the NRV averages 21 inches annually, with a range of 10-41 inches. The prevailing winds are from the southwest at an average of 10 miles an hour.

2.2 General History

Located along the "Wilderness Road" of westward expansion, the New River Valley was likely first explored by Europeans in the 1650s. Settlement began in the 1700s and by necessity it was along the New River or its tributaries. Contention over area and resources also resulted in several Indian raids in the late 1700s. Later efforts to control waterways and transportation routes brought several Civil War battles to the New River Valley.

Man-made, intentional flooding is prominent in New River Valley history. The first area settled in the NRV was settled by German "Dunkards," and so the area in Pulaski County became known as "Dunkards Bottom[land]." That land was later permanently inundated following the construction of Claytor Dam by Appalachian Power Company.

2.3 Population and Economy

The New River Valley's population was 165,145 in 2000, an 8.2% increase from 1990. Rapid population growth is occurring in the Counties of Floyd and Montgomery. The highest population densities are in the City of Radford, and the Counties of Montgomery and Pulaski. As indicated in Table 2-1 (below), since 2000, Giles and Pulaski Counties and the City of Radford have lost a portion of their population. This population decrease is mostly likely attributable to a loss of industries from the local region, as well as from Southwestern Virginia as a whole. At least part of the population increase in Montgomery County may be attributable to the location of new industries in that area, along with the presence of Virginia Tech. Figure 2-9 illustrates the population trends.

Table 2-1. Population for NRV Localities

Locality	Population			Numeric Change		Percent Change	
	1990	2000	2010	1990-2000	2000-2010	1990-2000	2000-2010
Floyd County	11,965	13,874	15,279	1,909	1,405	16.0%	10.1%
Floyd Town	396	432	425	36	-7	9.1%	-1.6%
Giles County	16,366	16,657	17,286	291	629	1.8%	3.8%
Glen Lyn	170	151	115	-19	-36	-11.2%	-23.8%
Narrows	2,082	2,111	2,029	29	-82	1.4%	-3.9%
Pearisburg	2,064	2,729	2,786	665	57	32.2%	2.1%
Pembroke	1,064	1,134	1,128	70	-6	6.6%	-0.5%
Rich Creek	670	665	774	-5	109	-0.7%	16.4%
Montgomery County	73,913	83,629	94,392	9,716	10,763	13.1%	12.9%
Belview CDP[+]	---	---	891	---	---	---	---
Blacksburg	34,590	39,573	42,620	4,983	3,047	14.4%	7.7%
Christiansburg	15,004	16,947	21,041	1,943	4,094	12.9%	24.2%
Elliston-Lafayette CDP	1,243	1,241	1,351[#]	-2	110	-0.2%	8.9%
Merrimac CDP	1,713	1,751	2,133	38	382	2.2%	21.8%
Plum creek CDP	---	---	1,524	---	---	---	---
Prices Fork CDP	---	---	1,066	---	---	---	---
Riner CDP	---	---	859	---	---	---	---
Shawsville CDP	1,260	1,029	1,310	-231	281	-18.3%	27.3%

Locality	Population			Numeric Change		Percent Change	
	1990	2000	2010	1990-2000	2000-2010	1990-2000	2000-2010
Pulaski County	34,496	35,127	34,872	631	-255	1.8%	-0.7%
Allisonia CDP	---	---	117	---	---	---	---
Belspring CDP	---	---	256	---	---	---	---
Draper CDP	---	---	320	---	---	---	---
Dublin	2,012	2,288	2,534	276	246	13.7%	10.8%
Fairlawn CDP	2,399	2,211	2,367	-188	156	-7.8%	7.1%
Hiwassee CDP	---	---	264	---	---	---	---
Parrot CDP	---	---	435	---	---	---	---
Pulaski	9,985	9,473	9,086	-512	-387	-5.1%	-4.1%
Snowville CDP	---	---	149	---	---	---	---
City of Radford	15,940	15,859	16,408	-81	549	-0.5%	3.5%
New River Valley	152,680	165,146	178,237	12,466	13,091	8.2%	7.9%
Virginia	6,189,197	7,078,515	8,001,024	889,318	922,509	14.4%	13.0%

Sources: U.S. Census Bureau and Weldon Cooper Center for Public Service
+ Census designated places (CDP)
# Elliston CDP (902) and Lafayette CDP (449) combined, they are listed separately in the 2010 Census.

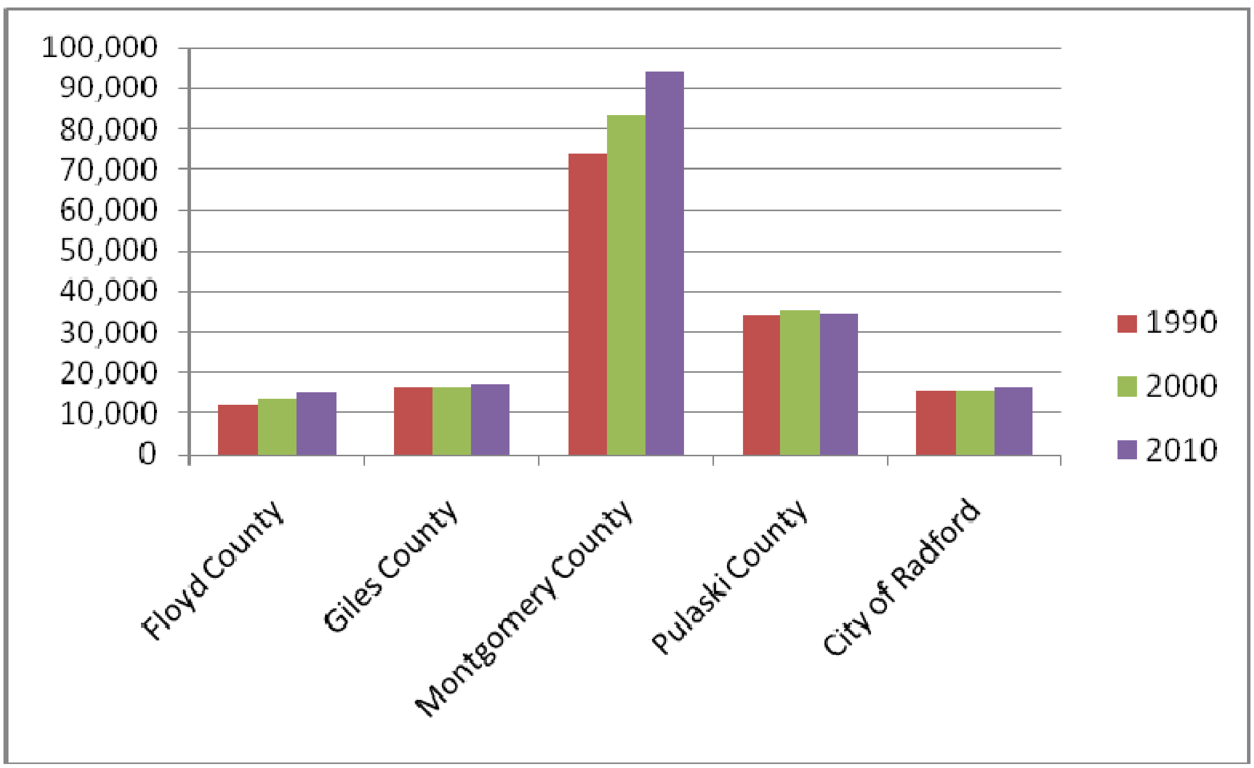


Figure 2-9. Population Trends in the New River Valley

The New River Valley is a dynamic area of industry and trade, due in part to its location within a day's drive to approximately three-quarters of the nation's major markets. The scenic vistas, historical and cultural attractions, education centers, transportation access and other qualities inherent to the area are drawing tourists and businesses to this steadily growing valley. The growth and interconnectivity were confirmed in June 2003 by the designation of the Blacksburg-Christiansburg-Radford area as a Metropolitan Statistical Area.

Despite economic growth, the NRV residents' incomes still lag substantially behind the Virginia average. Moreover, the NRV economy is especially vulnerable to global pressures, given the NRV's continuing dependence on traditional manufacturing jobs. Traditionally, NRV unemployment rates are higher than the state average as well. See Table 2-2 for a summary of key economic data.

Table 2-2. Income and Employment Characteristics in the NRV

Locality	2007 Median Household Income	2000 Per Capita Income	2007 Poverty Rate	May 2009 Unemployment Rate	2007/08 Fiscal Stress
Floyd County	$39,478	$16,345	12.9%	7.7%	78
Giles County	$41,186	$19,396	11.4%	9.6%	55
Montgomery County	$42,029	$17,077	19.9%	7.1%	65
Pulaski County	$40,427	$18,973	14.1%	12.4%	50
City of Radford*	$24,654	$14,289	6.9%	9.6%	39
New River Valley	N/A	$17,284	N/A	8.8%	N/A
Virginia	$59,575	$23,975	9.9%	7.0%	N/A

Sources: U.S. Census Bureau Fact Sheets. 2000 Census. Virginia Employment Commission. Report on the Comparative Revenue Capacity, Revenue Effort, and Fiscal Stress of Virginia's Counties and Cities 2007/2008, Commission on Local Government, 2010.

2.4 Housing

As of the 2000 Census, the New River Valley had about 70,000 housing units. The vast majority of these units were owner-occupied except for college housing around Virginia Tech and Radford University. Median rent varied from about $375 in Giles County to $535 in Montgomery County (Table 2-3).

Table 2-3. 2000 General Housing Characteristics

Locality	Occupied Housing Units			Median Value		Vacancy Rate	
	Total	Owner	Renter	Owner	Renter	Owner	Renter
Floyd County	5,791	4,738	1,053	$79,700	$407	1.0%	6.1%
Giles County	6,994	5,526	1,468	$69,200	$375	1.3%	6.7%
Montgomery County	30,997	17,093	13,904	$114,600	$535	1.2%	3.8%
Pulaski County	14,643	10,780	3,863	$80,000	$382	1.2%	7.3%
City of Radford	5,808	2,585	3,224	$95,100	$437	1.0%	5.2%
New River Valley	64,234	40,722	23,512	$93,981	$478	---	---

Source: 2000 Census.

About 13% of the NRV housing units are mobile homes (Table 2-4), some of which tend to be clustered in floodplains. For example, the Shawsville-Elliston-Lafayette area, much of which is prone to flooding, has the fourth highest concentration of mobile homes in Virginia.

Table 2-4. Mobile Homes in the NRV

Locality	Total Housing Units	Mobile Homes	% Mobile Homes
Floyd County	8,311	2,076	25.0%
Floyd Town	257	21	8.2%
Giles County	7,732	1,236	16.0%
Glen Lyn	57	0	0.0%
Narrows	970	22	2.3%
Pearisburg	1,284	85	6.6%
Pembroke	498	90	18.1%
Rich Creek	319	3	0.9%
Montgomery County	32,527	4,281	13.2%
Blacksburg	13,635	522	3.8%
Christiansburg	7,408	741	10.0%
Elliston-Lafayette CDP	560	248	44.3%
Merrimac CDP	952	309	32.5%
Shawsville CDP	460	217	47.2%
Pulaski County	16,325	1,980	12.1%
Dublin	970	14	1.4%
Fairlawn CDP	1,071	109	10.2%
Pulaski	4,547	205	4.5%
City of Radford	6,137	172	2.8%
New River Valley	69,484	9,039	13.0%
Virginia	2,904,192	185,282	6.4%

Source: 2000 Census

As highlighted in Table 2-5 below, many of the homes in the NRV were built prior to the original flood mapping by the National Flood Insurance Program in the 1970s.

Table 2-5. Year Housing Structures Were Built in the NRV

Year Built	Floyd County	Giles County	Montgomery County	Pulaski County	City of Radford	Virginia
1990 to March 2000	3.8%	2.5%	2.6%	1.7%	0.3%	2.5%
1995 to 1998	8.2%	4.8%	9.8%	6.5%	4.3%	8.1%
1990 to 1994	10.5%	6.6%	10.1%	4.9%	10.0%	9.4%
1980 to 1989	14.8%	12.6%	22.1%	12.5%	19.6%	19.6%
1970 to 1979	18.9%	17.9%	25.3%	24.0%	16.8%	19.6%
1960 to 1969	13.0%	11.7%	11.5%	14.9%	15.3%	13.9%
1950 to 1959	6.8%	14.7%	7.6%	12.3%	10.4%	11.2%
1940 to 1949	5.0%	14.5%	4.4%	10.5%	11.0%	6.5%
1939 or earlier	19.0%	14.8%	6.8%	12.8%	12.3%	9.1%
Subtotal: Built prior to 1979	**62.7%**	**73.5%**	**55.5%**	**74.4%**	**65.9%**	**60.4%**

Source: 2000 Census.

2.5 Critical Infrastructure

Critical infrastructure in the New River Valley includes:

- Major transportation routes (US I-81, US Routes 11 and 460, and VA Routes 8, 100, and 114)
- Schools (including daycare/preschool, K-12, the New River Community College, Radford University and Virginia Tech)
- Emergency and public service facilities (hospitals, nursing homes, physicians offices, fire and rescue buildings, public administration buildings
- Utilities (water and wastewater plants, transmission lines for electric, gas and telecommunications)
- Major employers (Table 2-6) and employment centers (New River Valley Shopping Mall, Virginia Tech and Virginia Tech's Corporate Research Center, Radford Army Ammunition Plant, Radford University, New River Community College, and local industrial parks)
- Hazardous materials facilities

An assessment of the critical infrastructure in the NRV can be found in Chapter 4: Hazard Identification and Risk Assessment.

Table 2-6. Ten Largest Employers in the NRV – 1st Quarter 2009

Employer	Type	Size
Virginia Tech and Virginia Tech Cooperative Extension Office	Educational Services	1000+
Montgomery County School Board	Educational Services	1000+
Volvo Group North America, Inc.	Transportation Equipment Manufacturing	1000+
Radford University	Educational Services	1000+
Alliant Techsystems, Inc.	Merchant Wholesalers, Durable Goods	1000+
Wal Mart	General Merchandise Stores	1000+
Moog, Inc.	Electrical Equipment, Appliance, and Component Manufacturing	1000+
Echosphere Corporation	Administrative and Support Services	1000+
Pulaski County School Board	Educational Services	1000+
Carillion New River Valley Medical Center	Hospitals	500-999

Source: Virginia Employment Commission, Quarterly Census of Employment and Wages (QCEW)

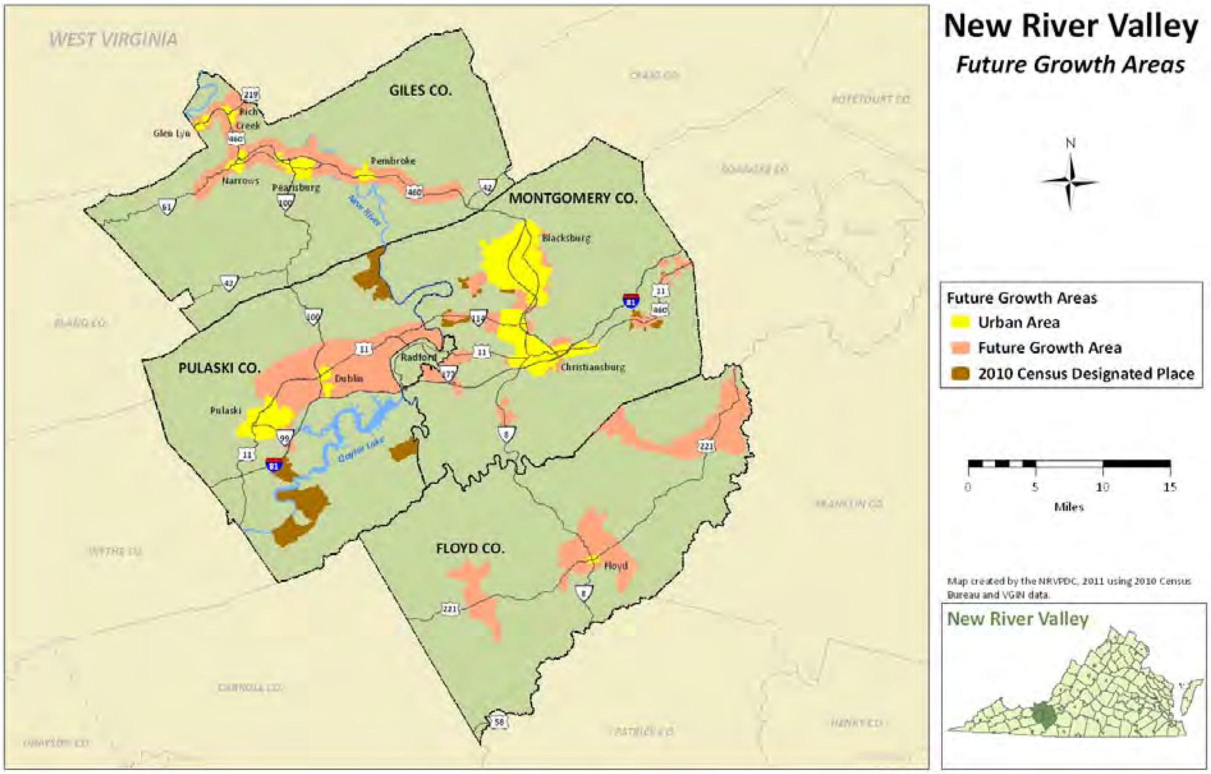
All localities include an assessment of their capital assets in their annual financial report. While this assessment is valuable to determine the value of the infrastructure owned by the locality, it does not indicate different types of infrastructure (e.g., specific buildings, equipment, water/sewer lines, or telecommunications) or the locations of this infrastructure. The

Governmental Accounting Standards Statement #34 does set a precedent to clarify assets of local governments in their fiscal reports, but these standards do not include a list of specific infrastructure. For future analysis, it will prove a valuable asset to have public infrastructure mapped to identify areas where infrastructure is potentially affected by hazards and the potential cost associated with repairing/replacing the infrastructure damaged. In general, the greatest natural hazard threats to interstates and primary roads tend to be severe winter weather, earthquakes (especially bridges) and rockslides (often a secondary effect of flooding or earthquake.) Natural hazards affecting schools varies with location, but include flooding, severe winter weather, and earthquakes. Water and wastewater systems are most vulnerable to flooding hazards, since they tend to be located near water sources. Hospitals, rescue buildings, and gas pipelines tend to be most sensitive to earthquakes, due to the delicate nature of equipment and sensitivity to movement. At least two major employers, the Radford Army Ammunition Plant (Alliant-Tech) and Hoechst-Celanese also own property within the floodplain.

Other important, though less vital facilities, include historic properties such as Smithfield Plantation, Glencoe Museum, and Blue Ridge Scout Reservation, one the of the largest Boy Scout reserves in America. Key natural areas include the Jefferson and Washington National Forest, Mountain Lake Conservancy, Claytor Lake State Park, Whitt-Riverbend Park, Bissett Park, Blue Ridge Parkway, Appalachian Trail, New River Trail State Park, Buffalo Mountain Preserve, as well as Nature Conservancy lands and other lands in trust.

2.6 Future Growth Areas

In their comprehensive plans, all four counties in the NRV have identified areas for higher density development in the future, or “growth areas.” Figure 2-10 is a schematic of these areas, as well as the urban areas and “villages” or census designated places. In principal, these areas have or will have significant infrastructure, including roads, water and wastewater service to support this growth. Table 2-7 indicates the most recent comprehensive plans adopted by each locality, as well as the last date of review of those plans.



Source: US 2010 Census and VGIN

Figure 2-10. Future Growth Areas in the NRV

Table 2-7. NRV Comprehensive Plans

Locality	Last Adoption	Last Review
Floyd-Floyd County	2011*	N/A
Giles County	2005	N/A
Glen Lyn	2001	
Narrows	2001	
Pearisburg	2007	N/A
Pembroke	2003	
Rich Creek	2008	N/A
Montgomery County	2004	2010
Blacksburg	2010	2010
Christiansburg	2003	2007
Pulaski County	2010	N/A
Dublin	1999	
Pulaski	2004	
City of Radford	2009	N/A

* Anticipated adoption, currently undergoing update

Growth in the region varies from county to county. Population growth is occurring primarily in Floyd and Montgomery Counties. In Floyd County, growth cycles between new families and retired individuals moving into the area. This cycle is generally reflected in the school-aged population – it grows and then flatlines. New residents in Floyd County are able to enjoy a rural way of life, while still having access to high-quality technology that may not be available in other areas. Additionally, new residents in the County are visitors that end up migrating to the area due to its music, arts, and other cultural attractions. The growth in Floyd is not focused in any particular area of the county. Based on current land use regulations in the county, most growth is considered rural residential with homes on 1-10 acre lots.

Unlike Floyd County, the growth in Montgomery County's population is largely attributable to the presence of Virginia Tech with its direct and associated job opportunities. Montgomery County's growth is focused primarily within the Towns of Blacksburg and Christiansburg, as well as within the six villages of Riner, Elliston & Lafayette, Price's Fork, Belview, Plum Creek, and Shawsville.

Giles County has experienced a slight decline in its population since the 2000 Census. Despite this fact, Giles County is the only local government in the region to have actively pursued infrastructure development ahead of other development. The County has pursued water and sewer construction projects in several of its rural communities in anticipation of future population growth. This is a unique perspective in the NRV, as Giles County looks to funnel growth into specific areas of the county in the future.

Since the 2000 Census, Pulaski County has also experienced population declines, most likely due to loss of heavy industry in the county. The County is looking to the future and has designated the areas along Route 11 north of Interstate 81 between the Towns of Pulaski and Dublin as the primary area for future development. This area of the county has access to critical transportation infrastructure, as well as other community facilities, such as schools. Additionally, the community of Fairlawn has seen some growth as a central location for residents commuting throughout the region and the availability of commercial infrastructure to support residents.

Chapter 3. Planning Process

3.1 Planning Team

Since 2009, the NRVPDC has been working with Radford University to update the *New River Valley Hazard Mitigation Plan.* The NRVPDC is responsible for organizing and coordinating the steering committee and working groups. Additionally, the NRVPDC is responsible for the required public involvement process for plan adoption. Radford University's Geography Department, under the leadership of Dr. Bernd Kuennecke, has been collecting, analyzing, and producing data for the Hazard Identification and Risk Assessment. The Radford team has developed unique and in-depth analysis of several hazards of particular concern in the region (i.e., rockfall, landslide, and flooding).

The Hazard Mitigation Steering Committee is comprised of a dedicated group of professionals from across the region. Participants on the committee include participating locality staff, representatives from state and federal agencies, and other interested local stakeholders. Nichole Hair, planning staff from the Town of Christiansburg, has served as the steering committee chairperson for this project. The steering committee oversaw the progress of the HIRA development, the work being done by the working groups, and the public involvement process. In addition to these supervisory duties, the steering committee provided valuable input on the plan development and identifying regional projects to include in the plan.

The working groups met once in most cases, twice in the case of geologic hazards, to provide expert input on the HIRA information and on the development of the mitigation objectives and strategies. Local topical experts were invited to the working groups and steering committee members were also encouraged to attend these meetings.

Figure 3-1 below illustrates the organizational structure of the planning team.

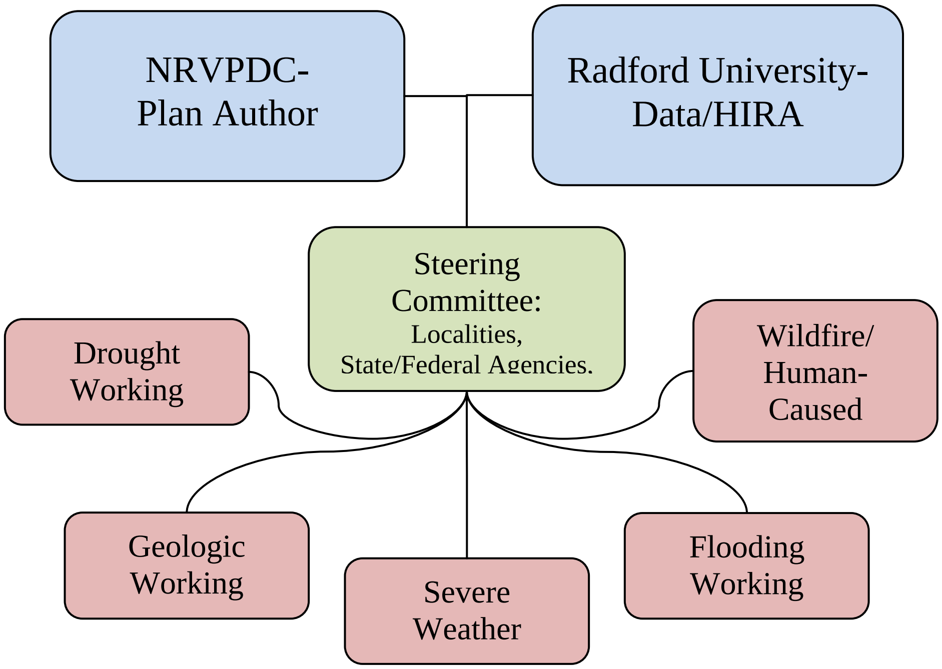


Figure 3-1. NRV Planning Team Organization

3.2 Planning Process

The original New River Valley Hazard Mitigation Plan was drafted in 2004 and approved by FEMA in 2005. In 2009, Radford University received FEMA funds to partner with the NRVPDC to conduct the five-year update of the Plan. A regional kick-off meeting was held at the New River Valley Competitiveness Center on June 30, 2009. At this meeting, the NRVPDC and Radford University reviewed the process for updating the plan, as well as outlining how the old plan would be improved upon via more in-depth data and mapping.

The steering committee continued to meet monthly from July 2009 to November 2009. All meeting agendas and sign-in sheets for steering committee and working group meetings are provided in Appendix 1. From January 2010 to July 2010, working groups came together to focus on one hazard at a time. Prior to each meeting, local topical experts were identified and invited to participate in the meeting. The meetings all followed a standard agenda. First the data was presented and participants had an opportunity to comment and provide input on the data and/or mapping. Second, the previously determined mitigation goals were reviewed and discussion was open for any changes or modifications to the goals based on the data provided. Following this review, the group then brainstormed mitigation objectives and strategies to include in the plan. The final component of each working group meeting was a capabilities and resources assessment. Participants were asked to identify local resources and partners that could or should participate in the proposed mitigation strategies.

Following the completion of the working group meetings in July 2010, the steering committee resumed their monthly meetings. These meetings provided the steering committee the opportunity to review and approve the data/mapping, conduct plan review, identify regional projects, and oversee the public involvement process.

3.3 Plan Participation

Localities are required by FEMA to meet standards of participation in plan development. Meeting these standards makes them eligible to apply for and receive mitigation funding. For the NRV plan, participating localities were required to meet at least two of the optional requirements and both of the required standards. The following are the optional requirements: 1) attendance at a minimum of three steering committee and/or working group meetings, 2) submission of requested data, 3) review and comment on draft materials, 4) host opportunities for public involvement, or 5) link to the project website from the locality website. After a substantial number of the steering committee and working group meetings had been completed, NRVPDC staff worked with localities that had not been present at a minimum of three meetings to ensure that they had fulfilled the participation requirements. Most of the localities that had not been attending meetings were towns in Giles County that have limited staff time and resources. On August 18, 2010, NRVPDC staff traveled to Giles County to present the progress to date and discuss with these towns whether and how they could participate going forward.

In addition to meeting at least two of the previously discussed standards, all participating localities were required to adopt at least one specific project and formally adopt the plan. All adoption resolutions are included in Appendix 2.

Table 3-1 below indicates the participation of all localities in the region, as well as other active members of the steering committee. Floyd, Giles, Montgomery, and Pulaski Counties, the City of Radford, and the Towns of Christiansburg, Blacksburg, Glen Lyn, Narrows, Pearisburg, Pembroke, Pulaski, and Rich Creek have all elected to participate in the update of the plan. Table 3-2 below indicates plan participation in both the 2005 original plan and the 2011 update. The Town of Dublin has chosen not to participate in the regional plan due to staff limitations and indicating that they prefer Pulaski County to handle any necessary mitigation projects. While adopting the plan in 2005, the Town of Floyd has elected not to participate in the 2011 update of the regional hazard mitigation plan. The Town cited severe limits on town staff as well as an extremely limited town size, the smallest in the Commonwealth, as their primary reasons for not participating. Beyond those changes, no other changes in participation occurred between 2005 and 2011.

Table 3-1. Plan Participation

Steering Committee Member	Representing	Participation			
		Steering Committee	Working Group	Other Participation	Not Participating
Nichole Hair – Chairperson	Town of Christiansburg	X	X	X	
Lydeana Martin	Floyd County			X	
	Town of Floyd				X
Craig Whittaker	Giles County	X	X	X	
	Town of Glen Lyn				X
Jesse Parsell	Town of Narrows			X	

Steering Committee Member	Representing	Participation			
		Steering Committee	Working Group	Other Participation	Not Participating
Rick Tawney	Town of Pearisburg				
Perry Moore	Town of Pembroke				
Gary Eaton	Town of Rich Creek				
Jamie MacLean	Montgomery County	X	X	X	
Karen Drake	Town of Blacksburg	X		X	
Bobby Clark	Pulaski County	X	X	X	
	Town of Dublin				X
John Hawley	Town of Pulaski				
Andrew Foy	City of Radford	X	X	X	
Stan Crigger	VDEM	X	X		
Willie Richardson	VDEM	X	X		
Peter Corrigan	National Weather Service	X	X		
Todd Branscome	Radford University- Office of Emergency Preparedness		X		
Kevin Byrd	New River Valley Planning District Commission	X	X		
Jerry Stenger	University of Virginia- Climatology Office		X		
Gary Coggins	VDH- New River Health District		X		
Barry Robinson	VCE- Montgomery County		X		
David Spears	VDMME		X		
Robbie Coates	VDEM		X		
Jerry Higgins	Blacksburg, Christiansburg, VPI Water Authority				
Chuck Dietz	VDCR		X		
Brad Wright	VDOF		X		

Table 3-2. Locality Participation 2005 and 2011

Locality	2005 Participation	2011 Participation
Floyd County	Yes	Yes
Floyd, Town	Yes	No
Giles County	Yes	Yes
Glen Lyn, Town	No	No
Narrows, Town	Yes	Yes
Pearisburg, Town	Yes	Yes
Pembroke, Town	Yes	Yes
Rich Creek, Town	Yes	Yes
Montgomery County	Yes	Yes
Blacksburg, Town	Yes	Yes
Christiansburg, Town	Yes	Yes
Pulaski County	Yes	Yes
Dublin, Town	No	No
Pulaski, Town	Yes	Yes
City of Radford	Yes	Yes

All meetings of the steering committee and working groups were open to the public as an opportunity for interested businesses, non-profit agencies, and individuals to participate. Meeting dates and times were published in the NRVPDC's bimonthly newsletter, both in print and electronically, as well as on the project website. Periodic updates were also published in the newsletter. The NRVPDC newsletter and project website were the two primary means of communicating about the planning process to those interested parties not directly involved in the process.

At the beginning of the planning process several key businesses in the region, including electric and gas utilities and the operators of the Radford Army Ammunition Plant, were invited to participate on the steering committee. Representatives from some of these businesses participated in a single meeting, but chose not to continue participation. During the plan review phase, invitations were sent to local chambers of commerce and their members to review and provide comment on the plan. Additionally, a brief overview of the plan and the invitation to comment on the plan was included in chamber of commerce newsletters. Adjacent planning district commissions were individually invited to review the draft plan and provide comment. The steering committee developed a list of local non-profits that would be interested in the results of the plan and those non-profits were also invited to review and comment on the plan.

3.4 Plan Update

For the five-year update for the New River Valley Hazard Mitigation Plan, the planning team and steering committee reviewed and updated each chapter of the plan. the general plan chapters, such as the Introduction, Community Profile, Planning Process, and Plan Maintenance chapters were drafted and provided to the steering committee for review. Each of the Hazard Identification and Risk Assessment (HIRA) sections were revised based on current information and the updated analysis conducted by Radford University. The working groups discussed both historical information focused on each hazard as well as brainstorming new mitigation objectives and strategies. These new strategies are included in each hazard section and in the mitigation strategy chapter. The Community Summaries chapter was updated through discussions with each community's representative to the steering committee. Through these discussions, new information was added where necessary and specific mitigation projects identified by the community were included.

The planning team reviewed numerous local documents to include in various sections of the updated plan, including but not limited to local comprehensive plans, emergency operations plans, and capital improvement plans. The information gleaned from these sources was included as data in the HIRA chapter, as well as providing some of the basis of the capabilities assessment section. The local comprehensive plans were particularly useful in determining proposed areas for future growth and areas where hazards may have the most impact. A summary of plans reviewed are presented in Table 3-3.

Table 3-3. Plans Reviewed during Planning Process

Locality	Emergency Operations Plan	Floodplain Management Plan	Stormwater Management Plan	Comprehensive Plan	Open Space Plan	Watershed Protection Plan	Capital Improvement Plan
Floyd County	*	*	*	√	*	*	**
Floyd, Town	*	*	*	√	*	*	X
Giles County	*	*	*	√	*	*	√
Glen Lyn, Town	*	*	*	√	*	*	**
Narrows, Town	*	*	*	√	*	*	**
Pearisburg, Town	*	*	*	√	*	*	**
Pembroke, Town	*	*	*	√	*	*	**
Rich Creek, Town	*	*	*	√	*	*	**
Montgomery County	√	*	*	√	√	*	√
Blacksburg, Town	*	*	*	√	√	*	√
Christiansburg, Town	√	*	*	√	*	*	**
Pulaski County	√	*	*	√	*	*	**
Dublin, Town	√	*	*	√	*	*	√
Pulaski, Town	*	*	√	√	*	*	**
Radford, City	*	*	*	√	*	*	**

* Limited information was available
** Most plans are older and have not been updated
√ = Reviewed
X = Not available for review

3.5 Public Involvement

Public input was solicited throughout the planning process. All steering committee and working group meetings were placed on the NRVPDC calendar published in the bi-monthly newsletter and were open to the public. A project website was created at: http://www.nrvpdc.org/HazardMitigation/HazardMitigationPlanning.html. This website allows the public to view not only parts of the plan, but also resources shared with the steering committee and working groups at meetings. This site also provides an input form for those members of the community to provide their input, even if they are unable to attend the public meetings.

Two rounds of public meetings occurred in conjunction with the drafting of this plan. In September 2010, the NRVPDC hosted a series of five public open house meetings for the public to review and comment on the data and mapping to be included in the plan. An open house was held in each of the four counties and the city to facilitate access for the public. At these open house meetings, a brief overview presentation was given at the top of the hour to provide participants a context for the material they were reviewing. The mapping to be included in the plan was displayed around the room for participants to examine and comment on. Comment sheets were provided as well as the project website address for participants to use for their comments. A second round of public meetings was held in February 2011 to provide community members the opportunity to comment on the entire plan before its official adoption by localities. Copies of the meeting announcements and press releases are included in Appendix 3.

Chapter 4. Hazard Identification and Risk Assessment (HIRA)

4.1 Introduction

The New River Valley is susceptible to a wide range of natural hazards. This chapter discusses each of the natural hazards possible in the region, including history, risk assessment and vulnerability, and past or existing mitigation. The hazard risk assessment and vulnerability looks specifically at two criteria: locations where the hazard is most likely to have negative impacts and the probability and severity of the hazard should it occur. When information is available, the specific impacts of a hazard is discussed, sometimes based on the usual impact in the region. These sections haven been completely revised since the 2005 plan to include additional, more helpful information.

4.1.1 Hazard Identification

Although hazards are classified in various ways, this plan places hazards into one of six categories: drought, geologic, flooding, severe weather, wildfire, and human-caused. Both geologic and severe weather hazards cover more than one specific event or situation. Geologic hazards include landslides, earthquakes, rockfall and karst. Severe weather hazards include freezing temperatures, non-rotational winds, snowfall, ice storms and tornados. Each hazard section includes mapping to identify areas with potential impacts.

4.1.2 Risk Assessment

Risk assessment seeks to define the probability of events and the likely consequences of events. The risk assessment and vulnerability presented herein is a result of an extensive analysis of historic event data, scholarly research and field work. The risk assessment and vulnerability portion of this plan was conducted by Radford University's Geography Department. For more information regarding this data and information please contact Dr. Bernd Kuennecke at bkuennec@radford.edu.

The box below defines some common terms used throughout this HIRA section, as well as the remainder of the plan.

Definitions

- Hazard: an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.
- Mitigation: sustained action taken to reduce or eliminate the long-term risk to human life and property from natural hazards and their effects; the emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.
- Natural hazard: hurricanes, tornados, storms, floods, high or wind-driven waters, earthquakes, snowstorms, wildfires, droughts, landslides, and mudslides.
- Hazard identification: the process of defining and describing a hazard, including its physical characteristics, magnitude and severity, probability and frequency, causative factors, and locations or areas affected.
- Risk: The potential losses associated with a hazard, defined in terms of expected probability and frequency, exposure, and consequences.
- Vulnerability: The level of exposure of human life and property to damage from natural hazards.

Source: *Planning for Post-Disaster Recovery and Reconstruction*, FEMA and APA, 1998.

4.1.3 Mitigation

Many times mitigation seeks to prevent the impacts of hazards on life and property. The primary goal of mitigation is to learn to live within the natural environment. This plan reviews past mitigation efforts in the New River Valley and identifies both strategies and specific projects that could further mitigate these impacts.

Mitigation options fall generally into six categories: prevention, property protection, natural resource protection, emergency services, structural projects and public information. Prevention projects are those activities that keep hazard areas from getting worse through effective regulatory planning efforts, such as comprehensive planning, building code update and enforcement, burying utility lines and water source planning. Property protection activities are usually undertaken on individual properties or parcels with coordination of the property owner, such as elevation, relocation and acquisition of frequently flooded or damaged structures, eliminating fuel sources surrounding the property, installing rain catchment systems and purchasing additional insurance. Natural resource protection activities seek to preserve or restore natural areas or natural functions of floodplain and watershed areas. They are often implemented by parks, recreation, or conservation agencies or organizations. Emergency services measures are taken during a hazard event to minimize its impact. These measures can include response planning, regional coordination and collaboration and critical facilities protection. Structural projects include activities associated with building new or additional infrastructure or features to minimize impacts from a hazard. The final category of public information is possibly the most important, empowering residents to take action to protect themselves and their property in the event of a hazard event. This category can include additional information available to the public, such as maps, brochures, and workshops, as well as property specific information included in parcel records.

4.2 Overview of Assessments

Each hazard assessment follows a similar format: introduction, history, risk assessment and vulnerability, past or existing mitigation, and mitigation goals, objectives and strategies. Some hazards include a brief discussion of special hazards areas that may be more prone to experiencing a certain hazard or more likely to be severely impacted by a specific hazard event.

Each identified hazard was prioritized by the steering committee using a standardized worksheet (see Appendix 1). Each hazard was evaluated on a 1-5 scale for frequency and a 1-4 scale for both intensity and area affected. Relative risk was then calculated using these ratings. Table 4-1 below illustrates how the hazards ranked in their relative risk to the region. A more detailed discussion of this risk assessment is included with each hazard section.

Table 4-1. New River Valley Regional Assessment of Relative Risk of Natural Hazards

High	Medium	Low
Freezing Temperatures Flooding High Winds (Non-rotational)	Drought Snowfall Human-caused Ice Storms	Landslides Wildfires Earthquake Rockfall Karst Tornado

4.3 Drought

4.3.1 History

According to the database from the National Climatic Data Center, there have been seven notable drought events since 1990, including several months in 1998, 1999, 2007 and 2008 that drought events were reported.

In the past decade, the New River Valley has experienced two significant droughts that have affected agriculture and water supply in the region. The first of these two recent droughts began in 2000 and continued through the early fall of 2002. Figure 4-1 below depicts the extent of the drought in September 2002, when portions of the region were under extreme and exceptional droughts with impacts predicted for agriculture, water supply and increased fire dangers. The accumulated rainfall deficit was at least 20 inches before precipitation resumed in the fall. The effects of this drought were more dramatic because precipitation deficits occurred in the summer, when vegetation used the moisture before it could recharge the groundwater.

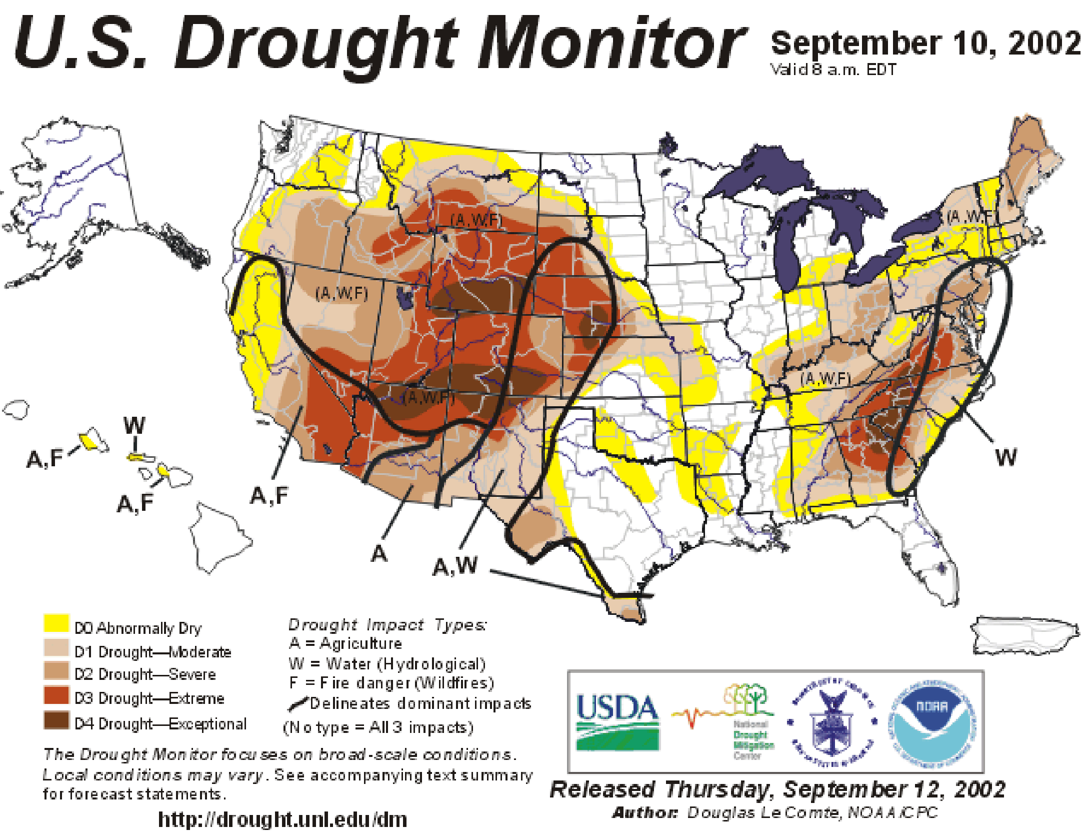


Figure 4-1. Impact Extent during 2000-2002 Drought

The second notable drought in recent years began in early 2007 and ended in early 2009. Figure 4-2 below shows the drought at its most severe for the region. At the time of this map, most of the region is in either severe or extreme drought with impacts predicted for both agriculture and water supplies.

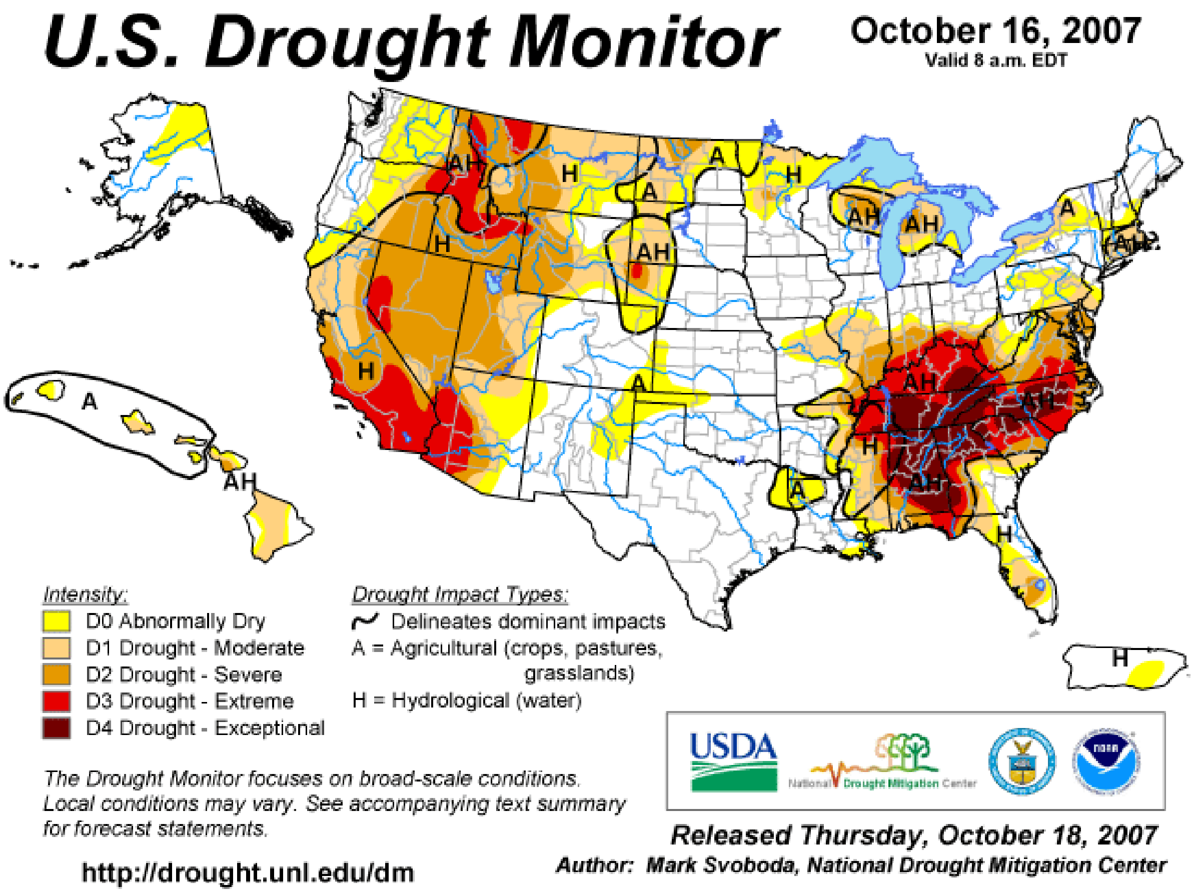


Figure 4-2. Impact Extent during 2007-2009 Drought

Figure 4-3 (below) tracks the regional Drought Monitor levels from January 2000 until May 2009. The two previously discussed droughts are easily observed in this time series data. Table 4-2 provides information on the basis of each drought status indicated in the time series.

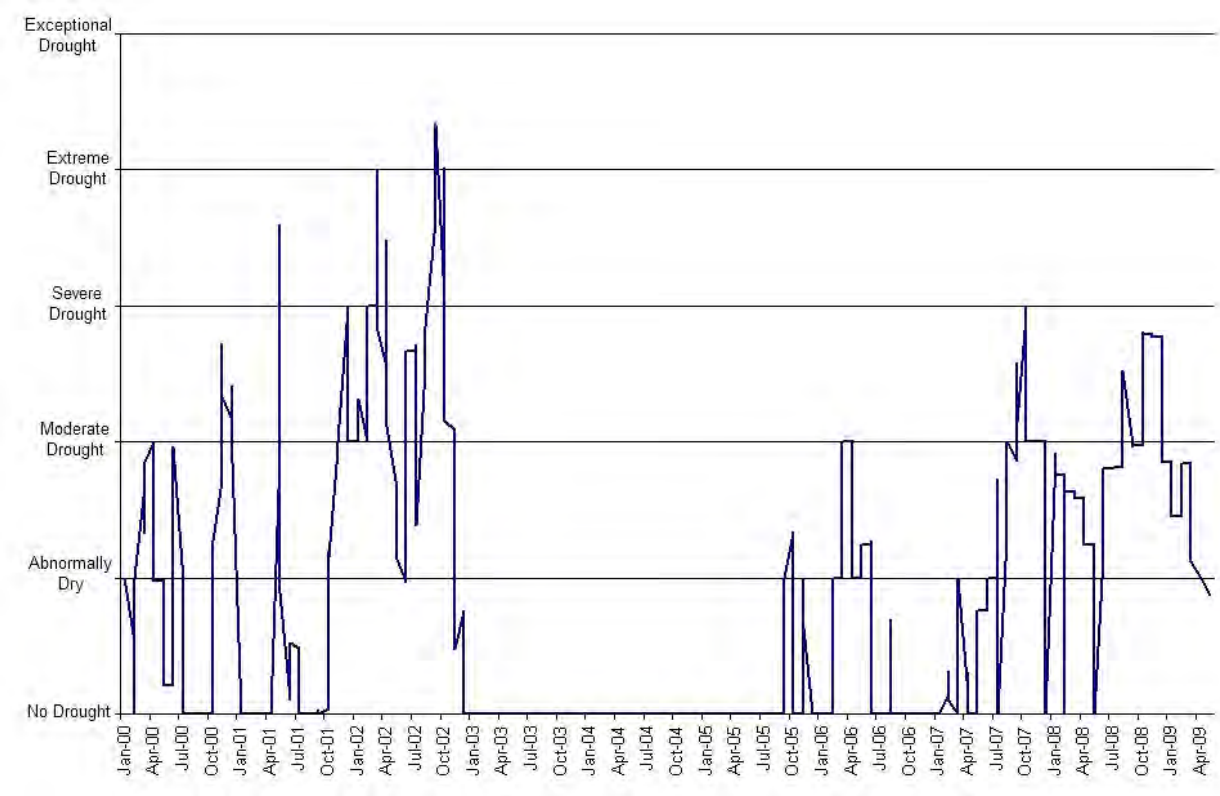


Figure 4-3. Drought Monitor Data: January 2000 – May 2009

Table 4-2. Drought Monitor Status Descriptions

Description	Possible Impacts
Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.
Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.
Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.
Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.
Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.

The Drought Monitor is a joint effort between the US Department of Agriculture (USDA) and National Oceanic and Atmospheric Administration (NOAA) to measure and predict impacts of drought nation-wide. The monitor synthesizes multiple indices and impacts to represent a consensus of federal and academic scientists. The Drought Monitor is released on a weekly basis; archived data is available dating to 2000. This data was downloaded as GIS shapefiles in mid-2009. For weeks when a portion of the region was classified as being in a stage of drought, a weighted average was calculated based on the proportion of the region in each drought stage. This weighted regional average is depicted in the time series above.

While not in a declared drought stage, the NRV has been experiencing very dry conditions during the summer of 2010. Many counties in eastern Virginia are in a declared drought and have applied for assistance from the USDA. During this dry period, Montgomery and Pulaski Counties have also applied for assistance from the USDA for their farmers. Floyd County has not been nearly as hard hit, with corn crops only being somewhat below average.

4.3.2 Risk Assessment and Vulnerability

No place in the world is immune to drought. Rainfall fluctuates year to year, and to experience a year of “below average” precipitation is not uncommon. Recently, a study of drought was published by researchers from Columbia University. Specifically, these scientists were looking for causes of drought in the southeastern United States. Based on climate data, there is a very weak relationship between La Niña events and dry winters in the southeast. Dry summers appear to be caused by more local atmospheric variability that is very difficult to predict. Additionally, these researchers looked at historical precipitation records (i.e., tree-ring records) and found several multi-year droughts, including a 21-year drought in the mid-1700s. The historic drought record indicates that while there have been several notable droughts in recent years, overall the 20th century has been unusually moist.

While considering the relative risk of all hazards possible in the New River Valley, the steering committee considered frequency of the event and severity, as well as the area affected by the hazard. using these considerations, drought was ranked as a moderate risk in the region. the steering committee noted that relative to other hazards, drought occurs occasionally, on average every three to five years, though more severe droughts have been known to last through several consecutive years. In many cases, precipitation deficits occurring during the summer months leading to a drought status are remedied by winter precipitation.

While recent droughts may not be of the magnitude of some historical droughts, it is clear that precipitation shortfalls in the region can pose a serious threat to water supplies, agriculture, and increase wildfire dangers. Wildfire will be discussed in a separate section.

4.3.3 Water Supplies

About 67% of NRV residents receive their water from a public water system; therefore, about 57,000 people are dependent on private springs and wells (see Table 4-3). Based on discussions with local PSA directors, it is assumed that most residents within town limits are on public water supplies and the exceptions to that assumption likely are less than 10 residences in a given town. The well permit data gathered from VDH paints another picture, as seen in Table 4-4 indicating the number of well permits obtained from 2004 to 2009 that are within town boundaries. The public water systems across the NRV are not generally interconnected, leaving systems vulnerable to inadequate supplies. For example, the Giles County Public Service Authority system, which supplies five towns and much of the unincorporated area, has only one primary source (wells).

Table 4-3. Populations with Public and Private Water Sources

Locality	Population (counties w/o Towns)	Public Water	Private Water (Well or Spring)	% On Private Water
Floyd*	13,874	982	12,892	93%
Giles	9,867	2,121	7,746	79%
Glen Lyn	163	163	0	0%
Narrows	2,148	2,148	0	0%
Pearisburg	2,764	2,764	0	0%
Pembroke	1,163	1,163	0	0%
Rich Creek	681	681	0	0%
Montgomery	27,109	5,302	21,808	80%
Blacksburg	41,796	41,796	0	0%
Christiansburg	19,477	19,477	0	0%
Pulaski	23,366	8,901	14,465	62%
Dublin	2,190	2,190	0	0%
Pulaski	8,983	8,983	0	0%
Radford City	16,125	16,125	0	0%
New River Valley	169,976	113,065	56,911	33%

* Floyd Co. population includes the town because PSA is joined.

Table 4-4. Well Permits within Town Boundaries

Town	Number of well permits
Blacksburg	35
Christiansburg	27
Dublin	1
Floyd	8
Glen Lyn	0
Narrows	2
Pearisburg	5
Pembroke	4
Pulaski	17
Rich Creek	1

According to Virginia Department of Health well permits dated between 2004 and 2009, 771 wells were drilled in the NRV. Of those, over 98% were new wells. As Figure 4-4 illustrates, there is a sharp spike in the number of permits filed for wells in 2007 and 2008. The numbers appear to fall in 2009, but data was only available through June 2009 at the time of collection.

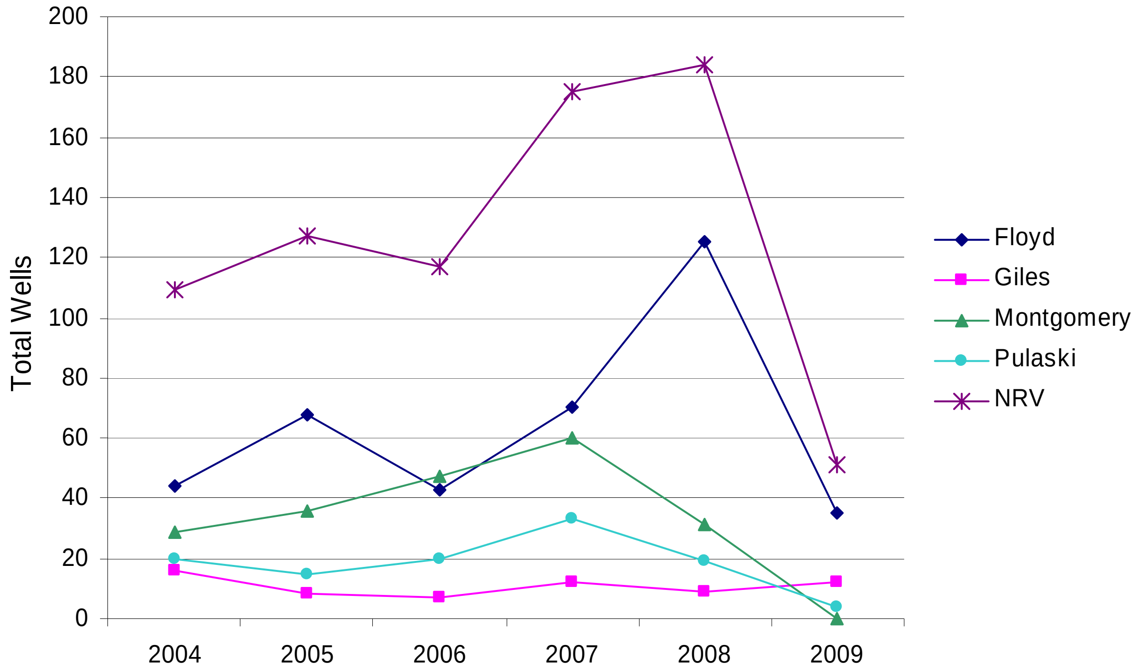
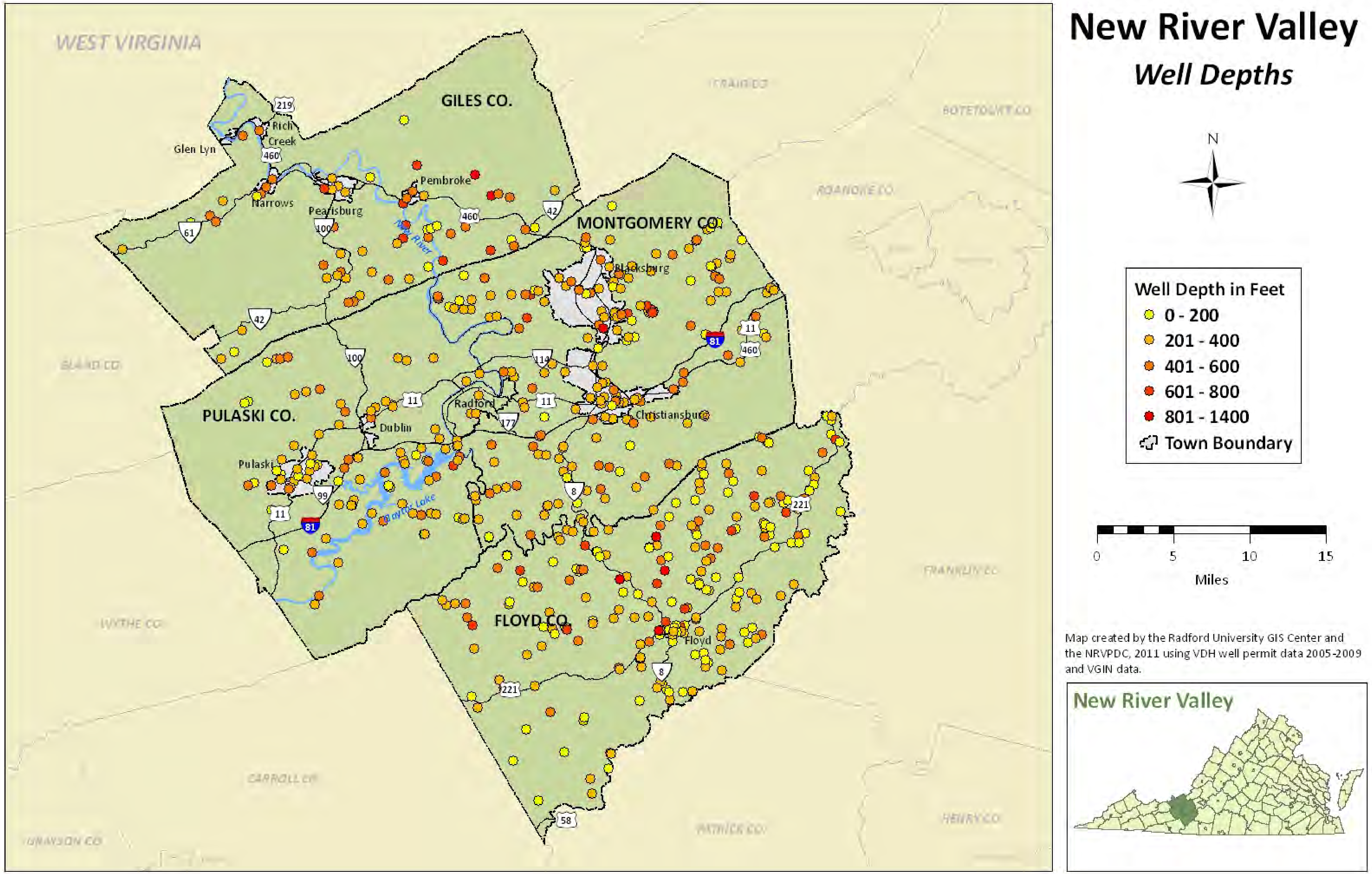


Figure 4-4. Well Permits in the NRV

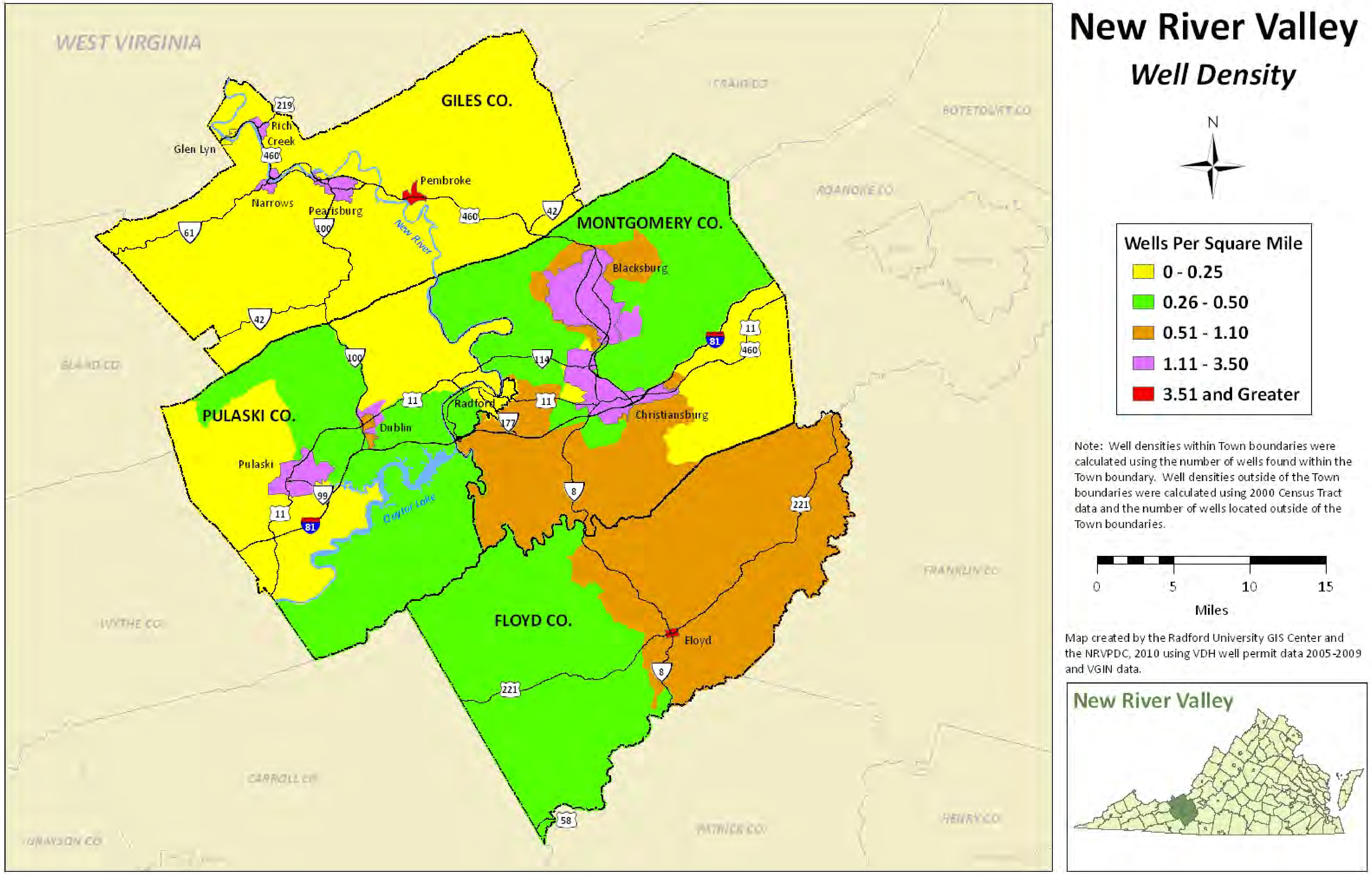
Map 1 below illustrates the distribution of wells throughout the planning district from 2004 to 2009 and the depths of the wells as reported on well permits to VDH.

Map 2 below illustrates the densities of wells per square mile throughout the region. The densities were calculated two ways. First, the density of wells within town boundaries was calculated based on the square miles in town. Second, the density of wells in census tracts throughout the counties was calculated. In areas where census tracts overlapped town boundaries, wells within town and the overlapping area were subtracted from the census data.

Map 1. NRV Well Depths



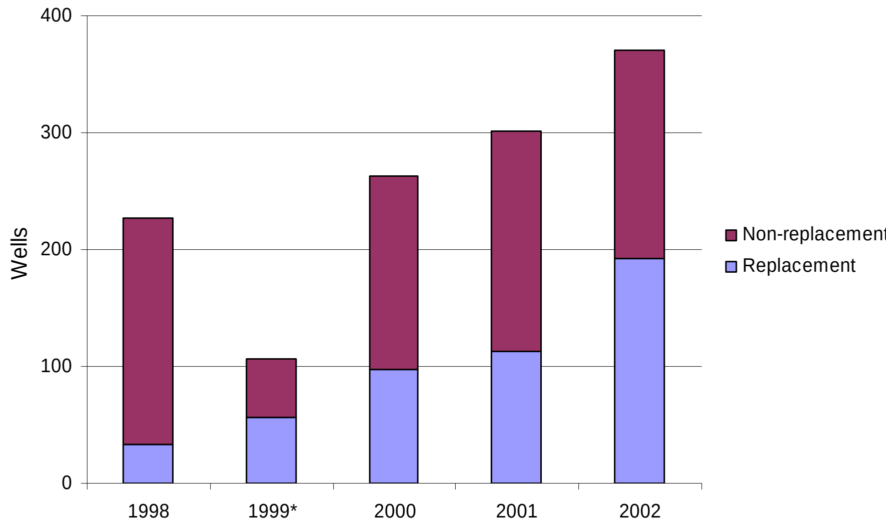
Map 2. NRV Well Density



4.3.4 Special Hazard Area

About 63% of the replacement wells in the NRV from August 1999 to November 2002 were in Floyd County, which is the only NRV jurisdiction in the Blue Ridge physiographic region. Throughout the period more than 43% of well permits in Floyd County were for replacement wells. By the worst part of the drought in 2002, this percentage increased to more than half (* 1999 does not have a full year of data available

Figure 4-5).



* 1999 does not have a full year of data available

Figure 4-5. Wells in Floyd County, 1998-2002

Floyd County had the most total number of well permits filed between 2004 and 2009, exceeded by Montgomery County by only four applications in 2006. During the same time period, Floyd County had the most applications for wells identified as replacement wells for the entire planning district. Based on the proportion of Floyd County's population dependent on private wells for their drinking water, this county's residents require additional consideration in times of drought when their wells might be most susceptible.

4.3.5 Agricultural Losses

Beyond threats to water supplies, the agricultural losses due to drought can be significant in the region. According to the NCDC database, the drought events recorded since 1990 have caused approximately $17 million in agricultural damages. As Table 4-5 demonstrates, agricultural losses for the drought of 2000-2002 were $10 million. Fortunately, the USDA classified all four counties in the NRV as federal drought disaster areas following the 2000-2002 drought. A Secretarial Designation (by the Secretary of Agriculture) requires several very specific conditions be met, specifically that the damages and losses must be due to a natural disaster; and a minimum 30-percent production loss of at least one crop in the county must have occurred. Following this designation, several programs from the Farm Service Agency are initiated including the Disaster Debt Set-Aside Program and a low-interest emergency loan program for producers. Floyd County is again the most vulnerable to drought of the NRV localities, based on the estimates of loss from the USDA shown in Table 4-5.

Table 4-5. Agricultural Losses 2000-2002 Drought

County	# Farm Facilities (developed springs, wells)	Value of Farm Facilities Lost	$ Livestock, Loss of Weight Gain	Total $ Loss
Floyd	560	$300,000	$3,700,000	$4,000,000
Giles	100	$100,000	$1,000,000	$1,100,000
Montgomery	370	$200,000	$2,500,000	$2,700,000
Pulaski	200	$200,000	$2,000,000	$2,200,000
Total	1230	$800,000	$9,200,000	$10,000,000

4.3.6 Other Economic Losses

Beyond the risks posed to water supply and agriculture, the region's tourism industry can be vulnerable to drought conditions. The New River draws tourists from around the area, as well as from outside the region to participate in various water-based activities. Additionally, Mountain Lake (the set for the movie *Dirty Dancing*) attracts tourists during the summer season. Mountain Lake is located on a fault line and periodically empties, especially during drought conditions. In both 2002 and 2008, the lake was virtually empty (Figure 4-6). During the 2008 season, the owners of Mountain Lake placed an emphasis on recreational activities around the resort area that were not water-centered. Despite these efforts, the low lake levels had a significant effect on revenue.

To address the nearly-dry pond at Mountain Lake in 2002, the private owners attempted to pump water back into the lake. They found this to be ineffective, however. Fortunately, heavy rains in 2003 and 2009 re-charged the lake.

Figure 4-6. Mountain Lake, 2002

During the drought of 2000-2002, Chateau Morrisette, a winery and fine dining establishment in Floyd County, suffered the loss of its principal spring.

4.3.7 Past or Existing Mitigation

The existing public water systems themselves, especially those with multiple sources, are one measure of mitigation, adding versatility and reliability to local public water supplies. Four years of water study has explored the possibility of a regional water authority, transmitting water from treatment facilities to users in a large portion of the valley. The City of Radford's water treatment facility and other current sources produce enough water to provide public water to not only the residents of the city, but also to parts of Pulaski, Montgomery, and Floyd Counties. These water systems are either totally unconnected or under-connected. By interconnecting systems, these localities can reliably provide their customers with access to public water, with abundant backup sources of drinking water.

Other mitigation efforts include conservation and rainwater catchment systems. Conservation efforts were largely voluntary until the State Emergency Declaration in September 2002. Rainwater catchment systems have traditionally been personal efforts to provide additional water supply during "normal" years (Figure 4-7). During extended periods without rain, many of the systems can serve as cisterns, with water being delivered by truck from other sources.

(Photo Courtesy of Rainwater Harvesting, Inc.)

Figure 4-7. Rain barrel

New sophistication in rainwater systems is also resulting in larger-scale projects. The Carillion New River Valley Medical Center in Montgomery County constructed a rainwater catchment system to simultaneously reduce stormwater run-off and supply re-use needs. This clay-lined pool collects all stormwater run-off from the medical center and some from the adjacent surgical center to supply recycled water for cooling the building. Since the system became operational in 2007, the Medical Center has recycled over two million gallons of water. These large systems are based on the same principals as the traditional "rain barrels."

4.3.8 Mitigation Opportunities

A complete listing of NRV hazard mitigation goals, objectives, and strategies can be found in Chapter 5: Mitigation Strategy. Below are the goals, objectives, and strategies identified by the drought working group to specifically lessen the impacts of drought in the region.

1. **Minimize economic losses and health risks during droughts.**
    a. *Develop a set of planning tools that mitigate the impacts of drought.*
        i. Improve data and inventory of water users to better assess the vulnerability of water supplies to drought.
        ii. Identify back-up water sources or increase storage capacity for public water systems.
        iii. Develop a system of notification of precipitation predictions that will assist agricultural producers in short-term decision making.
        iv. Pursue MOUs between localities and companies to haul in water as an alternative source of water during drought conditions.
        v. Encourage water providers in the region to take advantage of programs designed to prevent leaks and water losses in their systems.
        vi. Continue efforts to promote interconnections of municipal water systems for use should an emergency situation arise.
    b. *Encourage research and development of prediction capabilities that will assist in decision-making during drought conditions.*
        i. Support the improvement of drought forecasting and predictions available from government sources (i.e., NOAA, NWS).
        ii. Support efforts to develop and improve simulation modeling that provides information regarding all potential impacts and outcomes for decision-makers.
    c. *Promote educational efforts to assist residents in dealing with the impacts of drought.*
        i. Provide information to residents of existing conservation measures and the sliding scale of prescriptive measures to assist in mitigating the impacts of drought.
        ii. Promote educational efforts developed for private well owners about proper care and maintenance of their well, as well as the potential impacts associated with drought.

4.4 Geologic Hazards: Landslides, Rockfall, Karst, and Earthquakes

Geologic hazards, including landslides, rockfall, karst, and earthquakes occur frequently within the New River Valley. In 1897, the region experienced a magnitude 5.8 earthquake centered in Giles County. In this section, each type of geologic hazard will be discussed individually, their history, risk assessment and vulnerability, past mitigation, and mitigation opportunities. At the end of the section goals and objectives specific to geologic hazards will be presented.

4.4.1 Landslides

Two types of sudden and often catastrophic landslide events are common in mountainous areas in Virginia: 1) storm-generated mudslides and debris flows; and 2) highway landslides, rockfalls, and rockslides. Both can have serious potential economic impact and public safety consequences.

1) **Storm-generated debris flows** occur when hurricanes or other storms of high precipitation intensity saturate mountainsides in areas of unstable soil and rock. Once movement is initiated at higher elevations, mud, rock, and other debris rushes down first order mountain streams growing in size and destructive energy. Debris flows are known to have occurred in the New River Valley, as evidenced by ancient debris flow deposits found in many of its tributary drainage systems.

2) **Highway landslides, rockfalls, and rockslides** can be a hazard anywhere that terrain has been modified for the construction of transportation corridors including roads, railroads, and canals. Terrain modifications include cuts which create unnaturally steep slopes in both soil and rock that are subject to weathering and the pull of gravity. Older cuts are especially prone to instability because construction methods have changed through the years and landslide mechanics were not as well understood in the past as they are today and older cuts have had more time for rock and soil materials to weather and weaken.

4.4.1.1 History

Western Virginia was the site of one of the most devastating landslides in US history. Nelson County and its vicinity had 150 deaths and $133 million in damage from Hurricane Camille remnants in 1969. The catastrophic debris flows occurred following 20+ inches of rain.

While no devastating landslides have occurred in the NRV, significant landslides have occurred. The 1897 earthquake triggered significant rockslides in Giles County, though little information is available on damage. Major flooding in 1940 resulted in landslides that temporarily closed rail lines and roads. The most significant slide on recent record was in the Draper community of Pulaski County in June 1994, when six inches of rain in three hours produced landslides that knocked at least one home from its foundation and blocked five miles of roads. Narrows in Giles County has periodic landslides that affect Route 460. In February 2003, winter storms and flooding caused landslides in the NRV like the one shown in Figure 4-8.

Figure 4-8. Minor landslide in Elliston, February 2003

In March 2010, a rockfall event in Pulaski County on Route 11 between Dublin and Fairlawn closed the road for approximately two hours (Figure 4-9). The rockfall occurred in the afternoon with no apparent cause, such as precipitation or immediate disturbance to the area. As discussed below in the risk assessment and vulnerability section, this particular road cut had been rated as an “A” site indicating a high potential for a rockfall event that could impact traffic flow and/or result in property damage and/or injury.

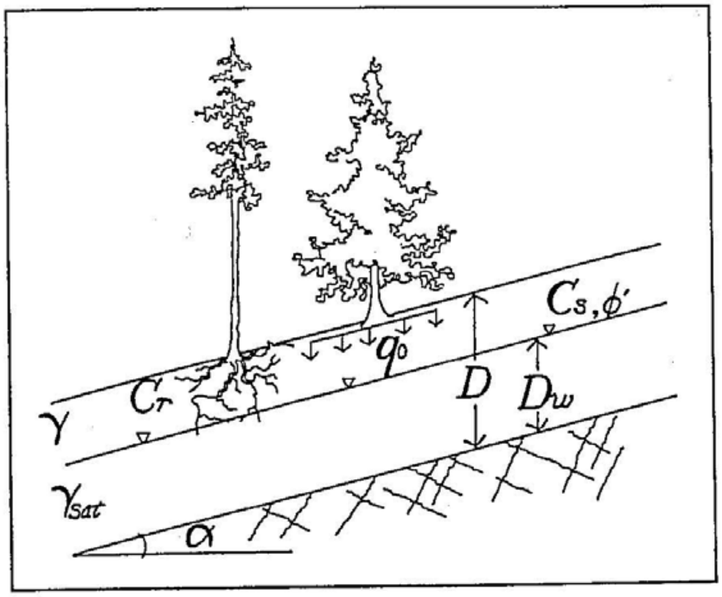
Figure 4-9. Rockfall in Pulaski County, March 2010

4.4.1.2 Risk Assessment and Vulnerability

two sets of risk assessment mapping were developed for this updated hazard mitigation plan. These maps are 1) storm-generated debris flow safety factor maps, and 2) highway landslide, rockfall, and rockslide hazard potential inventory. The methods for both maps are discussed below.

Storm-generated debris flow safety factor map (Map 3) was created using digital elevation models (DEMs) overlain by USDA soils maps. The DEMs were manipulated using GIS mapping techniques to generate slope maps from which slope inclination and slope direction can be determined within 10 meter cells across the landscape. The USDA soils maps and accompanying reports provide information about the physical characteristics and thicknesses of the soil layers within each of the slope map cells.

The Level I Stability Analysis (LISA) safety factor equation (Figure 4-10) is applied to each cell and assigned a color based on the relative stability of the soil within the cell when saturated by a major storm event. The exact magnitude of the storm is not required since the safety values for individual cells are evaluated relative to safety values of the surrounding cells. Those most likely to be unstable for a moderate storm will be the same as those most likely to be unstable for a major storm and vice-versa.



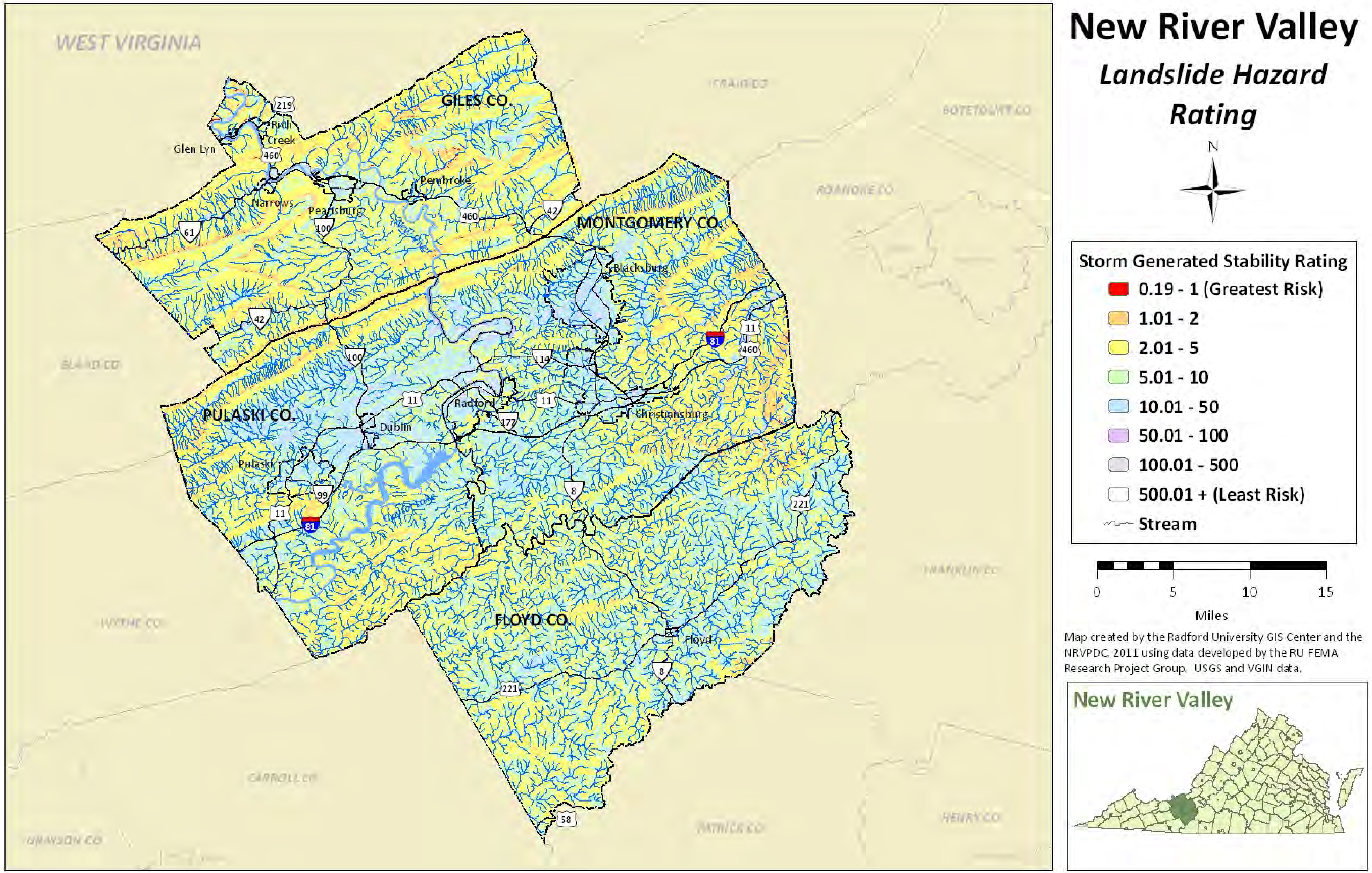
$$FS = \frac{C_r + C_s' + \cos^2\alpha[q_0 + \gamma(D - D_w) + (\gamma_{sat} - \gamma_w)D_w]\tan\phi'}{\sin\alpha\cos\alpha[q_0 + \gamma(D - D_w) + \gamma_{sat}D_w]}$$

where FS = factor of safety
α = slope of the ground surface, degrees
D = total soil thickness, ft
D_w = saturated soil thickness, ft
C_r = tree root strength expressed as cohesion, psf
q_0 = tree surcharge, psf
C_s' = soil cohesion, psf
ϕ' = effective internal angle of friction, degrees
γ_d = dry soil unit weight, pcf
γ = moist soil unit weight, pcf
γ_{sat} = saturated soil unit weight, pcf
γ_w = water unit weight, pcf

Figure 4-10. Level I Stability Analysis (LISA) model

The red end of the storm-generated stability rating spectrum (reds and oranges) indicates probable landslide initiation points during storms. Communities and infrastructure down slope from initiation points following the first order tributary drainage systems will be at greatest risk. The blue end of the spectrum and neutral colors indicate areas least likely to initiate landslides according to the LISA stability calculations.

Map 3. Landslide Hazard Rating



Highway landslide, rockfall, and rockslide hazard potential is shown on the following maps (4 through 9) by colored "pins" marking the starting points of measured road cuts. Red pins indicate the most hazardous A-rated slopes, blue pins indicate the least hazardous C-rated slopes, and green pins indicate slopes of moderate hazard according to the FHWA rating guidelines.

All A and B-rated slopes have associated field data collection forms available for reference (Figure 4-11). These field sheets provide information about each road cut and the basis for its preliminary rating. Each field sheet has spaces available for detailed rating parameters and scoring should it be necessary to return to the site at some time in the future to perform a detailed numerical evaluation for remediation or ranking purposes.

RHRS FIELD DATA SHEET

HIGHWAY: 99E

REGION: 1

HIGHWAY # 1E	Beginning M.P. 12.62	[L] / R	Ending M.P. 12.94
COUNTY # 3	DATE 91 08 07	NEW	Rated By Siel
CLASS [A] B	ADT 18,300	UPDATE	Speed Limit 30

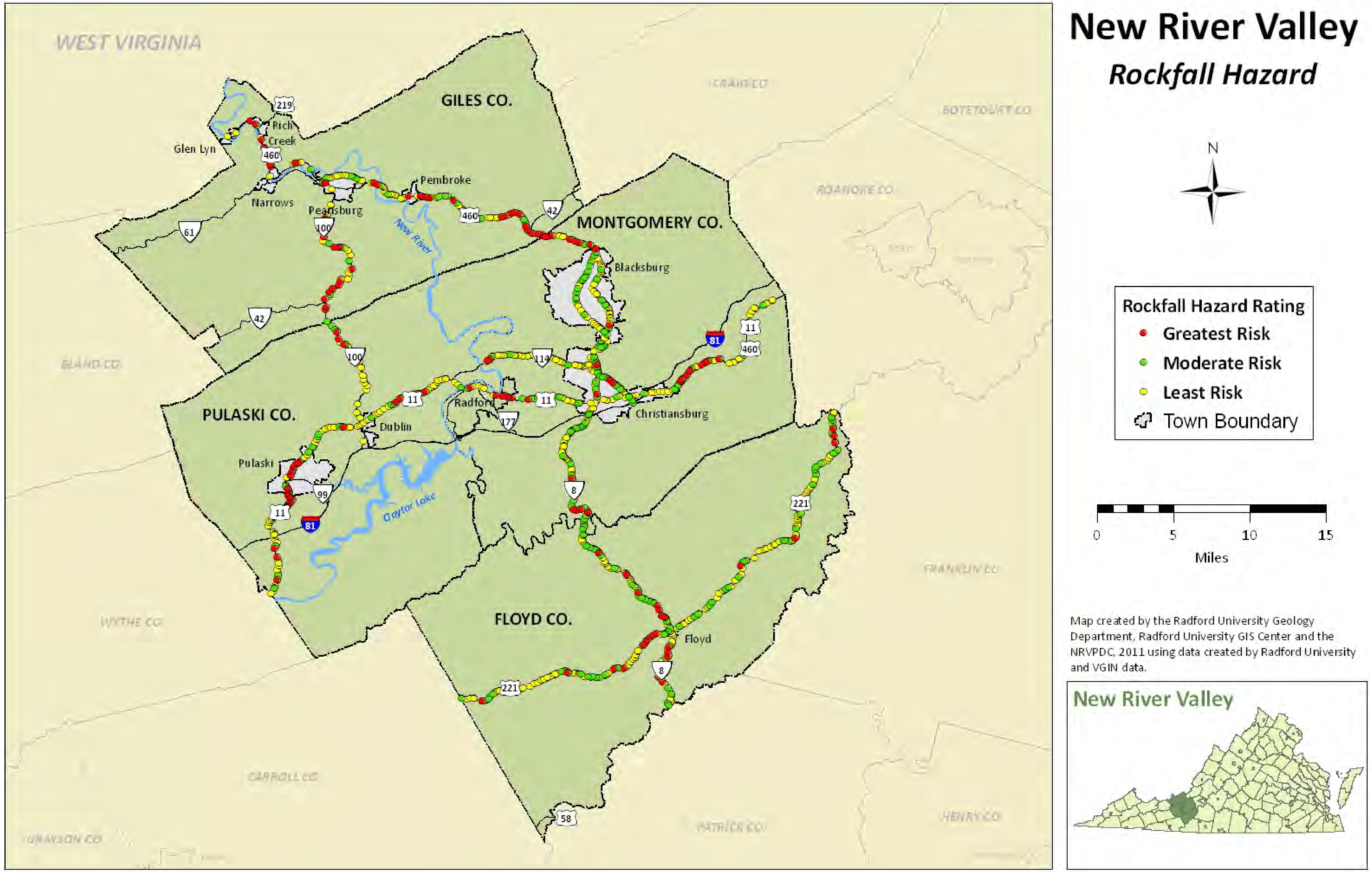
CATEGORY	REMARKS	CATEGORY SCORE	
Slope Height 116 ft °/ °/	Access to top of slope. Height measured with tape.	SLOPE HEIGHT	100
Ditch Effectiveness G M L [N]	None	DITCH EFFECT	100
Average Vehicle Risk 813 %		AVR	100
Sight Distance 450 ft Percent Decision Site Distance 100 %		SIGHT DISTANCE	3
Roadway Width 48 ft		ROADWAY WIDTH	2
GEOLOGIC CHARACTER		GEOLOGIC CHARACTER	
CASE 1		CASE 1	
Structural Condition D [C]/F R [A]	Toppling	STRUCT COND	81
Rock Friction R I [U] P C - S		ROCK FRICTION	9
CASE 2		CASE 2	
Differential Erosion Features F O N M		DIF ER FEATURES	
Difference in Erosion Rates S M L E		DIF ER RATES	
Block Size/Volume 3 ft ft/yd^3	Up to 8 yd^3	BLOCK SIZE	27
Climate Precipitation L M [H] Freezing Period N [S] L Water on Slope N I [C]		CLIMATE	50
Rockfall History F O M [C]		ROCKFALL HISTORY	75

COMMENTS: History of accidents. Road patrols required year round.

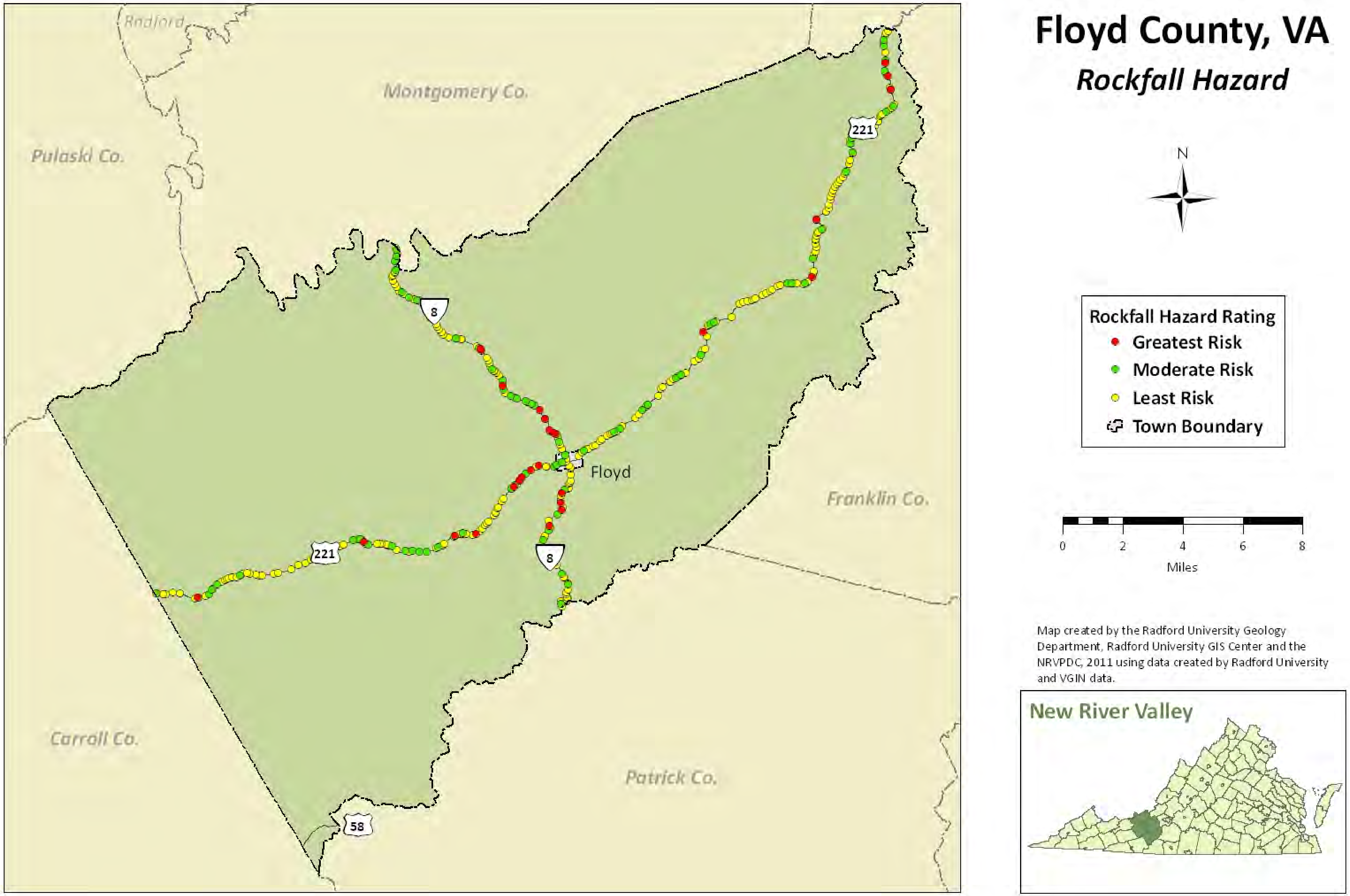
TOTAL SCORE 547

Figure 4-11. Sample field data collection sheet for rating highway rockfall hazards

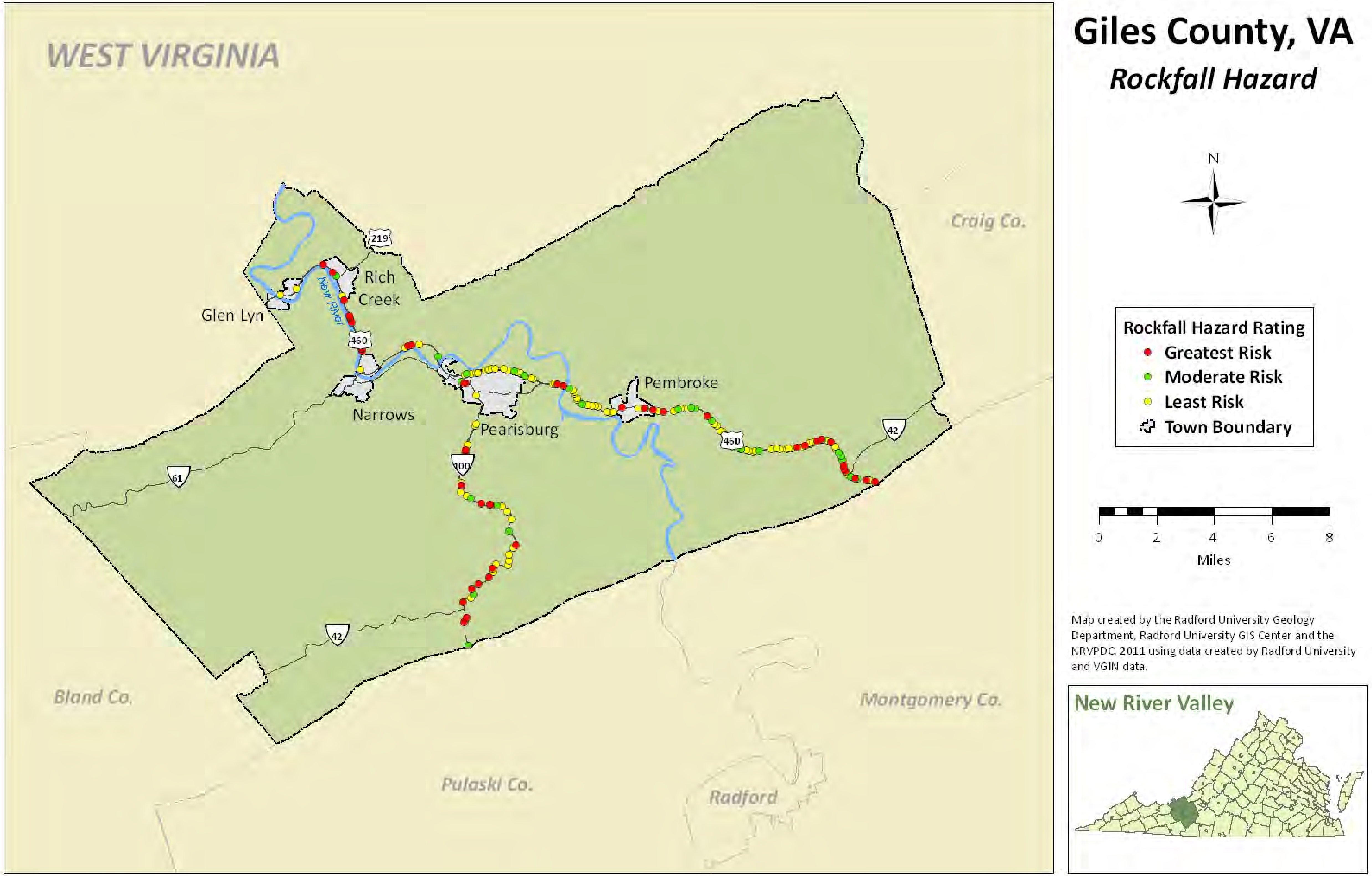
Map 4. NRV Rockfall Hazard



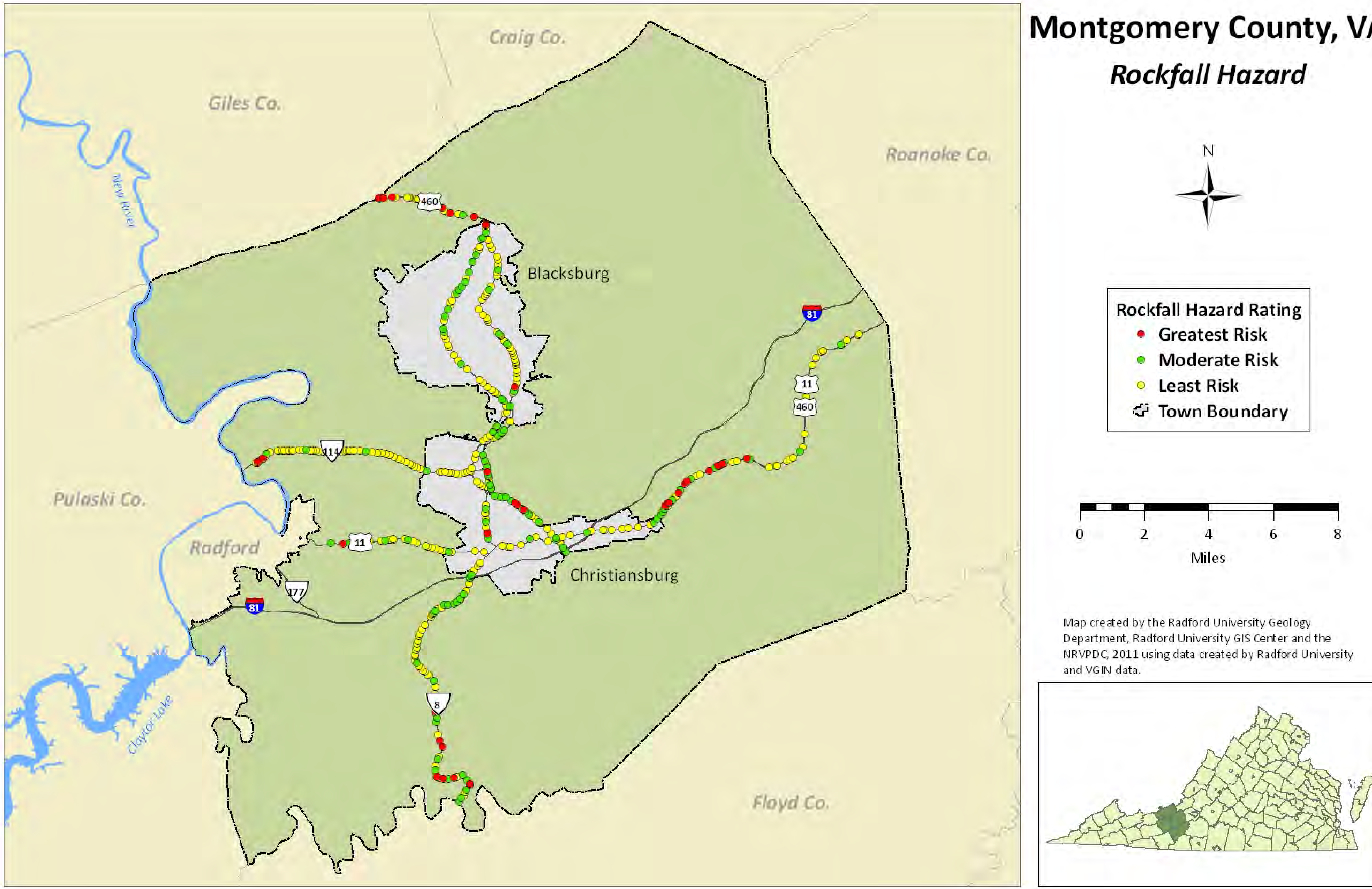
Map 5. Floyd County Rockfall Hazard



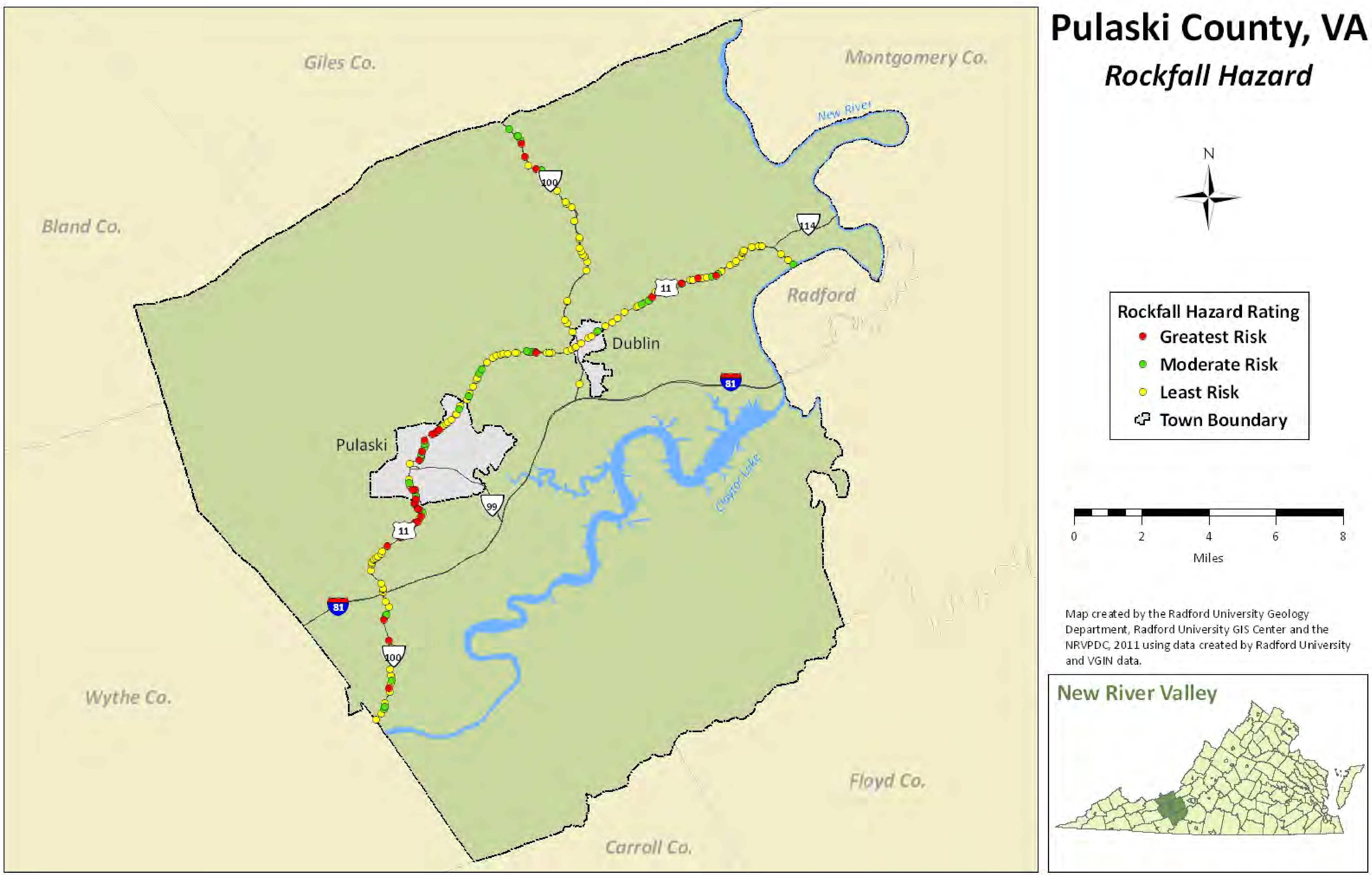
Map 6. Giles County Rockfall Hazard



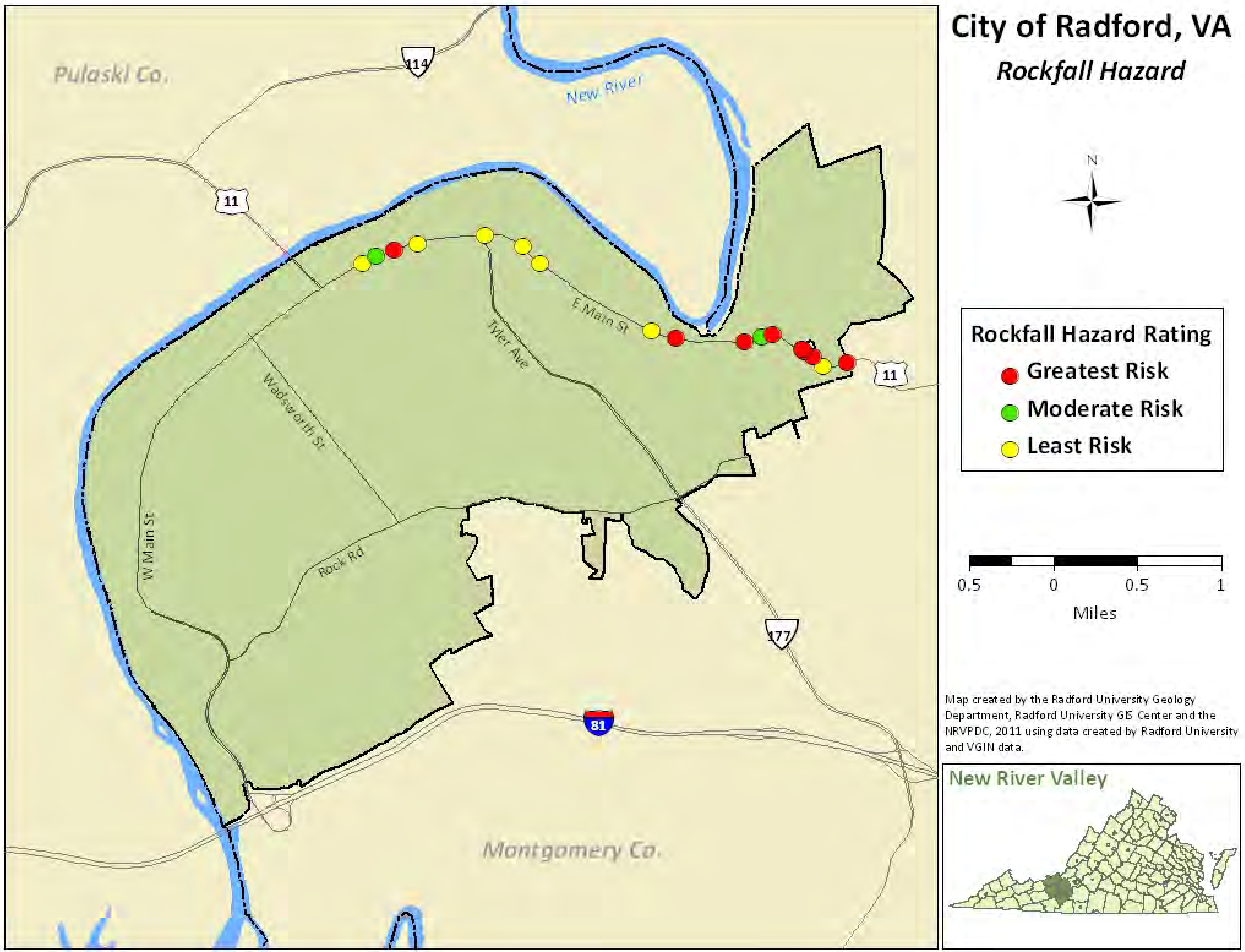
Map 7. Montgomery County Rockfall Hazard



Map 8. Pulaski County Rockfall Hazard



Map 9. City of Radford Rockfall Hazard



While considering the relative risk of all hazards possible in the New River Valley, the Steering Committee considered frequency of the event and severity, as well as the area affected by the hazard. Using these considerations, Landslide was ranked as a low risk in the region. The Steering Committee noted that relative to other hazards, landslides occur occasionally, on average every three to five years. Relatively speaking though, landslides are relatively isolated and their intensity is moderate in comparison to other hazards.

4.4.1.3 Past or Existing Mitigation

Most zoning and subdivision ordinances in the NRV have only weak language stating that "size, location, shape, slope and condition of land shall be suitable" for development. Generally, no specific parameters are set. So, development on steep or unstable slopes is largely unrestricted in the NRV. The one exception is the Town of Blacksburg which requires that "primary conservation areas" such as floodplains, wetlands, and steep slopes "shall be dedicated as open space" (where slopes are 25% or greater.) Also, the Virginia Department of Transportation (VDOT) does utilize safety fences to help protect against minor rockfalls into traffic along primary roads (Figure 4-12).

Figure 4-12. Safety fence along I-81 near Christiansburg Mountain

4.4.2 Karst

The term "karst topography" is derived from the surface topography of a limestone region in Slovakia where these landscapes were first studied. Limestone is a very common type of rock in the upper crustal sections of the earth. All of the numerous types of limestone are highly susceptible to chemical weathering mostly brought about by the presence of acids, foremost of which is carbonic acid (carbonation). Karst is typified by landscapes of pitted bumpy surface topography, poor surface drainage, and the common presence of underground solution channels in the form of cavern systems which, in turn, often form labyrinths of far-reaching underground networks.

Karst can only develop under the following conditions:

a) The geologic formations must consist of limestone containing at least 80% calcium carbonate for solution processes for this development to occur effectively;

b) The limestone formations must be jointed (fractures by warping, lifting, lateral tectonic pressure) to allow for passages along which water can travel through the otherwise impermeable limestone;

c) There must be aeration between the surface of the rock formation and the water table; and

d) A variety of different additional acids may be derived from the vegetation cover, enhancing the solution processes.

One of the dominant signs of karst is the presence of sinkholes. These are typified by circular or semi-circular surface depressions with depths from 7 to 330 feet and diameters ranging from 33 to 3300 feet. When the bottom of a sinkhole collapses into an underlying cave system, these sinkholes can become quite large. Figure 4-13 and Figure 4-14 below illustrate two different types of sinkholes possible in karst areas.

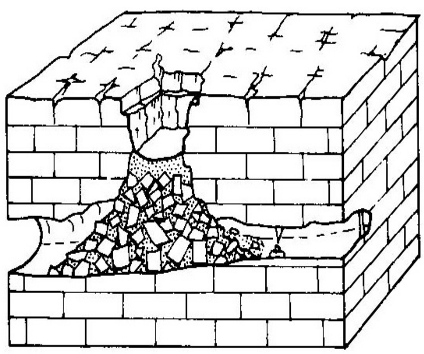


Figure 4-13. Cover Collapse Sinkhole

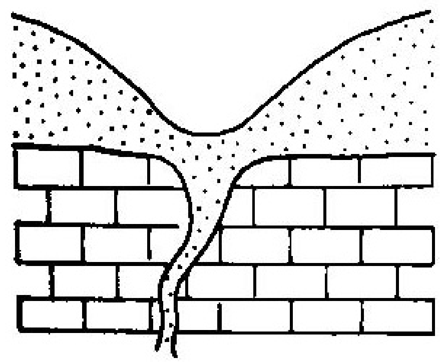


Figure 4-14. Subsidence Sinkhole

Surface water in karst areas typically flows into sinkholes and through the bottom into underlying cavern systems. This water often travels for significant distances in these underground drainage channels, to re-emerge from caves that surface streams have cut into, or it becomes part of the local water table, flowing through the limestone formations along fractures.

4.4.2.1 History

Much of the NRV rests on karst topography, and therefore the landscape is dotted with sinkholes (Figure 4-15). While there are no records of major structural damage caused by sinkholes in the NRV, such incidents have occurred in other karst regions. Major highway collapses are a recurring event for example. On the contrary, sinkholes opened up in Pearisburg during the 2002 flooding which provided sufficient temporary drainage to avoid significant flood damage to structures. Sinkholes are always challenging, however, as there is potential for direct groundwater contamination.

Figure 4-15. Sinkhole in Castle Rock Recreation Area, Giles County

4.4.2.2 Risk Assessment and Vulnerability

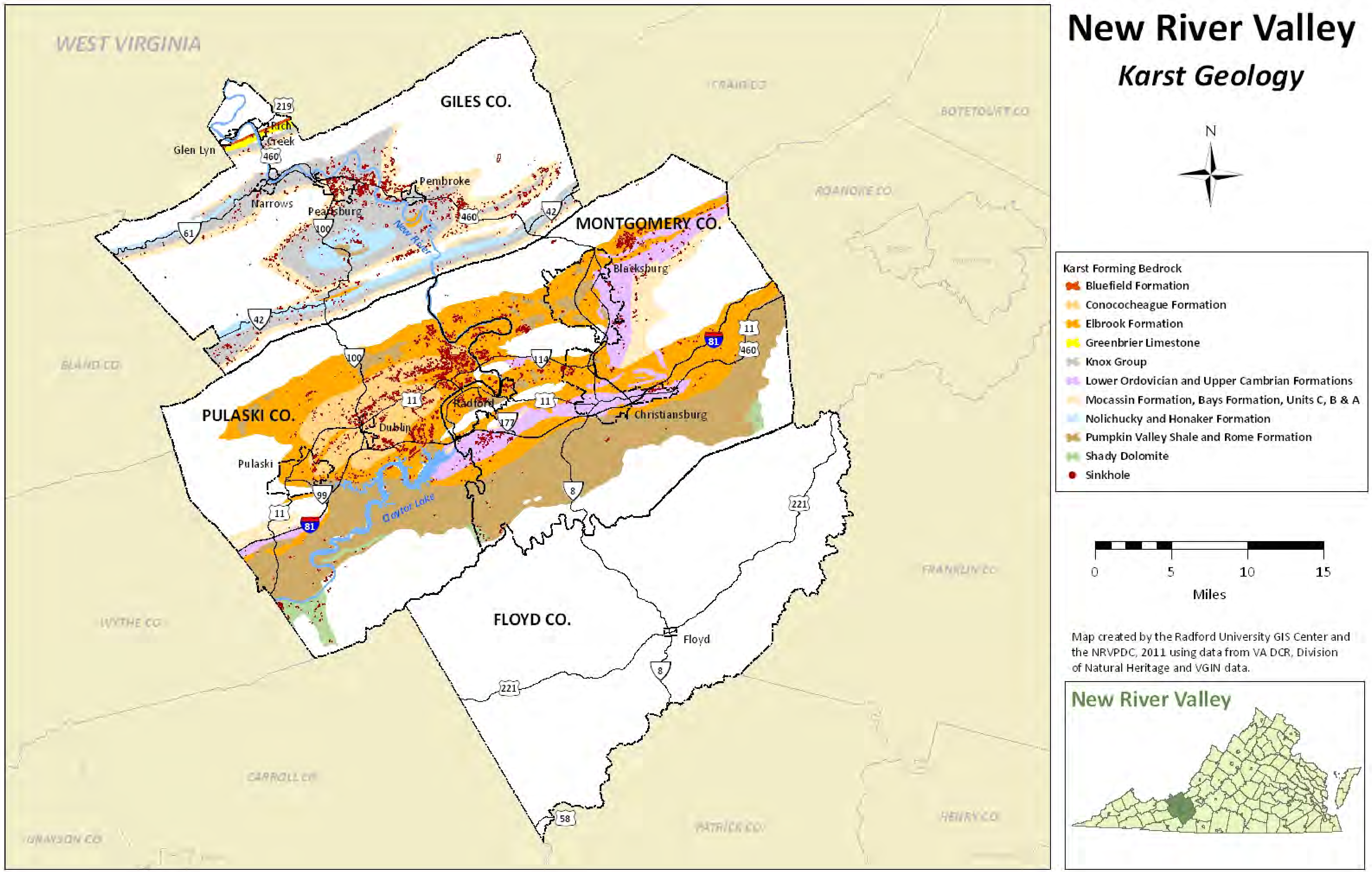
The distribution of karst-forming bedrock throughout the NRVPDC area is shown on Map 10. Of note is the fact that Floyd County has no karst-forming bedrock formations. The county is underlain by igneous rocks do not lend themselves to karst and the formation of sinkholes.

Pulaski and Montgomery Counties have karst-forming bedrock beneath more than 60% of their respective land areas. The percentage for Giles County is slightly less: nearly 50%. The City of Radford is completely underlain by karst-forming bedrock. Sinkholes, cave entrances, and the occasional subsidence of surface areas due to collapse of underlying cavern systems are common throughout all areas where these karst-forming formations (mostly limestone formations) are encountered.

The principal event associated with karst is subsidence, or sinkholes, which may open up under structures such as a home. The risk of new sinkholes developing is highest during times of flooding or drought. In terms of structural damage, a new sinkhole would likely impact only one property.

Sinkholes also literally open up a direct avenue for potential groundwater contamination, which can occur naturally through run-off or when people dump waste or dead animals into them. Surface contaminations typically percolate into the sub-surface cavern systems. Here they commonly travel for significant distances (several dozen miles at times) with the sub-surface water-flow, and the contaminated water then re-emerges to the surface along stream-cut valleys or simply becomes part of the contamination of the water table. Such movement of subsurface-water-borne contaminants is not easily traceable (or visible), and the impact can be truly regional. The risk for the population is associated with the unconscious use of such contaminated water pumped from private wells. While all wells in all areas are as risk of contamination, it is the presence of wells in the karst regions that are of particular concern, due to the significant distance which sub-surface water travels here. While fecal coliform has been found in 25-30% of wells in some areas, expensive dye tracing is necessary to trace paths from sinkholes, so no cases of direct contamination have been discovered.

Map 10. NRV Karst Geology



While considering the relative risk of all hazards possible in the New River Valley, the Steering Committee considered frequency of the event and severity, as well as the area affected by the hazard. Using these considerations, karst was ranked as a low risk in the region. The Steering Committee noted that relative to other hazards, land subsidence related to karst occurs seldom, with negligible and isolated effects.

4.4.2.3 Past or Existing Mitigation

Most land use ordinances in the NRV, including zoning and subdivision ordinances, have only weak language regarding karst, such as "land deemed to be topographically unsuitable shall not be platted for residential use."

Most karst mitigation efforts to date have been made by the Virginia Department of Conservation and Recreation (DCR), which has an office in the NRV, or the Senior Environmental Corp, or the Cave Conservancy. DCR has sponsored local workshops for planners and local officials.

Also, VDOT requires the locality and developer to make additional stormwater management provisions in areas with karst topography prior to the acceptance of subdivision streets.

4.4.3 Earthquake

As the name implies, an earthquake is the trembling at the Earth's surface or below, resulting from the release of energy or strain on the Earth's tectonic plates. The shaking and movement can cause serious damage to buildings and structures. There are four hazards associated with earthquakes (from *Planning for Post-Disaster Recovery*):

- Ground motion: waves of vibration
- Seismic activity: energy transferred, measured by magnitude (total energy) and intensity (subjective description at a particular place)
- Surface faulting: visible, lasting ground changes
- Ground failure: weak or unstable soils can liquefy and move

The most familiar terminology associated with earthquakes are magnitude and intensity. Table 4-6 below provides explanation of the Modified Mercalli Intensity Scale (MMI) and relates it to likely magnitude and damages at the epicenter. The value on MMI Scale recorded for the same event can vary based on the distance from the epicenter.

Table 4-6. Richter/Modified Mercalli Scales for Earthquakes

Richter Scale Magnitude	Typical Modified Mercalli Intensity	Type	Damage Description
1.0 – 3.0	I	Instrumental	– Not felt by many people unless in favorable conditions.

Richter Scale Magnitude	Typical Modified Mercalli Intensity	Type	Damage Description
3.0 – 3.9	II – III	Weak – Slight	– Felt only by a few people at best, especially on the upper floors of buildings. Delicately suspended objects may swing. – Felt quite noticeably by people indoors, especially on the upper floors of buildings. Many do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
4.0 – 4.9	IV – V	Moderate – Rather Strong	– Felt indoors by many people, outdoors by few people during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rock noticeably. Dishes and windows rattle alarmingly. – Felt outside by most, may not be felt by some outside in non-favorable conditions. Dishes and windows may break and large bells will ring. Vibrations like large train passing close to house.
5.0 – 5.9	VI – VII	Strong – Very Strong	– Felt by all; many frightened and run outdoors, walk unsteadily. Windows, dishes, glassware broken; books fall off shelves; some heavy furniture moved or overturned; a few instances of fallen plaster. Damage slight. – Difficult to stand; furniture broken; damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by people driving motor cars.

Richter Scale Magnitude	Typical Modified Mercalli Intensity	Type	Damage Description
6.0 – 6.9	VII – IX	Very Strong – Destructive – Violent	– Difficult to stand; furniture broken; damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. Noticed by people driving motor cars. – Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture moved. – General panic; damage considerable in specially designed structures, well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.

Richter Scale Magnitude	Typical Modified Mercalli Intensity	Type	Damage Description
7.0 +	VIII or higher	Destructive – Violent – Intense – Extreme – Cataclysmic	– Damage slight in specially designed structures; considerable in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture moved. – General panic; damage considerable in specially designed structures, well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. – Some well built wooden structures destroyed; most masonry and frame structures destroyed with foundation. Rails bent. – Few, if any masonry structures remain standing. Bridges destroyed. Rails bent greatly. – Total destruction - Everything is destroyed. Lines of sight and level distorted. Objects thrown into the air. The ground moves in waves or ripples. Large amounts of rock move position. Landscape altered, or leveled by several meters. In some cases, even the route of rivers is changed.

4.4.3.1 History

In the New River Valley, earthquakes are common, although typically of such a minor scale that the movements are not felt by residents, but rather recorded by instruments at Virginia Tech's Seismic Observatory. There are three types of faults present in the NRV: 1) surface faults (most have strong vertical movements), 2) reverse faults (with horizontal movements and can involve sections of the crust rolling over either partially or completely), and 3) ground failure (involving primarily unconsolidated rock debris and soil).

On May 31, 1897 an earthquake estimated at 5.8 on the Richter scale occurred in the NRV. The epicenter was in Pearisburg, but it was felt as far north as Cleveland, Ohio and as far south as Atlanta, Georgia. In the Giles County area, chimneys fell, brick homes were damaged, streams changed course, and rockslides and landslides covered railroad tracks. This is the largest recorded earthquake in the state of Virginia, though smaller earthquakes frequently occur throughout the state.

4.4.3.2 Risk Assessment and Vulnerability

Map 11 below illustrates the estimated damages in 2000 dollars if the earthquake of 1897 were to occur presently. The following table shows the estimated damages based on the state's HAZUS modeling of earthquakes in their 2010 state plan.

Table 4-7. HAZUS Total Annualized Loss (2010 State Plan, Table 3.13-10)

Locality	Annualized Loss Amount
Montgomery County	$474,519
Pulaski County	$236,341
City of Radford	$102,522
Giles County	$100,542
Floyd County	$55,855

According to Martin Chapman, PhD, a seismologist at Virginia Tech, a 6 to 6.5 magnitude earthquake is estimated to be a 1-in-2,500-year event in the New River Valley. Specifically, he suggests that the region within 30 kilometers of the epicenter of the 1897 earthquake is most likely to see the next significant event.

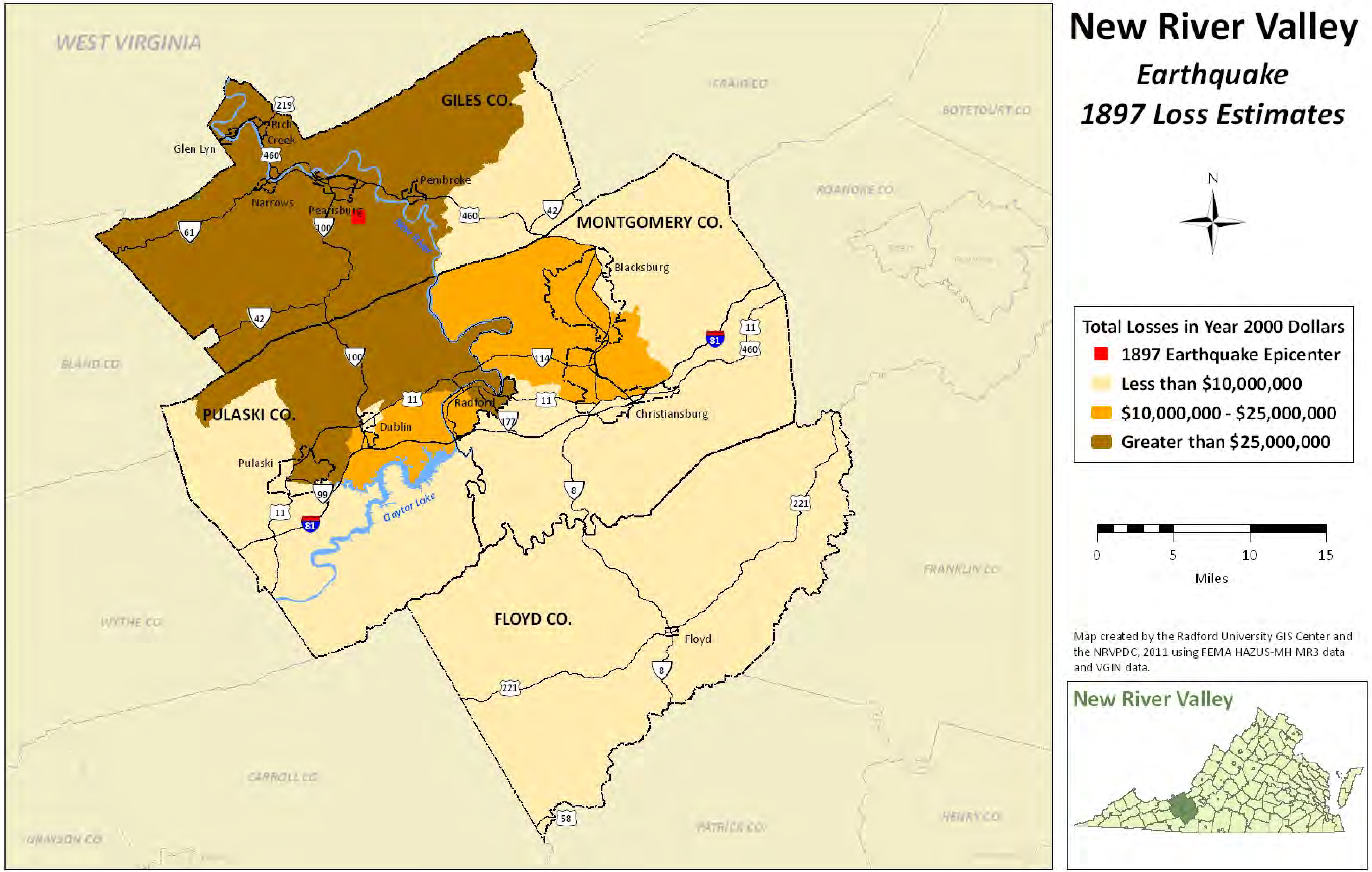
The probability of an earthquake with a significant force striking the NRVPDC is highly unlikely in the near future. However, one has to keep in mind that earthquakes are unpredictable, both in occurrence as well as in magnitude. The results of modeling using FEMA's HAZUS-MH MR3 and USGS data is indicated on Map 12. The model assumption is an earthquake with a magnitude of 5 striking the area and the resultant loss as annualized costs.

Also according to Dr. Chapman, old brick and block construction results in the most death and injuries during this level of earthquake. Specifically, he mentioned that firehouse doors and hospital equipment not restrained may be rendered inoperable. There are four hospitals in this high hazard area, and there are approximately 15 firehouses. A major earthquake could damage medical and rescue equipment, as well as major bridges—causing millions of dollars in damage.

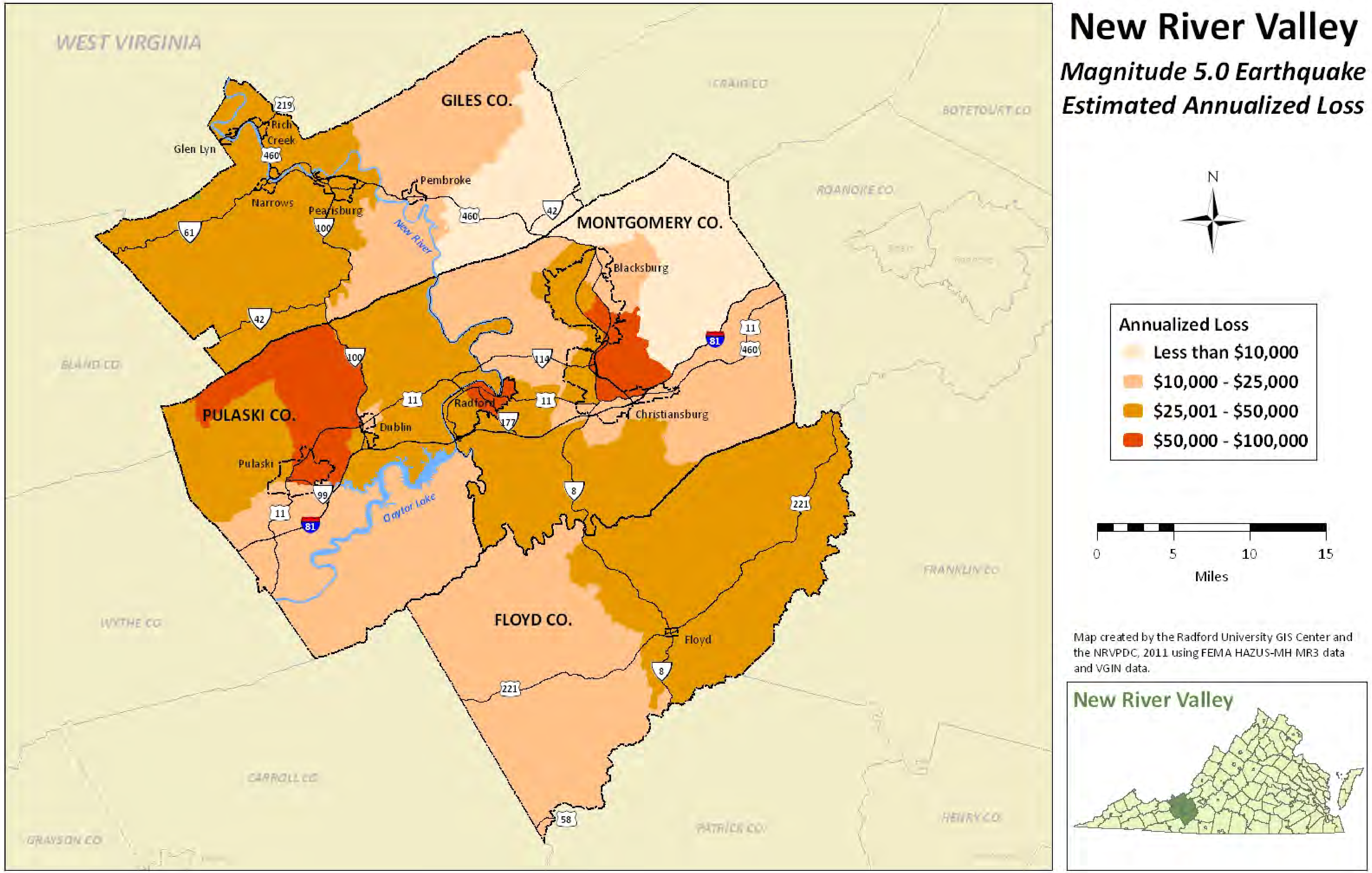
There is also one major underground natural gas transmission line (through Pulaski and Montgomery Counties) and a major hydroelectric dam (Claytor Dam in Pulaski County) that could be affected by a major quake. Given the very low probability of this type event, however, no additional assessment was deemed necessary at this time.

While considering the relative risk of all hazards possible in the New River Valley, the Steering Committee considered frequency of the event and severity, as well as the area affected by the hazard. Using these considerations, earthquake was ranked as a low risk in the region. Though a significant earthquake event could be catastrophic for the region, it is unlikely to occur frequently.

Map 11. NRV 1897 Earthquake Loss Estimates



Map 12. NRV Magnitude 5.0 Earthquake Estimate Annualized Loss



4.4.3.3 Past or Existing Mitigation

The only earthquake mitigation currently in effect is the statewide building code. The building standards in earthquake hazard areas will be further increased with the new International Building Code.

4.4.3.3.1 Mitigation Opportunities

A complete listing of NRV hazard mitigation goals, objectives, and strategies can be found in Chapter 5: Mitigation Strategy. Below are the goals, objectives, and strategies identified by the geologic working groups to specifically lessen the impacts of geologic hazards in the region.

1. **Minimize structural damage due to landslides.**
   a. *Develop strategies to protect existing structures from the impacts of landslides and debris flows.*
      i. Identify areas where potential debris flow could be diverted to avoid existing structures.
      ii. Re-vegetate areas in danger of becoming slides.
   b. *Develop educational materials and notification systems to better inform residents of landslide hazards.*
      i. Create a database or reporting system for landslides.
      ii. Notify permit applicants of site vulnerability to landslide and debris flow.
      iii. Develop appropriate signage that warns of the danger of landslide and rockfall, especially during heavy rain periods.
      iv. Install warning devices on extremely vulnerable sites that have remote notification for emergency and response personnel.
   c. *Encourage planning practices that mitigate the impacts of landslides and rockfall on new and existing developments.*
      i. Ensure that the most accurate data is available while making planning decisions (i.e., zoning, subdivisions).
      ii. Restrict future development in landslide prone areas.
      iii. Continue to improve data available for future planning and mitigation.
      iv. Incorporate additional language into ordinances to mitigate impacts from landslides.
      v. Continue to monitor A-rated rockfall cuts for future slope movement.
      vi. Encourage projects that expand catchment areas (i.e., ditches and shoulders) in potential rockfall areas of roads.
      vii. Encourage slope protection, reinforcement and reconstruction projects to prevent future rockfall events.
      viii. Engage in pre-demolition activities that control rockfall events.
   d. *Engage in activities to plan for and avoid future landslide and rockfall impacts.*
      i. Gather existing route information for detours that may be necessary in the event of a rockfall event.
2. **Minimize risks to developments and structures in areas prone to earthquakes and new sinkholes.**
   a. *Encourage activities to protect structures from future events.*
      i. Ensure that seismic requirements are included in building codes.
      ii. Reinforce critical facilities to withstand seismic events.

b. *Develop educational programs to increase residents' awareness of likelihood of geologic events.*
    i. Develop training/education activities for all government staff on appropriate response for geologic events.
    ii. Maintain awareness of regional seismic activity.
    iii. Develop informational materials about potential for sinkholes in vulnerable areas.

c. *Engage in planning activities to minimize impacts of earthquakes and sinkholes.*
    i. Identify and mark known sinkholes.
    ii. Conduct aerial surveys of hazardous conditions resulting from sinkholes.
    iii. Survey local surveyors, well diggers, septic installers, soil scientists and other local experts to identify new sinkhole locations.
    iv. Ensure that identified sinkholes are marked on plats, easements, and building permits.
    v. Conduct water quality assessments to determine impacts of sinkholes on water sources.
    vi. Encourage further dye tracing to track water as it moves between the surface and below ground.
    vii. Ensure that groundwater sources are protected from contamination by requiring septic drainfields to be a minimum distance from a known sinkhole.
    viii. Ensure structures are not placed near known sinkholes.

4.5 Flooding: Riverine, Flash Flooding and Dam Inundation

Flooding is perhaps the most common and widespread hazard within the New River Valley, as it is across the nation. DFIRMs from the NFIP are available for all counties and the city in the NRV. These are digitized versions of the paper maps created in the 1970s at the origination of the NFIP. The DFIRMs locate the 100-year floodplain, meaning the area that has a 1% chance of flooding in any given year. Property owners living within a community that participates in the NFIP can purchase flood insurance through the federal program, regardless of their location in or outside of the floodplain. Insurance rates do increase as the predicted risk of flooding increases, as based off the DFIRMs.

Figure 4-16 below shows a generalized depiction of a 100-year floodplain. The base flood is also called the 100-year flood which has a 1% probability of being equaled or exceeded in any given year. The floodplain is defined as any land area susceptible to partial or complete inundation by water from any source. The floodway is the central channel and that portion of the adjacent floodplain which must remain open to permit passage of the base flood. The greatest intensity floodwaters are generally in the floodway, and anything in this area is at greatest risk during a flood. The remainder of the 100-year floodplain is called the “fringe” where water may be shallower and slower. The depth and intensity of the water flow here is determined by existence of obstructions.

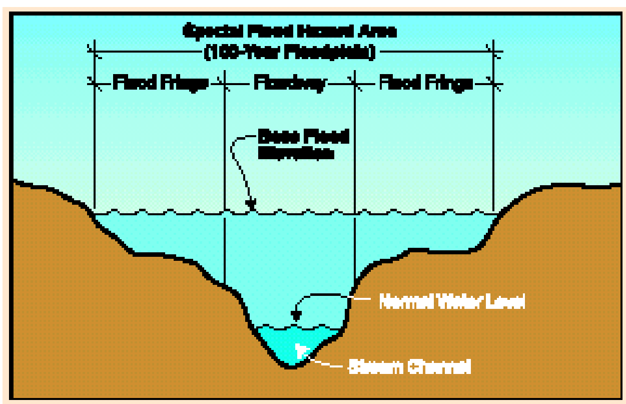


Figure 4-16. Generalized 100-Floodplain

It is important to note that on the FIRMs and in the supporting Flood Insurance Studies “the hydraulic analysis…is based on the effects of unobstructed flow. The flood elevations as shown are considered valid only if the hydraulic structures in general remain unobstructed and do not fail.” When flow is obstructed, as often happens with debris, the impacted area is wider and/or the depths of the water are greater.

Table 4-8 below describes the flood hazard areas as depicted by the DFIRMs and their associated probabilities.

Table 4-8. FEMA Special Flood Hazard Area designations and probabilities

Probability	Zone	Description
Annual probability of Flooding of 1% or	A	Subject to 100-year flood. Base flood elevation undetermined.

Probability	Zone	Description
Greater	AE or A1-A30	Both AE and A1-A30 represent areas subject to 100-year flood with base flood determined.
	AH	Subject to 100-year shallow flooding (usually areas of poundings) with average depth of 1-3 feet. Base flood elevation determined.
	AO	Subject to 100-year shallow flooding (usually sheet flow on sloping terrain) with average depth of 1-3 feet. Base flood elevation undetermined.
	V	Subject to 100-year flood and additional velocity hazard (wave action). Base flood elevation undetermined.
	VE or V1-V30	Both VE and V1-V30 represent areas subject to 100-year flood and additional velocity hazard (wave action). Base flood elevation determined.
Annual Probability of Flooding of 0.2% to 1%	B or X500	Both B and X500 represent areas between the limits of the 100-year and 500-year flood; or certain areas subject to 100-year flood with average depths less than 1 foot or where the contributing drainage area is less than 1 square mile; or areas protected by levees from the 100-year flood.
Annual Probability of Flooding of Less than 0.2%	C or X	Both C and X represent areas outside the 500-year flood plain with less than 0.2% annual probability of flooding.
Annual Probability of Flooding of Less than 1%	No SFHA	Areas outside a "Special Flood Hazard Area" (or 100-year flood plain). Can include areas inundated by 0.2% annual chance flooding; areas inundated by 1% annual chance flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; areas protected by levees from 1% annual chance flooding; or areas outside the 1% and 0.2% annual chance floodplains.

In the NRV there are multiple properties that are defined as either Repetitive Loss or Severe Repetitive Loss by the NFIP. Table 4-9 summarizes these properties.

Table 4-9. Repetitive and Severe Repetitive Loss Properties by Locality

Locality	Repetitive Loss Properties	Severe Repetitive Loss Properties	Type of Properties
Floyd County	1	1	All residential
Giles County	5	1	All residential
Montgomery County	15	1	1 commercial, 14 residential
Pulaski County	5	0	All residential
Town of Pulaski	2	0	All residential

The Town of Pulaski acquired two repetitive loss properties in 2002 and have successfully utilized five structural acquisitions for community greenspace.

4.5.1 History

The New River Valley is prone to riverine and flash flooding. The history of each is delineated next.

4.5.1.1 Riverine

Riverine flooding is the more gradual flooding that occurs on major waterways such as the New River following many days of rain. There is typically advance notice for this type of flooding. Riverine flooding occurred along the New River in 1878, 1916 and 1940. All three events were deemed “100-year event. Notably, all of these events occurred prior to the completion of the power-generating dam on the New River, though it was not built for flood control purposes. Riverine flooding not only affects the development on the river, including that in Radford, Pearisburg and Narrows, but it also causes backwater effects into the downstream portions of tributaries like Little Stony and Doe Creeks.

In addition to these notable flood events, seven flood events have been recorded in the National Climatic Data Center (NCDC) database from 1996 to 2006. These recorded events have cost just over $5 million in damages and resulted in two deaths and one injury. Unfortunately these records do not indicate the magnitude of the flooding, so it is impossible to tell if these were 100-year floods, or more common flooding that occurs regularly in some portions of the region.

4.5.1.2 Flash Flooding

The more frequent and damaging type of flooding in the NRV is flash flooding. The mountains of western Virginia are among the most dangerous flash flood-prone areas in the U.S., due to the strong storms created by the collision of warm, moist Gulf air and cold fronts from the North (Water News, Virginia Tech, 1987). Often this flooding occurs from localized thunderstorms or tropical storm-related events. For example, in June, 1972, Tropical Storm Agnes wreaked havoc on western Virginia.

Since 1995, approximately 120 flash floods have been reported throughout the NRV in the NCDC database. Even though these events were reported much more frequently than riverine flooding, the damages reported were just over $4 million, with no deaths or injuries reported.

4.5.1.3 Dam Inundation

Various types of dams exist to serve a multitude of functions within the NRVPDC area. These include farm use, recreation, hydroelectric power generation, flood and storm-water control, water supply and fish or wildlife ponds. In some cases, a single dam structure serves multiple functions, such as generating hydroelectric power and providing recreational opportunities to boaters and fishermen.

State and federal governments regulate dam construction, maintenance and repair. On the state level, the Virginia Dam Safety Act of 1982 (and as amended effective December 22, 2010) serves as the guiding legislation. Within the NRV there are 15 dams that are of a class that is regulated. Table 4-10 below describes these dams.

Table 4-10. Regulated Dams in the NRV

Dam Name	County	River/Stream	City	Owner
Hogan's Dam	Pulaski	Hogan Branch	Pulaski	Town of Pulaski
Gatewood Dam	Pulaski	Peak Creek	Pulaski	Town of Pulaski
Radford (Little River Hydro)	Montgomery	Little River	Radford	City of Radford
Claytor	Pulaski	New River	Radford	Appalachian Power Co, American Electric Power
Little River Dam	Montgomery	Little River	Radford	City of Radford
Scott Dam	Floyd			Frank A. Scott
Mabry Mill Pond Dam	Floyd	Mabry Mill Pond		
Park Ridge Dam	Floyd			Park Ridge Property Owner
Rakes Mill Dam	Floyd	Dodd Creek		
Bennetts Dam	Montgomery	Smith Creek		William F. Bennett
Lake Powhatan Dam	Pulaski	Big Macks Creek		B.S.A., Blue Ridge Mountain
Ottari Scout Camp #2 Dam	Pulaski	Little Laurel Creek		B.S.A., Blue Ridge Mountain
Thornhill Dam	Pulaski	BOT		Bernard Simmons
Glen Lyn Bottom Ash Dikes Dam	Giles	New River		AEP Service Corp.
Glen Lyn Flyash Dam	Giles	East River		AEP Service Corp.

The federal government maintains an inventory of dams through the National Dam Inspection Act of 1972 and, more recently, the Water Resources Development Act of 1996. Maintained by the U.S. Army Corps of Engineers, the National Inventory of Dams has been available on-line since January 1999 (https://nid.usace.army.mil).

State and federal regulations differ slightly from each other in methods of classifying dam hazard potential. For the federal national inventory, dams are grouped into one of three categories, based on two criteria: the potential for loss of human life and the potential to cause economic, environmental and lifeline losses, in the event of a dam failure. Dams classified as a high hazard indicate that loss of one human life is likely if the dam fails, while dams classified as significant hazards indicate that possible loss of human life and likely significant property or environmental destruction should the dam fail. It is interesting to note that of the dams above, only 4 are shown in the national database that includes a hazard rating. These four are listed in Table 4-11 below.

Table 4-11. Hazard Rating of Dams in NRV

Dam Name	River/Stream	Year Built	Hazard Rating
Hogan's Dam	Hogan Branch	1900	High
Gatewood Dam	Peak Creek	1958	High
Claytor	New River	1939	High

Dam Name	River/Stream	Year Built	Hazard Rating
Little River Dam	Little River	1934	Significant

4.5.2 Risk Assessment and Vulnerability of Flooding[1]

FEMA's HAZUS-MH MR3[2] was used to assess the flood vulnerability for New River Valley PDC. The potential for loss, or the degree of vulnerability, was measured using three different factors:

1. Amount of county land area susceptible to a 100-year flood.
2. Amount of potential damage by square footage of buildings (by construction type and by occupancy).
3. Amount of direct economic losses related to buildings.

The three measures of loss give a general picture of the very complex issue of vulnerability to floods.

4.5.2.1 Location and Aerial Extent

HAZUS-MH MR3 was used to generate the flood depth grid for 100-year and 500-year return periods (Map 13) calculated for one square mile drainage areas. The riverine model was determined from a user provided US Geological Survey (USGS) 10 meter digital elevation model (DEM) and peak discharge values obtained for reaches so generated.

The majority of flooding in the New River Valley is along the New River itself. Other feeder streams were also modeled but their contribution and impact is minimal. Complete vulnerability scenario modeling for every county (and Radford City) yielded a picture of varying degrees of vulnerability to flooding (Table 4-12). Pulaski County has the largest flood zone (24.9 square miles) while Floyd County has the smallest flood zone (9.37 sq miles). Floyd County, far removed from the main course of the New River, has the lowest percentage of its land in floodplains. In contrast, Radford City, which is the smallest in area, lies directly along the New River and as such it has the highest percentage (12%) of land area within the floodplain. Overall, 69.75 square miles of the planning district's 1,470.84 square miles fall within the 100-year floodplain. In other words, 4.74% of the land area of the planning district is vulnerable to a 100-year flood event.

[1] *Disclaimer*:
The estimates of social and economic impacts contained in this report were produced using HAZUS MH MR3 loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific flood. These results can be improved by using enhanced inventory data and flood hazard information.

[2] Released July 2007.

Map 13. NRV Floodplains

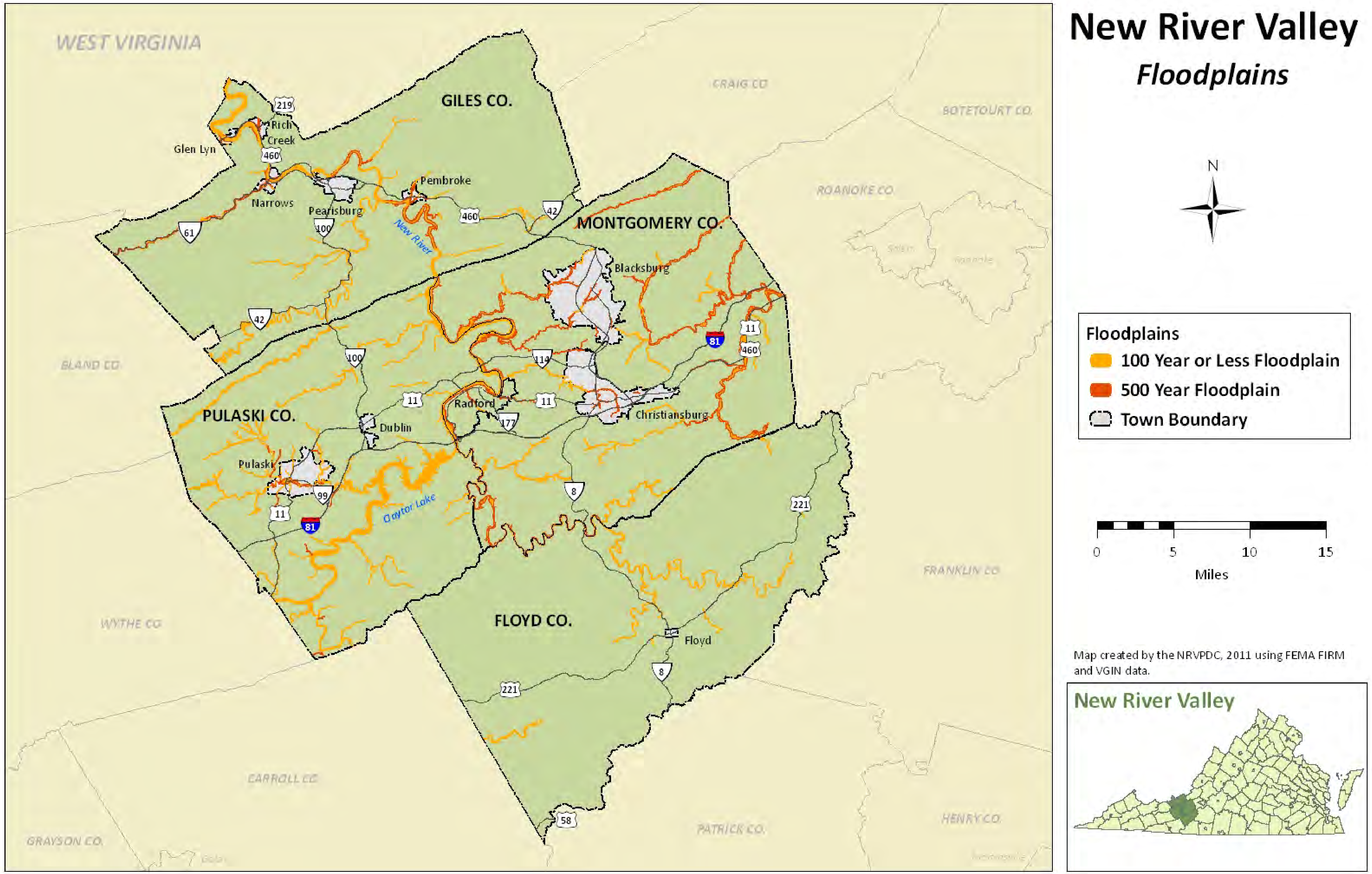


Table 4-12. 100-year Flood Zone Area

Locality	Flood zone Area (sq. mi)	Total Area (sq. mi)	% of Total
Floyd	9.37	381.46	2.46
Giles	18.02	360.32	5.00
Montgomery	16.22	389.47	4.16
Pulaski	24.9	329.49	7.56
Radford	1.24	10.10	12.28
NVRPDC Total	**69.75**	**1470.84**	**4.74**

The size of the flood zone is a convenient and more general measure of flood vulnerability. A more accurate method for expressing the level of vulnerability is loss estimation based on potential damage from a 100-year flood event. HAZUS-MH processing capability accounts for five flood events (10, 20, 50, 100, and 500 years) per return period. The following estimations are based on a 100-year flood event.

4.5.2.2 Loss Estimation Analysis

The HAZUS-MH loss estimation results (average expected value per year) can be obtained for deterministic and probabilistic scenarios. The flood risk assessment presented herein was based on probabilistic analysis since no specific flood event was modeled. Deterministic analyses are based on the laws of physics and correlations among experience or tests to predict a particular outcome. One or more worst credible possible scenarios can be developed, but the frequency of events must be evaluated.

Probabilistic analyses are used to develop loss estimations and annualized losses due to potential damage. HAZUS standardized hazard outputs can be in the form of direct economic losses, induced, social and business interruptions. The analyses consider the likelihood of occurrence of a specific event, its resulting losses and consequences. The likelihood estimates are based on both statistics and historical information.

4.5.2.3 Building Damage and Stock Exposure by Building Type

One common measure in loss estimation is the amount of square feet of damage to buildings by construction type and/or by occupancy in the event of a flood. A simplified statistic can be derived by setting a threshold on a specified level of damage. One such a statistic is substantial damage.

Substantial damage is defined as any damage that is over 50% of the available square footage by the type of building construction. For instance it can be observed from Table 4-13 that in Floyd County the overall amount of building damage by construction type is 37.2%. This means that a 100-year flood event will most likely cause damage in excess of 50% in 37.2% of the buildings. The table also provide specific breakdown by construction type. For Floyd County the total square footage of wood buildings is 34,000 square feet, and of these, 14,000 square feet will most likely experience damage in excess of 50%.

Given that Floyd County averages significant damage in 37.4% of its structures, it is clear therefore that wood structures will have proportionately greater damage than any other type. It is also apparent that based on this statistic, Radford City structures along the 100-year floodplain are more vulnerable with 58% receiving substantial damage. Pulaski County is the least vulnerable with only 20% of structures likely to experience damage in excess of 50%. The average for the planning district is 28% receiving substantial damage, which is just over ¼ of the total square footage.

Overall, Floyd County has the least amount of square footage receiving substantial damage in almost all categories. In part this is due to the limited amount of area subject to flooding. For instance, the County has no concrete or manufactured housing in the floodplains.

Manufactured housing tends to be extremely vulnerable particularly in Montgomery (124/139), Giles (33/36) and Pulaski counties (45/46). In the event of a 100-year flood, substantial damage to the buildings in these counties will be 89%, 92%, and 98%, respectively.

Although construction types are spatially much more widespread than occupancy categories, damage to manufactured housing (91.40%) dominates wood (24.85%), concrete (24.83%), masonry (22.95%) and steel (22.19%) structures. In general, these patterns show overall distribution of vulnerability averaging across categories at 28.4%.

Table 4-13. Building Damage by Building Type

		Locality					
Building Type		**Floyd**	**Giles**	**Montgomery**	**Pulaski**	**Radford**	**NVRPDC**
Concrete	Total	0	14	27	68	36	145
	Substantial	0	2	1	10	23	36
	Percentage	0.00%	14.29%	3.70%	14.71%	63.89%	24.83%
Manuf. Housing	Total	0	36	139	46	0	221
	Substantial	0	33	124	45	0	202
	Percentage	0.00%	91.67%	89.21%	97.83%	0.00%	91.40%
Masonry	Total	3	132	126	271	91	623
	Substantial	1	41	9	40	52	143
	Percentage	33.33%	31.06%	7.14%	14.76%	57.14%	22.95%
Steel	Total	6	113	92	317	103	631
	Substantial	1	26	7	44	62	140
	Percentage	16.67%	23.01%	7.61%	13.88%	60.19%	22.19%
Wood	Total	34	344	316	530	128	1352
	Substantial	14	103	29	119	71	336
	Percentage	41.18%	29.94%	9.18%	22.45%	55.47%	24.85%
% Substantial of Net Total		**37.2**	**32.1**	**24.3**	**20.9**	**58.1**	**28.4**

In thousands of square feet
Substantial damage >50% damage

4.5.2.4 Building Damage and Stock Exposure by Occupancy

A breakdown of the total square feet of potential building damage by county into different categories of occupancy, provide a different perspective of flood vulnerability (Table 4-14). As in the case of damage by building type, damage by occupancy was also analyzed at ≥50% as substantial damage.

The occupancy categories tracked by HAZUS-MH are agricultural, commercial, educational, governmental, industrial, religious/non-profit and residential. The overall substantial damage for the NRV is between 20% and 40% of structures. However, it is noteworthy that the majority of the potential damage to buildings in the NRV is to residential buildings. In both absolute (907.5 square feet) and percentage (34.28%) terms, residential buildings are more vulnerable than any other category. The category with least impact across the counties is government. In fact in Radford City there are no government buildings at substantial risk in the event of a 100-year flood. The figure for Floyd County seems high but it is also important to examine the raw square footage; it is very small meaning a few government building(s) may account for this lopsided statistic. Similar to government buildings, education facilities (mainly schools) are not found within the floodplain for the most part. Therefore, substantial damage to education buildings is generally very low in the NRV; it is only in Pulaski County that 14.5% of educational facilities stand a chance for substantial damage from a 100-year flood event. This trend demonstrates the importance of the public service sector in the NRV.

The distribution of agricultural damage shows Giles County with the highest vulnerability with approximately 47% receiving substantial damage. The rest of the counties' agriculture is much less vulnerable. Radford City stands out as the one with the highest commercial (56.61%) and industrial (59.99%) flood vulnerability.

Table 4-14. Building Damage by General Occupancy

		Locality					
Occupancy Type		**Floyd**	**Giles**	**Montgomery**	**Pulaski**	**Radford**	**NVRPDC**
Residential	Total	133.66	653.64	770.04	911.72	178.48	2647.54
	Substantial	54.07	242.89	234.58	273.08	102.89	907.51
	Percentage	40.45%	37.16%	30.46%	29.95%	57.65%	34.28%
Commercial	Total	15.11	170.84	56.45	219.4	136.79	598.59
	Substantial	4.29	67.96	12.78	7.28	77.43	169.74
	Percentage	28.39%	39.78%	22.64%	3.32%	56.61%	28.36%
Industrial	Total	10.6	84.75	127.86	361.32	49.94	634.47
	Substantial	1.18	8.47	10.49	75.22	29.96	125.32
	Percentage	11.13%	9.99%	8.20%	20.82%	59.99%	19.75%
Agriculture	Total	2.57	5.39	12.91	7.19	0.32	28.38
	Substantial	0.62	2.53	2.82	2.38	0.13	8.48
	Percentage	24.12%	46.94%	21.84%	33.10%	40.63%	29.88%
Religion	Total	1.3	22.59	15.19	32.59	5.86	77.53
	Substantial	0.27	5.72	0.46	1.55	2.81	10.81
	Percentage	20.77%	25.32%	3.03%	4.76%	47.95%	13.94%
Government	Total	0.64	9.24	1.28	36.74	0	47.9
	Substantial	0.42	1.35	0.07	0.57	0	2.41
	Percentage	65.63%	14.61%	5.47%	1.55%	0.00%	5.03%
Education	Total	0.1	8.85	11.09	4.64	0.21	24.89
	Substantial	0.01	0.59	0.17	0.67	0	1.44
	Percentage	10.00%	6.67%	1.53%	14.44%	0.00%	5.79%

Occupancy Type	Locality					NVRPDC
	Floyd	Giles	Montgomery	Pulaski	Radford	
% Substantial of Net Total	37.1%	34.5%	26.3%	22.9%	57.4%	30.2%

In thousands of square feet
Substantial damage >50% damage

4.5.2.5 Dollar Exposure

Unless floodwaters flow at a high velocity and the structure and the foundation become separated or the structure is impacted by flood-borne debris, it is unlikely that a building will suffer structural failure in a flood (HAZUS-MH MR4 Technical Manual, 2010). Therefore, the way HAZUS-MH works is that building type, design level and quality of construction do not play a major role in damage resistance to flooding. In general, it is expected that the major structural components of a building will survive a flood, but that the structural finishes and contents/inventory may be severely damaged due to inundation.

HAZUS-MH models general building stock dollar exposure which can be viewed by general occupancy, general building type or specific building type. This option provides estimates of direct physical damages to buildings and contents, the exposure of essential facilities to flooding, the consequential direct economic losses and the number of people displaced by evacuation and inundation. The latter is not examined in this report.

Table 4-15 and Table 4-16 provide summary statistics for building stock exposure by type and occupancy for the NRV.

Table 4-15. Building Stock Exposure by Building Type

Building Type	Locality					NVRPDC
	Floyd	Giles	Montgomery	Pulaski	Radford	
Concrete	59,329	98,857	610,883	273,406	125,741	1,168,216
Manuf. Housing	52,115	46,867	162,613	75,355	6,431	343,381
Masonry	149,262	217,139	1,148,394	488,926	238,054	2,241,775
Steel	15,649	28,456	332,338	86,315	85,578	548,336
Wood	355,950	485,412	1,986,348	1,023,597	387,218	4,238,525
Total	**632,305**	**876,731**	**4,240,576**	**1,947,599**	**843,022**	**8,540,233**

All values in thousands of dollars

Table 4-16. Building Stock Exposure by Occupancy

Occupancy Type	Locality					NVRPDC
	Floyd	Giles	Montgomery	Pulaski	Radford	
Residential	501,948	664,208	3,041,634	1,402,236	630,010	6,240,036
Commercial	66,969	128,799	758,327	224,807	137,775	1,316,677
Industrial	31,853	42,881	134,789	232,722	42,414	484,659
Agriculture	7,137	4,374	18,368	7,523	835	38,237
Religion	11,785	24,008	105,638	42,903	19,099	203,433
Government	5,236	5,231	28,960	17,909	4,704	62,040

Occupancy Type	Locality					NVRPDC
	Floyd	Giles	Montgomery	Pulaski	Radford	
Education	7,327	7,259	152,853	19,467	8,165	195,071
Total	**632,255**	**876,760**	**4,240,569**	**1,947,567**	**843,002**	**8,540,153**

All values in thousands of dollars

Table 4-15 shows the dollar exposure by building construction type. The overall picture presents a typical expected outcome based on the quality and durability of the construction. Within the NRV the most likely damage in order of magnitude range from manufactured housing ($343,381,000) to steel ($548,336,000) to concrete ($1,168,216,000) to masonry ($2,241,775,000) to wood ($4,238,525,000) for an estimated total of $8,540,233,000. Notice that that wood damage is the highest in part because it is common, but also because it is more vulnerable. Steel has one of the lowest damage values because it is rare and also less vulnerable. Manufactured housing which dominates the percentage of square footage receiving substantial damage (see Table 4-13) has a low dollar exposure mainly because of their value and cheaper construction.

As can be seen in Table 4-16, the agriculture category has the least exposure in terms of dollar value. This is expected since land designated as agriculture has the least number of standing buildings. The major damage is in residential and commercial buildings. Government buildings also have a low exposure risk for the simple reason that public facilities are seldom in flood-prone areas.

The key difference in the dollar exposure values provided is the issue of spatial location. Consistently Radford City tends to show high risks primarily due to its proximity to the New River. The same can be said about Giles County. At the same time, Montgomery and Pulaski are both large counties but ones with few buildings within the floodplains.

One key parameter not considered in this estimation of expected flood damage is building age. Age is an issue because building codes (and expected building performance) change over time, and because development regulations change when a community enters the NFIP. In cases where the building floor data was developed prior to entrance in the NFIP, it can be assumed that this portion of data in the exposure analysis will be more susceptible to damage resulting from a 100-year flood event. In the final analysis, the interpretation of the statistics generated depends not only on the type and occupancy of the buildings but also the age of the buildings in question.

4.5.2.6 Transportation System Dollar Exposure

The broad transportation systems included in HAZUS-MH program are highways, railways, light rail, bus, ports, ferries and airports.

The following are the characteristics of the categories under consideration in this analysis:

- Highways - consists of roadways, bridges and tunnels. HAZUS-MH MR3 as is does not include assessment of losses to street segments and other highway components.
- Railways - consists of tracks, bridges, tunnels, stations, fuel, dispatch and maintenance facilities. The HAZUS-MH MR3 flood model does not account for flood-borne debris impact or the loads resulting from flood-borne debris trapped against transportation

features such as bridges. Also the model does not assess losses to railway segments and other railway components, but will produce an estimate of the percent damage to a bridge and the probability of the bridge being functional, depending on the estimated damage.

– Bus - bus transportation system consists of urban stations fuel facilities, dispatch and maintenance facilities. In the NRV there are two functional bus systems: *Blacksburg Transit* (BT) that operates fixed-routes mainly in the Towns of Blacksburg and Christiansburg and *Pulaski Area Transit* which operates primarily in the Town of Pulaski. Both transit services also provide an on-demand service for qualifying disabled residents. There is also a local bus system in the City of Radford, *The Tartan*, operated by Radford University. The BT system was included in the present modeling, but the other two were not.

– Airport - an airport transportation system consists of control towers, runways, terminal buildings, parking structures, fuel facilities and maintenance and hangar facilities. There are two facilities within the NRV namely the New River Valley Airport (NRV Airpark) in Dublin (Pulaski County) and the Virginia Tech Montgomery Executive Airport in Blacksburg (Montgomery County).

Overall the most impact in the event of a 100-year flood, highways will experience the largest loss followed by railways and airports. Montgomery County will bear most of the brunt and in all categories (Table 4-17).

Note that light rail, ports and ferry categories are not included in the analysis because they do not exist in the NRV.

Table 4-17. Transportation System Dollar Exposure

	Locality					
Transportation	**Floyd**	**Giles**	**Montgomery**	**Pulaski**	**Radford**	**NVRPDC**
Highway	325,836.08	508,996.01	624,394.27	397,872.44	67,188.53	1,924,287.33
Railway	0	62,752.33	78,330.38	38,847.70	11,784.57	191,714.98
Bus Facility	0	0	2,027.40	0	0	2,027.40
Airport	0	0	67,945.80	33,972.90	0	101,918.70
Total	**325,836.08**	**571,748.34**	**772,697.85**	**470,693.04**	**78,973.10**	**2,219,948.41**

All values in thousands of dollars

4.5.2.7 Utility Dollar Exposure

The inventory classification scheme for lifeline systems separates components that make up the system into a set of pre-defined classes. The classification system includes potable water, wastewater, oil, natural gas, electric power and communication systems. Oil systems and natural gas are not included in the report because they do not exist in the form described within the NRV. The following is a brief description of the utility systems:

– Potable water – this system consists of pipelines, water treatment plants, control vaults and control stations, wells, storage tanks and pumping stations. The model estimates damage, losses and functionality for select vulnerable components of the potable water system. These include treatment plants, control vaults and control stations and pumping stations.

- Wastewater – wastewater system consists of pipelines, wastewater treatment plants, control vaults and control stations and lift stations. The model will estimate damage, losses, and functionality for select vulnerable components within the wastewater system including treatment plants, control vaults and control stations and lift stations.

- Electric power – electric power system consists of generating plants, substations, distribution circuits and transmission towers. The flood model as is only performs a limited analysis on select vulnerable electric power system components vis-à-vis generating plants and substations.

- Communication – a communication system consists of communications facilities, communications lines, control vaults, switching stations, radio/TV station, weather station or other facilities. At this time HAZUS-MH MR3 flood model has deferred estimating damage and losses for communications facilities.

The inventory data used to estimate utility dollar exposure in each case includes the geographical location and classification of system components, replacement cost for facilities and the repair costs for the system components.

At the moment wastewater systems are more vulnerable than any of the other categories in part because collecting points for wastewater is always located downhill, coinciding with river flood zones. Potable water systems are significantly at risk at a distant second to wastewater in all localities except Floyd County (Table 4-18).

At this time, the flood model does not account for flood borne debris impact, or water borne debris loads which can cause significant clean-up efforts for utility systems (HAZUS-MH MR3 Technical Manual, 2007). The Flood Model analyzes those system components that are more vulnerable or costly to clean-up, repair or replace since they are likely to control the overall recovery costs and time.

Table 4-18. Utility System Dollar Exposure

	Locality					
Utility	**Floyd**	**Giles**	**Montgomery**	**Pulaski**	**Radford**	**NVRPDC**
Potable Water	0	30,969.00	30,969.00	61,938.00	30,969.00	**154,845**
Waste Water	61,938.00	309,690.00	309,690.00	123,876.00	0	**805,194**
Electric Power	0	102,300.00	0	0	0	**102,300**
Communication	93	186	651	744	93	**1,767**
Total	**62,031.00**	**443,238.00**	**341,310.00**	**186,558.00**	**31,062.00**	**1,064,199**

All values in thousands of dollars

4.5.2.8 Vehicle Dollar Exposure

Vehicle dollar exposure is the estimated value of the vehicles[3] by location, based on home address (by census block). The flood model looks at passenger cars, light trucks (including SUVs) and heavy trucks (commercial/industrial vehicles including 18-wheelers). The HAZUS estimation procedure for flood damage of motor vehicles (vehicle dollar exposure) is based on vehicle inventory within a study area, allocation of vehicles by time of day to different locations, estimated value of vehicles and the percent loss damage function according to the flood depth.

Generally, vehicle dollar exposure is higher for night – when registered vehicles are assumed to be at the registered residence – than day. If the day dollar exposure is high then the model assumes that the locality records more day into-locality traffic (commuters) than out-of-locality traffic. Giles County has such traffic flow, recording more vehicles during the day than at night.

Table 4-19. Vehicle Dollar Exposure – Day

	Floyd	Giles	Montgomery	Pulaski	Radford	NVRPDC
Cars	7,744,005	60,876,281	61,448,130	26,630,381	11,304,286	168,003,083
Light Trucks	3,256,585	25,600,293	25,840,773	11,198,870	4,753,790	70,650,311
Heavy Trucks	6,028,317	47,389,109	47,834,265	20,730,406	8,799,816	130,781,913
Total	**17,028,907**	**133,865,683**	**135,123,168**	**58,559,657**	**24,857,892**	**369,435,307**

All values in thousands of dollars

Table 4-20. Vehicle Dollar Exposure – Night

	Floyd	Giles	Montgomery	Pulaski	Radford	NVRPDC
Cars	15,252,605	33,462,314	115,663,533	42,549,215	22,816,621	229,744,288
Light Trucks	6,414,176	14,071,902	48,639,967	17,893,215	9,595,070	96,614,330
Heavy Trucks	11,873,382	26,048,721	90,038,216	33,122,414	17,761,587	178,844,320
Total	**33,540,163**	**73,582,937**	**254,341,717**	**93,564,843**	**50,173,277**	**505,202,937**

All values in thousands of dollars

4.5.2.9 Direct Economic Annualized Losses for Buildings

Annualized loss provided an estimate of the maximum potential annual loss. Annualized losses are essentially the summation of losses over all return periods multiplied by the probability of those floods occurring. In mathematical terms, the analysis essentially looks like this:

Annual Loss = Sum of (Probability of Occurrence) * ($ loss)

These loss estimates document the magnitude of the natural hazards problems, as well as provide a benchmark against which progress toward reducing losses due to natural hazards through public policy can be assessed. Annualized Direct Economic Losses estimates are only available

[3] The vehicle valuation is based on the distribution of new and used vehicles provided by each state's Department of Motor Vehicles (DMV) and the average sale prices of these vehicles.

for buildings because HAZUS-MH focuses on building assets using a more complete inventory and analysis.

Table 4-21. Direct Economic Annualized Losses for Buildings in the NRV

	Capital Stock Losses				Income Losses				
Locality	**Cost Building Damage**	**Cost Content Damage**	**Inventory Loss**	**Building Loss Ratio**	**Relocation Loss**	**Capital Related Loss**	**Wages Loss**	**Rental Income Loss**	**Total Loss**
Floyd	3,918	3,365	225	2.0	2	1	9	1	**7,549**
Giles	26,048	32,385	2,124	4.9	53	88	426	18	**61,597**
Montgomery	20,843	21,509	980	3.3	41	67	195	20	**44,048**
Pulaski	32,570	48,700	4,769	3.2	71	104	763	25	**87,635**
Radford	17,804	28,539	1,091	10.0	54	66	164	18	**48,054**
NVRPDC Total	**101,183**	**134,498**	**9,189**	**23.4**	**221**	**326**	**1557**	**82**	**248,883**

All values in thousands of dollars

Although only about 5% of the New River Valley is predicted to be vulnerable to flooding impacts, it is evident that estimated losses can easily run into several million dollars.

The following sections contain locality specific information and mapping for flooding. Original information was compiled from FEMA reports, National Flood Insurance Studies, Army Corps of Engineer studies, Natural Resources Conservation Service reports, newspaper accounts and local records.

4.5.2.10 Floyd County

Floyd County is situated atop a high plateau of the Blue Ridge Mountains that divides eastward flowing waters from westward flowing waters. Essentially no water flows into Floyd County; all flowing water begins in the county and drains to other areas. A number of important streams originate in Floyd County, including Big Reed Island Creek and Little River (tributaries of the New) and headwater streams of the Dan, Smith, Pigg, Backwater and Roanoke Rivers. The following were studied in detail by the Flood Insurance Study performed by FEMA to identify and prioritize flood hazards (1989):

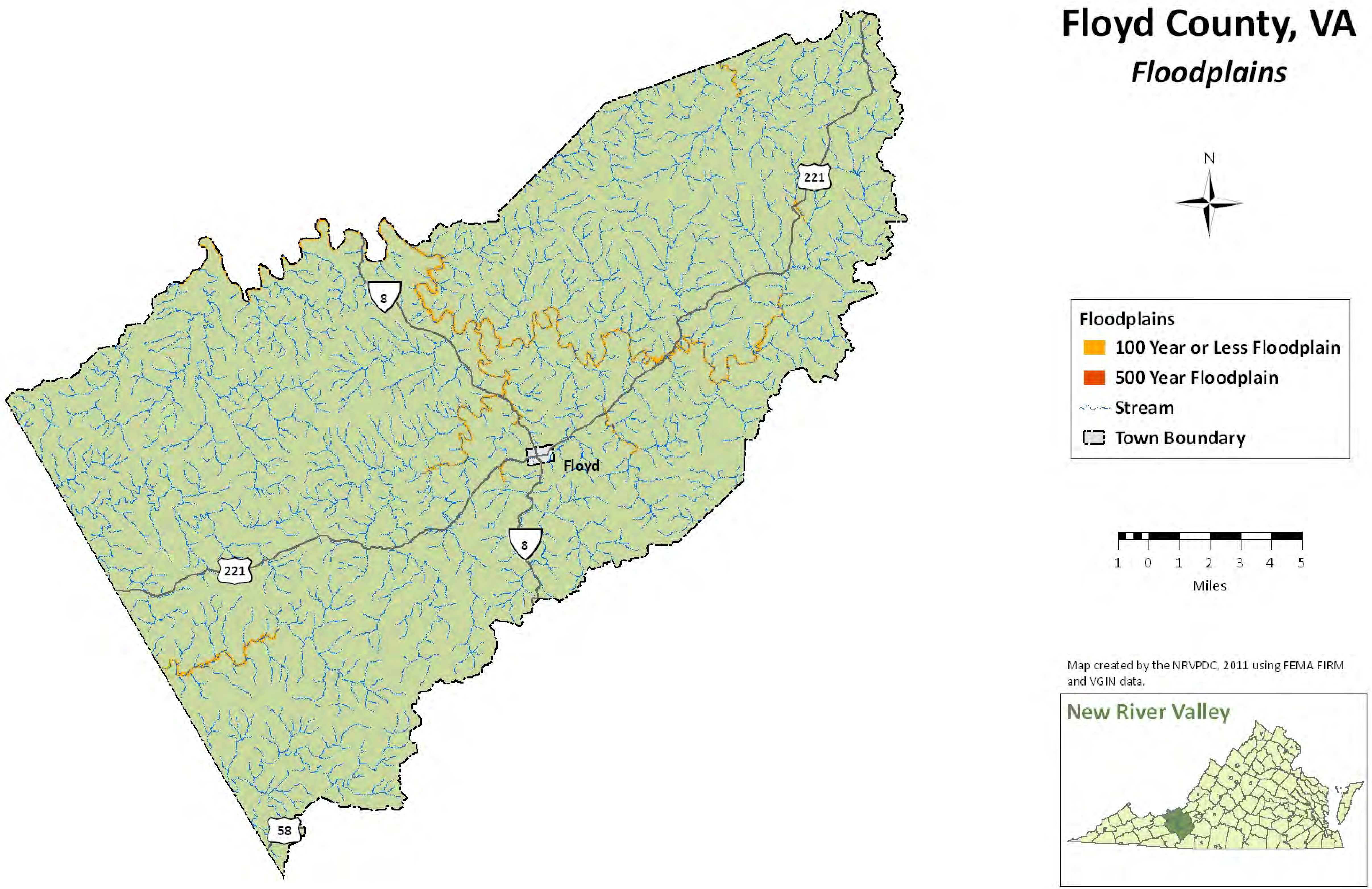
- Little River
- Dodd Creek
- West Fork of Little River
- Pine Creek
- Meadow Run

Flooding has been recorded in these areas of the county in 1940, 1959, 1972, 1985, and 2003. The floods are primarily due to heavy rains from localized storms and tropical storms in this area and cause significant economic damage to private, commercial, and public property, especially roads and bridges. The largest flood occurred on June 21, 1972 when Little River's discharge at

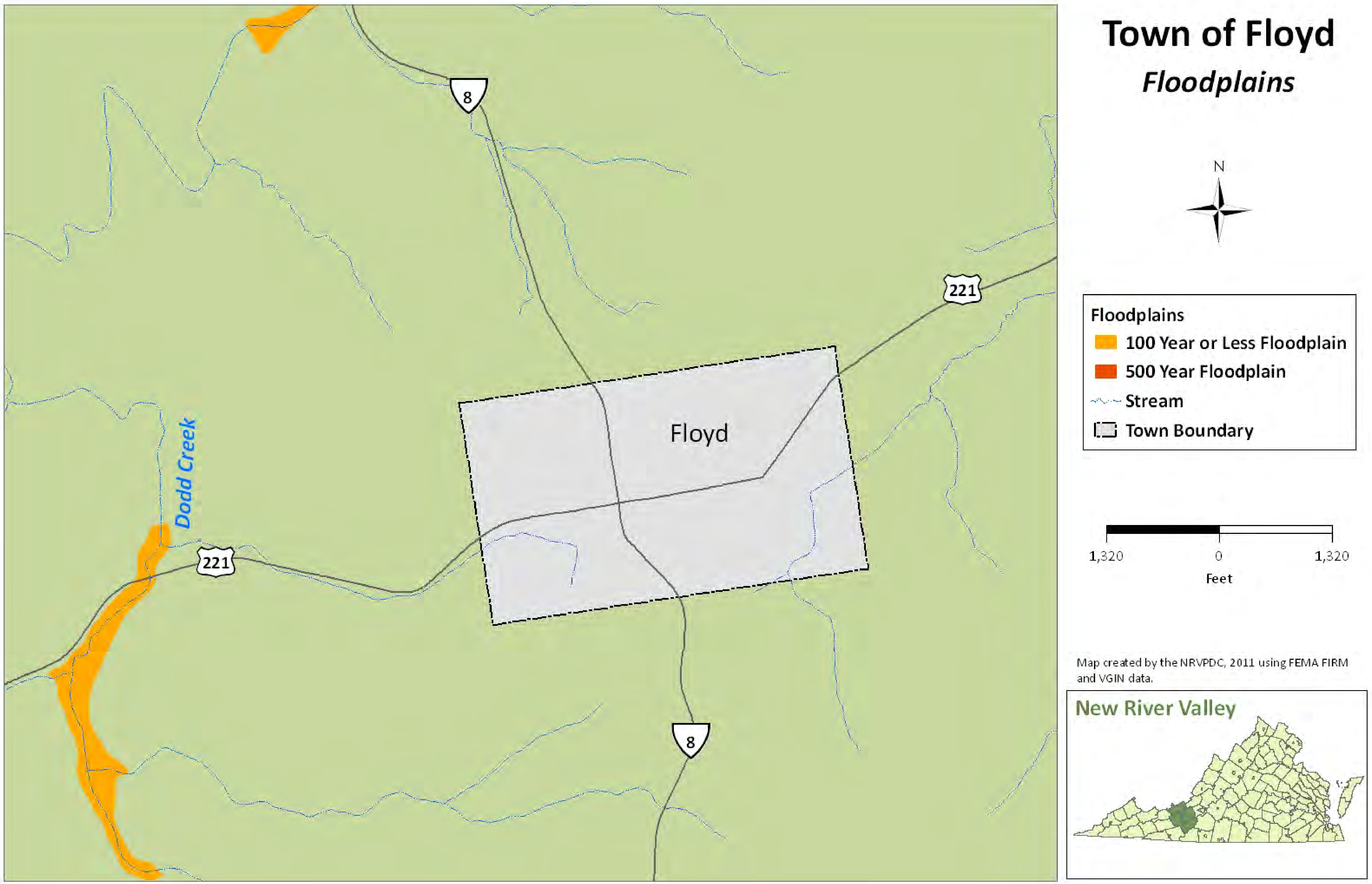
Graysontown reached 22,800 cubic feet per second (cfs). This flood has an approximate recurrence interval of 50 years. Map 14 illustrates the 100-year and 500-year floodplains in the county, while Map 15 illustrates the same for the Town of Floyd.

It is believed that the number of homes with significant flooding risk to primary living areas is limited in Floyd County. Only 12 properties in Floyd County participate in the National Flood Insurance Program and only one is a repetitive loss property. Floyd County is experiencing substantial housing and population growth, but it is not currently believed to be occurring in the flood hazard area.

Map 14. Floyd County Floodplains



Map 15. Town of Floyd Floodplains



4.5.2.11 Giles County

The unincorporated areas of Giles County can be affected by flooding from 19 different streams or stream segments. The Flood Insurance Study by FEMA breaks these into two groups. One group was studied in detail, the other in approximate methods. The following streams studied in detail were done so due to known history of flood hazard and the projected growth in area:

- New River (in or near towns)
- Doe Creek
- Greenbrier Branch
- Laurel Branch
- Little Stony Creek
- Piney Creek
- Sinking Creek
- Spruce Run
- Stony Creek
- Wolf Creek

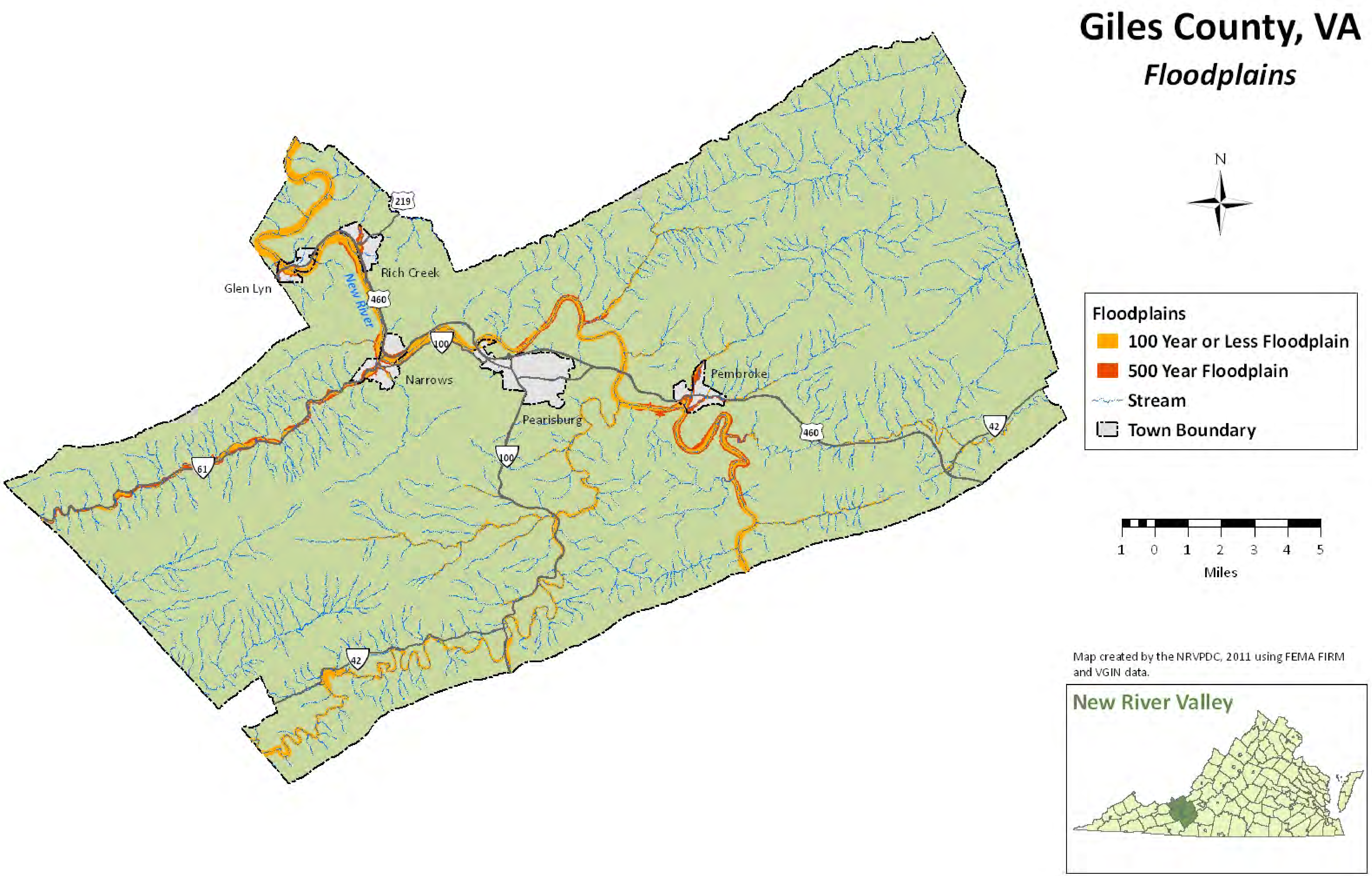
These were studied using approximate methods

- New River (remainder)
- Bluestone Lake
- Broad Hollow Creek
- Cecil Branch
- Dry Branch
- Little Sugar Run
- Sugar Run
- Tributary to Sugar Run
- Walbash Creek
- Walker Creek

Giles County is fairly rugged, with high mountains and narrow valleys with some rolling hills and small, flat plateaus. Many of the streams are characterized by large boulders and high-velocity flows during storms. This results in rapid and dangerous flash-flooding in several areas, threatening life and property with little time for warning and preparation (and thus the later identified needs of better warning mechanisms and swift-water rescue capabilities). Flowing through the middle of the county is the New River. Flowing northwest through Virginia and into West Virginia, the New River divides Giles County into almost two equal parts.

Low-lying areas of the county in the proximity of the above streams are the most subject to flooding (see maps below). Tropical storms and isolated storms are the main causes of flooding in the area. The largest flood recorded for the New River was in 1940 where the waters were almost to the 100-year flood elevation. A limited portion of the Celanese Acetate, LLC property, the largest employer in Giles County, is located along the New River, in the 100-year floodplain, so a 100-year storm or greater could have a dramatic indirect economic costs as well (in terms of work days lost). Doe Creek, Little Stony, and Sinking Creek all experienced their largest flood elevations in May 1973. Damages to property, road, bridges and utilities were reported to be between $600,000 and $800,000 ($1.5 million+ in 2003 dollars.) Detailed analysis on local flood-prone areas is provided next for Glen Lyn, Narrows, Pearisburg, Pembroke and Rich Creek.

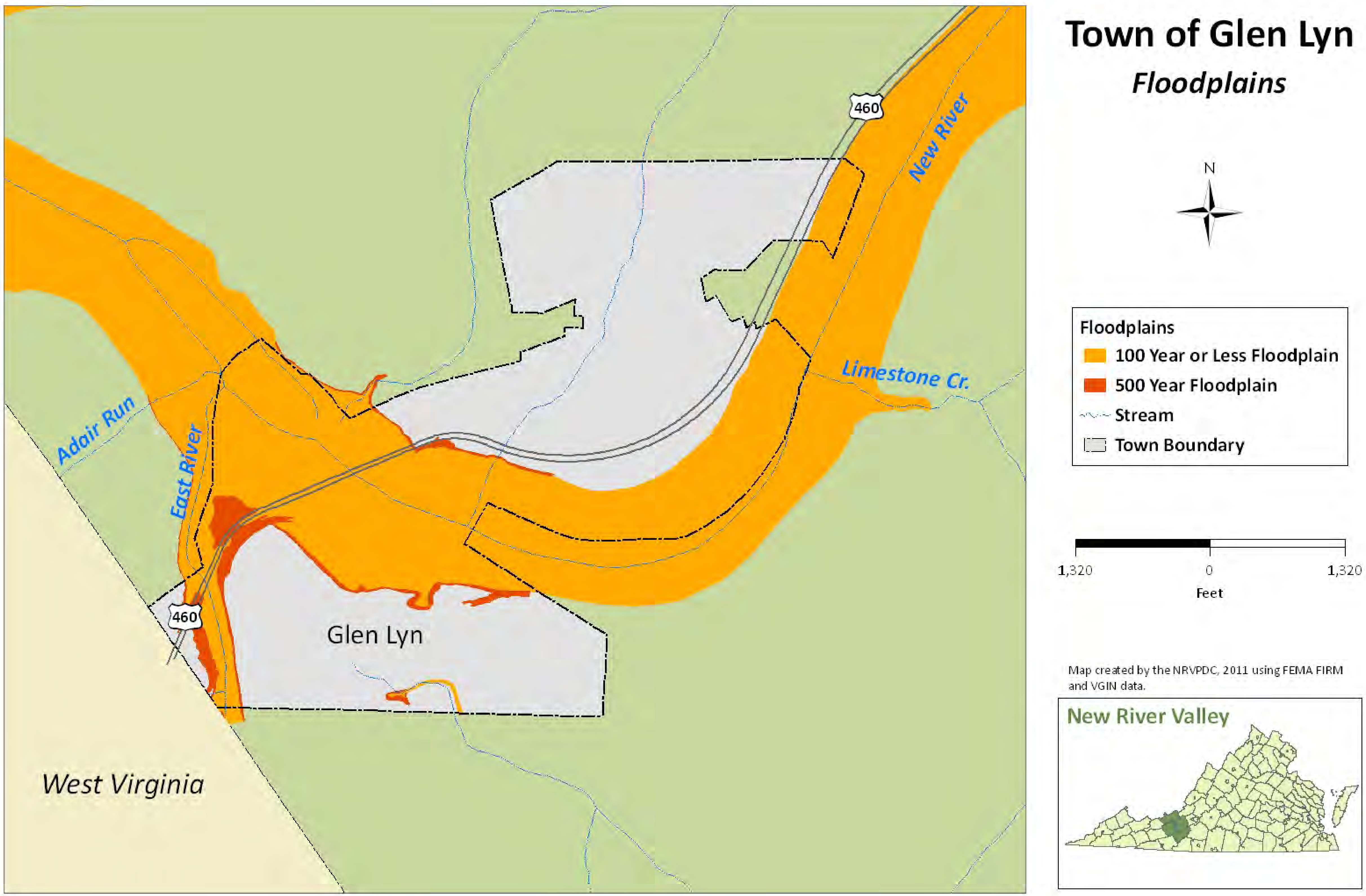
Map 16. Giles County Floodplains



4.5.2.12 Town of Glen Lyn

The Town of Glen Lyn lies alongside the New River as it flows north into West Virginia. Located within the floodplain and partially within the Town of Glen Lyn is the American Electric Power Plant. Otherwise, the majority of the Town is located on a hillside, and therefore only a few structures are at risk in the event of a flood. The largest recorded flood in the area was in 1940. The power plant became flooded, but only received minor damages. The 1940 event along with an event of 1916 and 1972 are the only recorded flood events for the Town of Glen Lyn. Glen Lyn participates in the National Flood Insurance Program, but there are currently no policies in effect.

Map 17. Town of Glen Lyn Floodplains

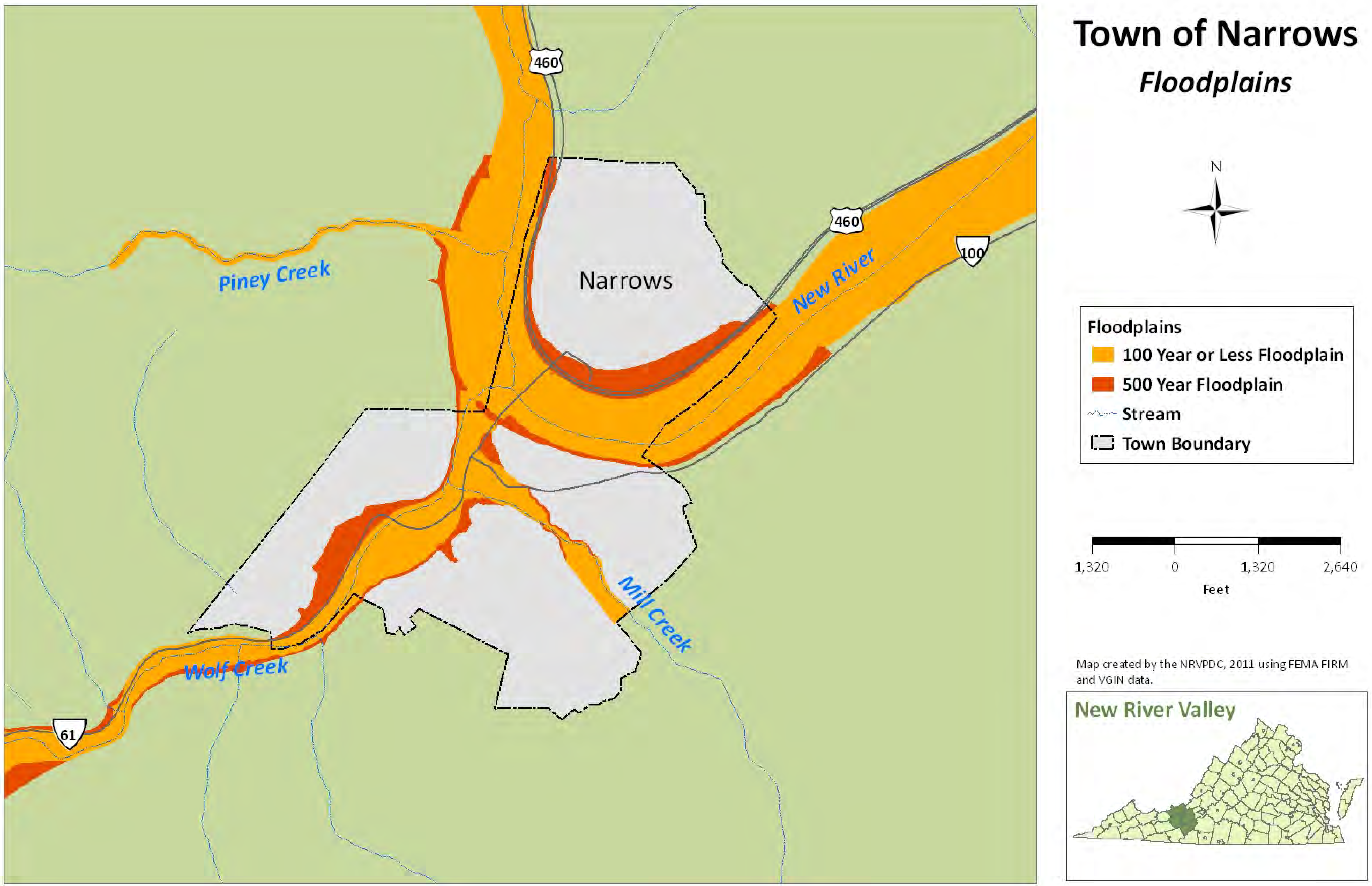


4.5.2.13 Town of Narrows

The Town of Narrows is located along a New River bend. The confluence of Wolf Creek and the New River occurs in the Town limits so flooding on the New has dramatic effects on the Town. Mill Creek, a tributary of Wolf, also contributes to flood problems. During the 1940 New River flood (estimated at 100-year flood), virtually the entire business section of the Town of Narrows was flooded. The local sewage treatment plant, still located in the New River floodplain, was damaged. Subsequent floods, including 1956 and 1972, caused significant property damage along Wolf Creek. Water entered homes and businesses peaking at a height of four feet in a local power substation.

The Town of Narrows is very vulnerable to flooding. There are no reported Repetitive Loss Properties in Narrows.

Map 18. Town of Narrows Floodplains



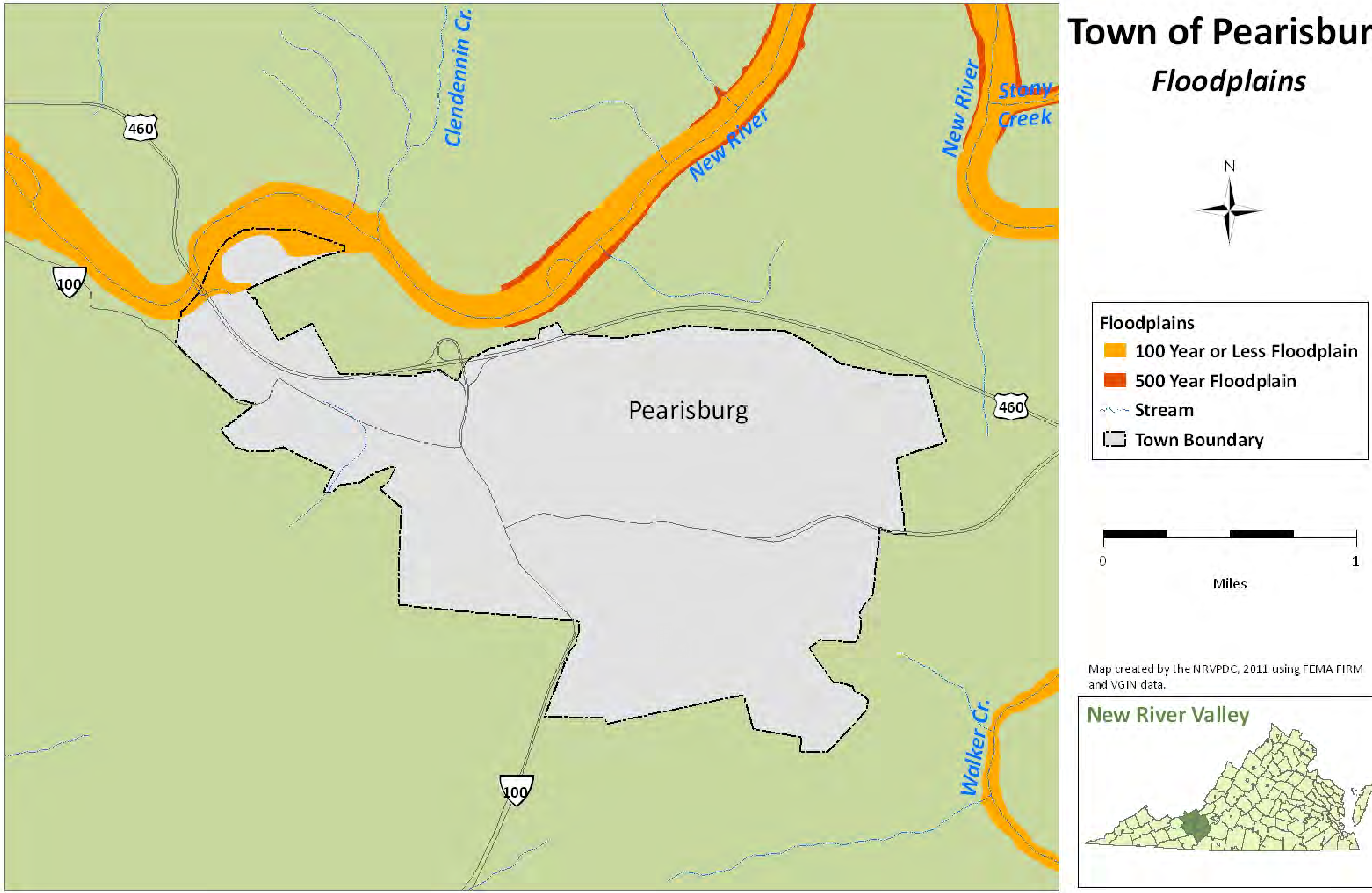
4.5.2.14 Town of Pearisburg

The Town of Pearisburg has experienced flood problems in the downtown area and on the east end. Most recently, the downtown experienced flooding in 1995, and the east end flooded in 2002. There has apparently been no federal flood insurance study in Pearisburg, though the Town conducted a study of downtown flooding issues in 1998.

Wenonah Street is affected by flooding in Pearisburg, as is the Bunker Hill area (Preliminary Engineering Report, 1998). Clifford and Chestnut streets experience minor stormwater flooding in backyards. Since no flood insurance studies or mapping have been done in the town, the risk factors are unknown.

Located inside the Town limits, the town's sewage treatment plant and a portion of the Hoechst-Celanese property (a major employer) are in the 100-year floodplain. The treatment plant facilities are elevated to a height of at least six inches above the base flood elevation. The treatment plant is valued at over $1 million. As of 2002, there were three flood insurance policies in Pearisburg area, covering $159,000 in structures. Pearisburg has one repetitive loss property.

Map 19. Town of Pearisburg Floodplains



4.5.2.15 Town of Pembroke

The Town of Pembroke is located in the center of Giles County. The town became incorporated in 1948 and had a population of 1,134 in 2000. Mays Hollow, Little Stony Creek, Doe Creek and the New River are all threats of flooding to the town and were the subjects of a flood insurance study in 1978.

Mays Hollow, Little Stony Creek and Doe Creek flow through the town while the New River flows along the town's southern border. The worst flooding on record of the New River was in August 1940. The flooding caused backwater effects that affected the lower lying areas and filled Little Stony and Doe Creek, causing damages to many residents.

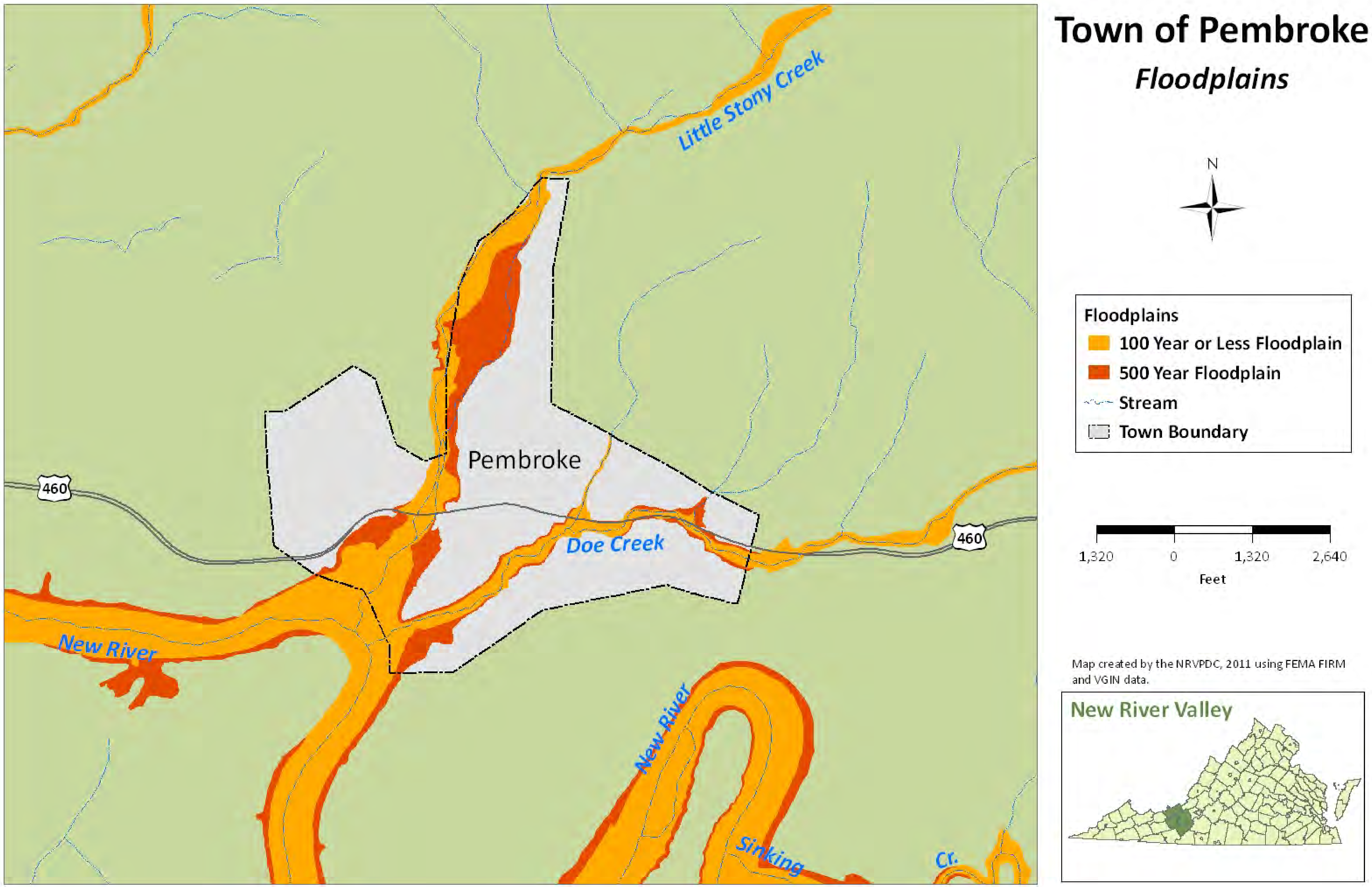
Localized thunderstorm events and tropical storm related precipitation are the primary cause of flooding in the area. A recent flood event occurred in July 2002, as already discussed, after a localized storm dropped 5.5+ inches of precipitation in less than four hours. This event caused flooding of Doe Creek, the temporary closing US Route 460, and substantial flood damage to residents and businesses.

Local residents point to the construction of US Route 460 and subsequent channelization of Doe Creek and Little Stony Creek as part of the problem. The small culverts are easily overwhelmed, and debris further exacerbates the problems.

The 2002 "Doe Creek" flood revealed part of Pembroke's vulnerability to flash-flooding. As Map 20 demonstrates, though, the Little Stony 100-year floodplain (flowing north to south) through the town is much larger than the Doe Creek 100-year floodplain (flowing east to west). If the 2002 event had been centered just slightly north and west, much more damage would have likely occurred, as there are many more structures close to the streambed along Little Stony.

Despite the high number of at-risk properties, there are only 23 flood insurance policies in the town, covering about $1.9 million in property.

Map 20. Town of Pembroke Floodplains



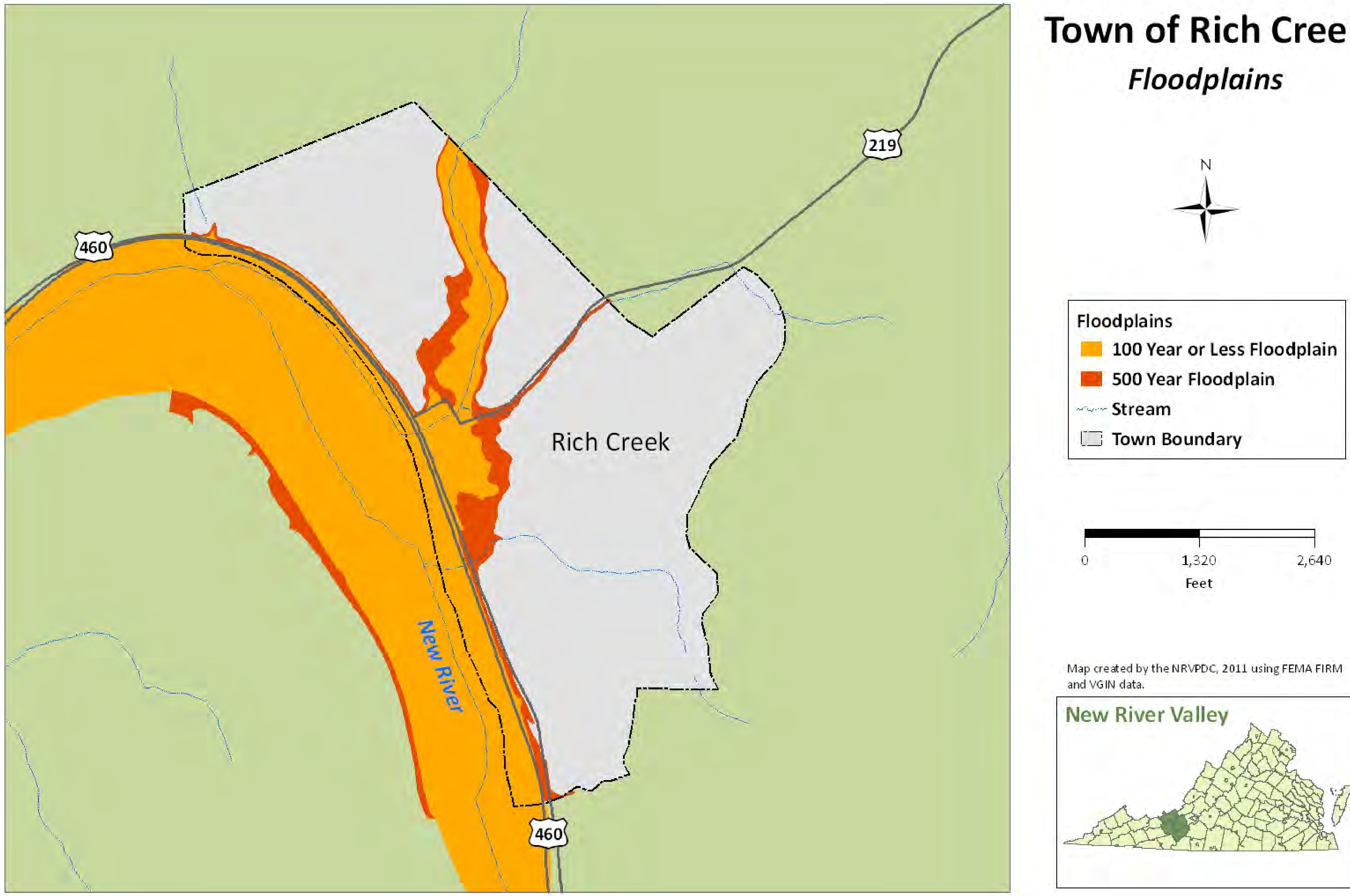
4.5.2.16 Town of Rich Creek

Incorporated in 1947, the Town of Rich Creek is located in Giles County only a few miles from West Virginia. The New River is the western boundary of the Town and is the primary source of periodical flooding. Another source of flooding is the Town's namesake, Rich Creek, a tributary to the New River.

Flooding in the Town of Rich Creek has been primarily due to heavy rains resulting from a tropical storm, or localized thunderstorm or frontal system. Flood events which resulted in property damage (including commercial) occurred in July 1916 and August 1940, but there is no data available on an estimation of damages. Both of these flood events were recorded as 100-year flood events.

Located on its namesake, much of Rich Creek is in the floodplain. No repetitive loss properties are known to be located in Rich Creek.

Map 21. Town of Rich Creek Floodplains



4.5.2.17 Montgomery County

Montgomery County is bordered on the north by Giles and Craig Counties, on the south by Floyd County, on the east by Roanoke County, and on the west by Pulaski County. Urbanized areas within the county experience fairly frequent flooding. These high risk areas will be discussed in more detail later.

The unincorporated areas of Montgomery County may be affected by flooding from many streams in the area. In the past, the most severe flooding of the major streams has been the result of heavy rains from tropical storms, while flooding of the smaller creeks has been primarily due to localized thunderstorms. Also, flooding is sometimes associated with heavy rains on top of snowmelt or a frozen ground.

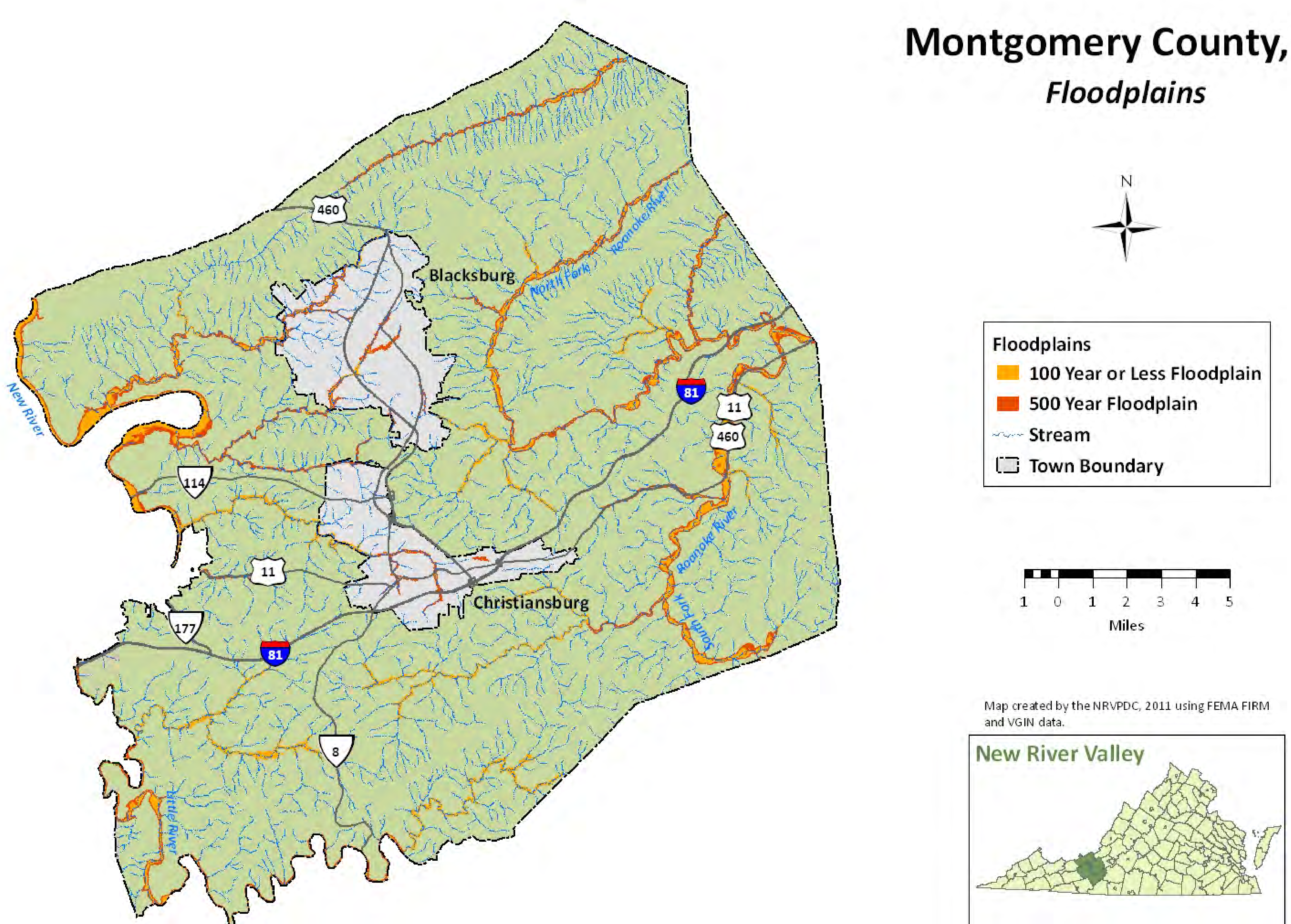
Flooding sources identified in the unincorporated areas of Montgomery County:

- Roanoke River
- North Fork Roanoke River
- South Fork Roanoke River
- Bottom Creek
- Bradshaw Creek
- Craig Creek
- Elliott Creek
- Goose Creek
- Indian Run
- Little River
- New River
- Plum Creek
- Slate Branch
- Spring Branch
- Stroubles Creek
- Toms Creek

The communities of Shawsville, Elliston, Lafayette, Allegheny Springs (Roanoke River basin) and Plum Creek, plus the towns of Blacksburg and Christiansburg are the primary areas affected. In June 1972, the elevations of the South Fork Roanoke and Roanoke River were at approximate 50-year frequency levels due to rainfall from tropical storm Agnes. This caused extensive damage to the adjacent communities in excess of one million dollars. This area also experienced flooding during the 1980s and 1990s and as recently as 2003. Many of these area are zoned for growth, including not only Blacksburg and Christiansburg but also much of Shawsville, Elliston and Plum Creek as evidenced by the new village designation in the future land use map.

As of September 2009, there were 182 NFIP in-force in the unincorporated areas of Montgomery County, covering $29,087,600 in structures. This areas includes eastern Montgomery and Plum Creek, but not the Towns of Blacksburg and Christiansburg, where policies in-force total $2,386,900 and $2,485,200, respectively (as of December 2002).

Map 22. Montgomery County Floodplains



4.5.2.18 Shawsville, Elliston, Lafayette and Alleghany Springs

Major flooding occurred in the Eastern Montgomery communities of Shawsville, Elliston, Lafayette and Alleghany Springs in 1940, 1972 and 1985. In June 1972, the elevations of the South Fork Roanoke and Roanoke River were at approximate 50-year frequency levels. This caused extensive damage to the above communities in excess of one million dollars. This area also experienced flooding in the early 1990's and as recently as the 2003 event referenced earlier.

In relatively mild downpours, communities in eastern Montgomery County experience flooded roads and hampered mobility. When serious rainfall occurs, as seen in the February 2003 event, substantial threats to life exist. Roads and bridges flood, as do homes, resulting in substantial damage.

4.5.2.19 Plum Creek

The Plum Creek section of Montgomery County is located largely along the Route 11 corridor between Christiansburg and Radford. While most flood hazard areas in unincorporated Montgomery County are zoned for agriculture, the Plum Creek area is largely zoned for growth.

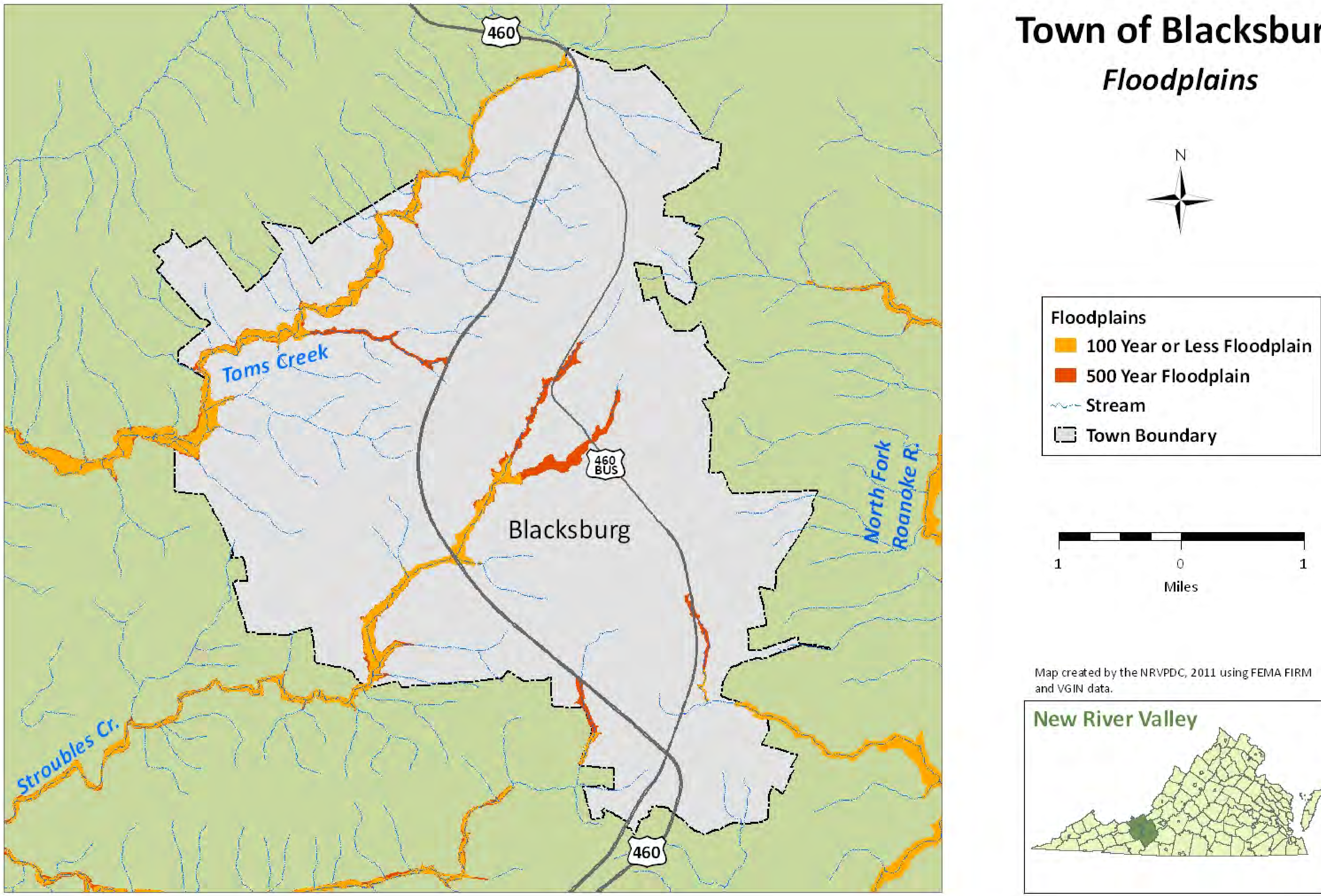
4.5.2.20 Town of Blacksburg

The Town of Blacksburg supports a population of 39,573 residents, the largest urban area in the New River Valley. The Town of Blacksburg was incorporated in 1871. Growth of the town has been as a result of the establishment and growth of Virginia Polytechnic Institute and State University (Virginia Tech) as a land grant college. The university began as an agriculture and mechanical college and has expanded to a leading university in such programs as engineering, architecture, business, and the arts. Currently home to approximately 25,000 students, the university is an enormous asset to the town.

Blacksburg is located atop the eastern continental divide where Toms and Stroubles Creeks flow into the New River. These two creeks along with Cedar Run, a tributary of the Roanoke River and Slate Branch are of the most concern for flood conditions. Flooding primarily occurs in the low-lying areas of the town and is the result of heavy rains of a localized storm, tropical storm, or combination rain and snowmelt in the area. Past history reports severe flooding include 1940, 1972, 1978, 1985, and 1991. The 1991 flood caused $4.5 million in damage on the Virginia Tech campus, including major damage to the Donaldson Brown Center (per Virginia Tech Environmental Health and Safety Services). Flood-protection methods for the residents and property of the town are controlled by the Town of Blacksburg in the form of zoning regulations, building codes and availability of FIRMs.

There are 13 flood insurance policies in force in Blacksburg, covering about $2.4 million in property. There are two repetitive loss properties in Blacksburg.

Map 23. Town of Blacksburg Floodplains

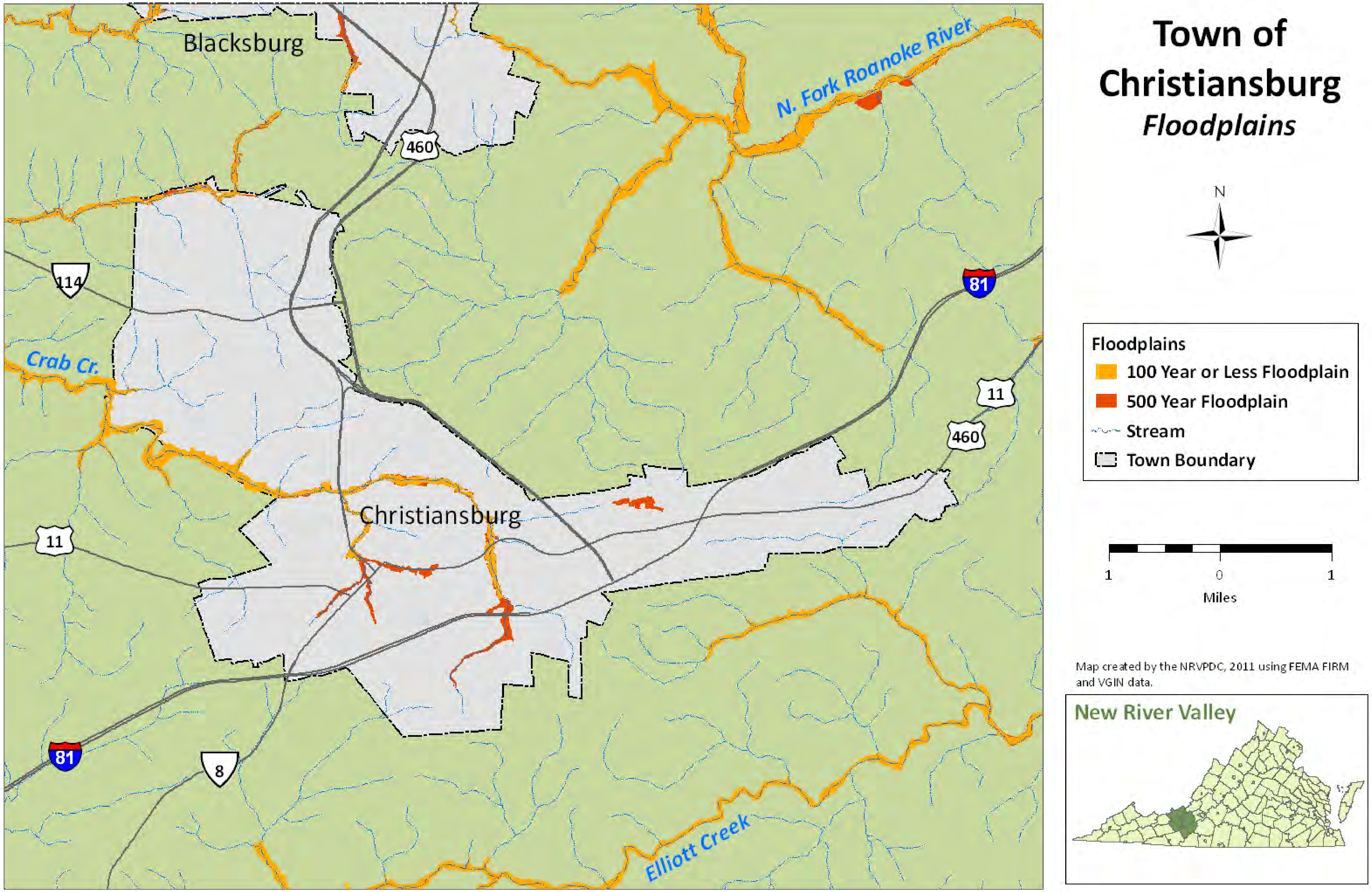


4.5.2.21 Town of Christiansburg

The Town of Christiansburg is located in central Montgomery County and serves as the county seat and commercial center for the entire New River Valley. Christiansburg was incorporated in 1792 and boasts a population, in 2000, of 16,947 residents. The town, located in the Valley and Ridge Physiographic Province, is characterized by rolling hills cut by rugged valleys. The floodplains are narrow, as the streams have small drainage areas and steep slopes. Development primarily lies above flood elevations, but floodplain regulations mitigate flood damage to future development.

Low-lying areas of Christiansburg may be subject to periodic flooding from Crab Creek, Walnut Branch and other small tributaries. The most severe flooding occurred in 1940, 1972, and 1978 as a result of localized thunderstorms and major weather fronts. Due to these floods, the area experienced large economic losses, but no loss of life was reported.

Map 24. Town of Christiansburg Floodplains



4.5.2.22 Pulaski County

Pulaski County is bordered by the Counties of Bland, Floyd, Giles, Montgomery, Carroll and Wythe. There are two towns in the county, Dublin and Pulaski, which is the county seat. the New River bisects the county from southwest to northeast. American Electric Power has a hydroelectric reservoir on the New River (built in 1939) within the county as well. Significant tributaries of the New River in Pulaski County include Peak Creek, Little Walker Creek and Big Reed Island Creek. These plus Peak Creek's two tributaries, Tract Fork and Sproules Run, are the principal sources of flooding in the county.

The most significant flood history and risks exist in and around the Town of Pulaski. In the last 90 years, the town has experienced at least 11 100-year floods, plus a 500-year flood in 1929. Based on the frequency of 100+-year floods in the last century, there is a 10-13% chance every year that the town will experience this level of flooding, rather than the anticipated 0.2-1% chance anticipated.

Tropical storms, including Hurricanes Donna (1960), Camille (1969) and Agnes (1972) are one cause of flooding. Localized thunderstorms from May to September tend to cause localized flooding. Rainstorms of longer duration tend to occur in colder months; these can also be exacerbated by snow/ice melts, as in February 2003.

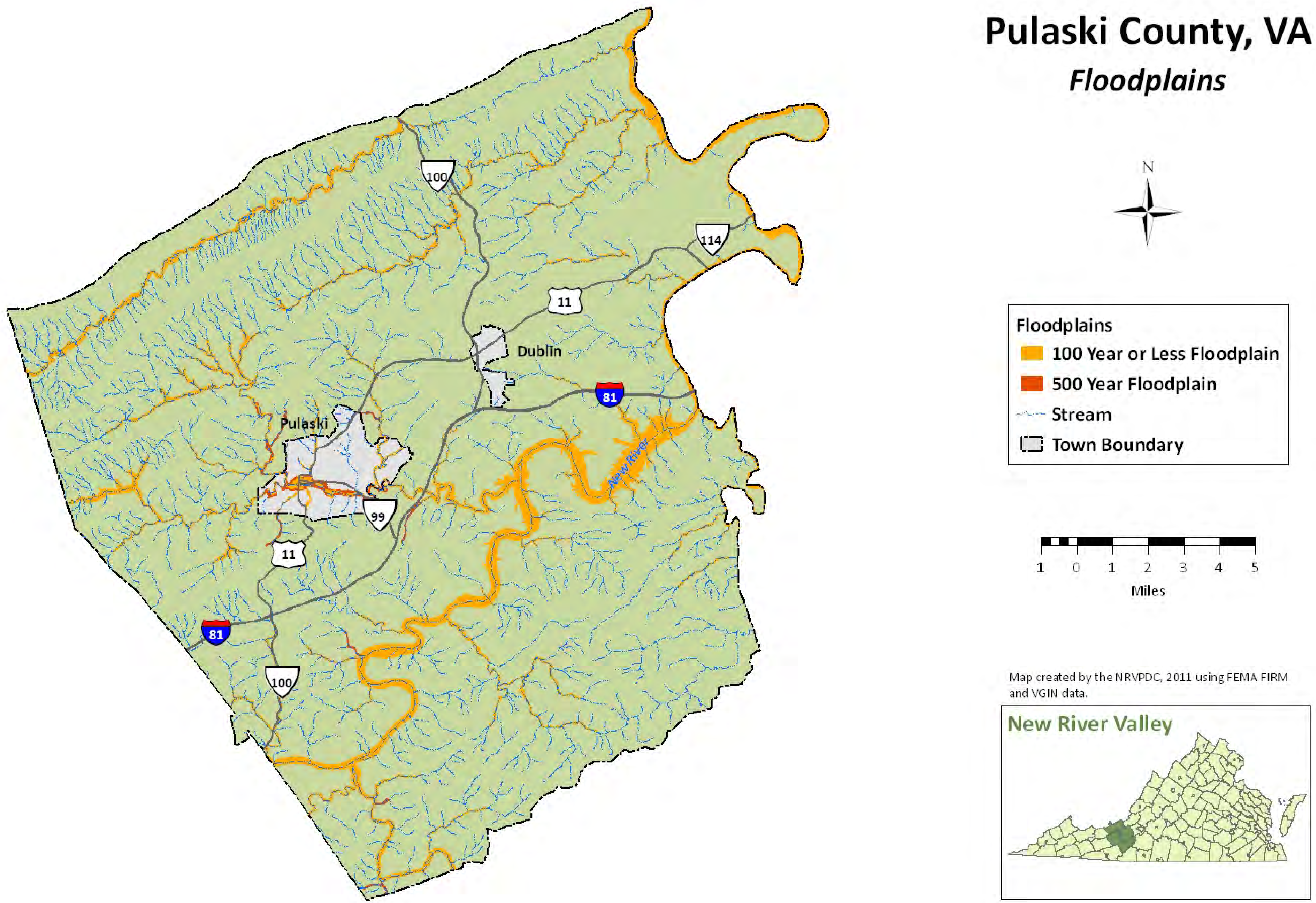
4.5.2.23 Big Reed Island Area

In the very southwest corner of Pulaski County, the Big Reed Island Creek flows from Floyd County to the New River at Allisonia. In the early 1990's, flooding destroyed two bridges in this area and damaged other structures.

4.5.2.24 Little Walker Creek Area

Located in the very northwest corner of Pulaski County, Little Walker Creek flows from Wythe County toward Giles County and the New River.

Map 25. Pulaski County Floodplains

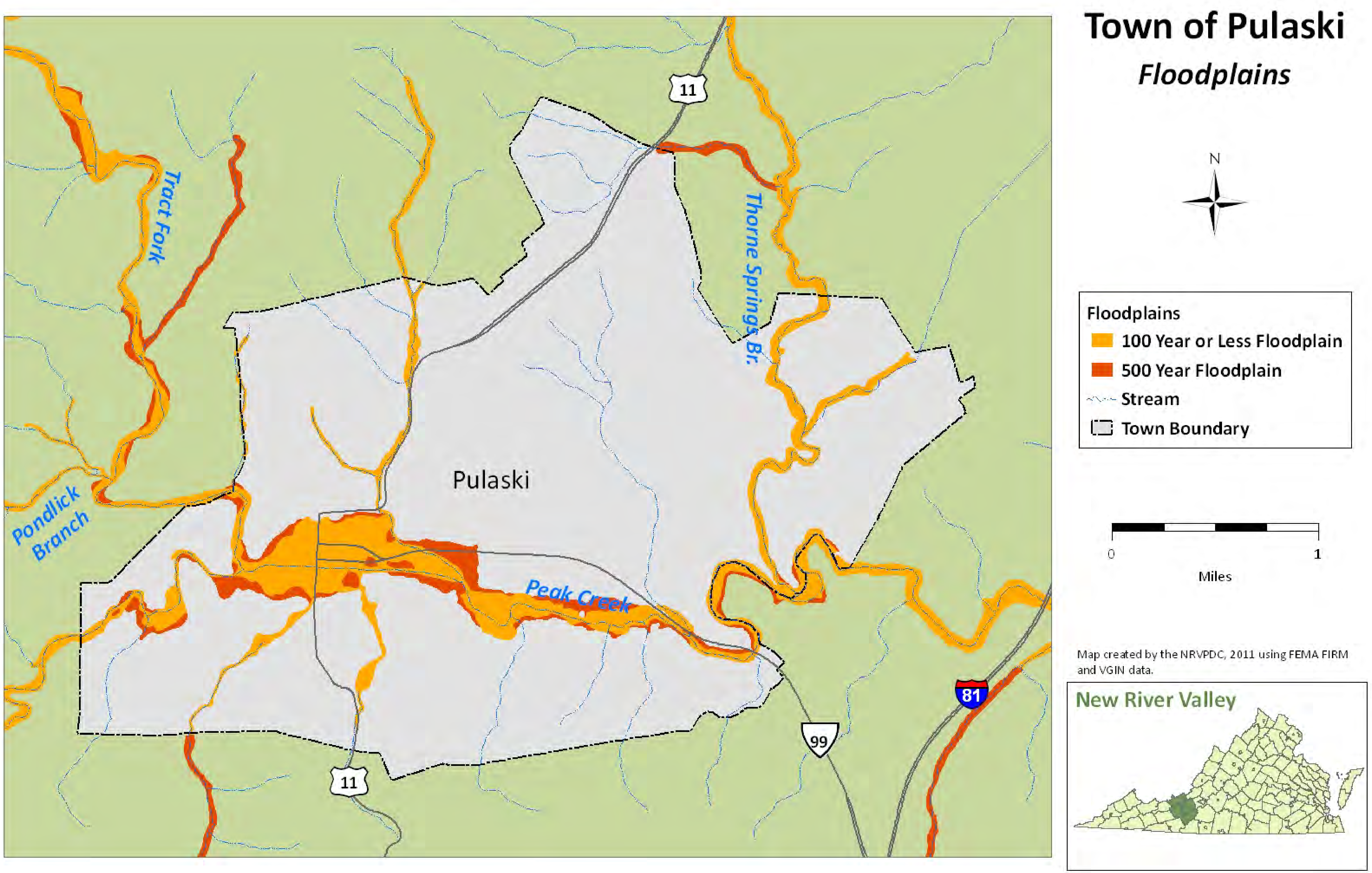


4.5.2.25 Town of Pulaski

The Town of Pulaski is subject to flooding from the main channel of Peak Creek. Peak Creek is a tributary to the New River with its confluence into Claytor Lake. Sproules Run and Tract Fork are also sources of flooding for the town, both are tributaries to Peak Creek. The Town's flooding is exacerbated by very steep terrain above the Town and the relatively flat terrain from the town to Claytor Lake (limiting more rapid drainage). Peak Creek has been channelized through the town, but the value of this is unclear. Analysis with the Virginia Department of Conservation (DCR) reveals that the flooding is also exacerbated by the channel obstructions, both man-made and natural. One man-made obstruction is the railroad trestle which acts as a dam and causes greater water depths and flooding during major storm events. Natural obstructions can include logjams.

The 100-year floodplain in the Town of Pulaski is fairly flat terrain and varies from 2,000 feet in width in the downtown area to 100 feet in the west end. Within the floodplain are roadways, educational and recreational facilities, business and commercial structures, scattered residences, and municipal facilities. Flood problems in the community can be separated into three distinct areas. These areas include the downtown area, the downstream, "Dora Highway" (east side) area, and the upstream, Kersey Bottom (west side) area. During the flood on May 28, 1973, 12 homes and two commercial establishments were inundated. Since that time, a few of those homes along Dora Highway have been bought out through FEMA and demolished. The last significant flood in the town occurred in March 2010. Flood waters rose into the downtown area, causing damage in several businesses and the sheriff's office.

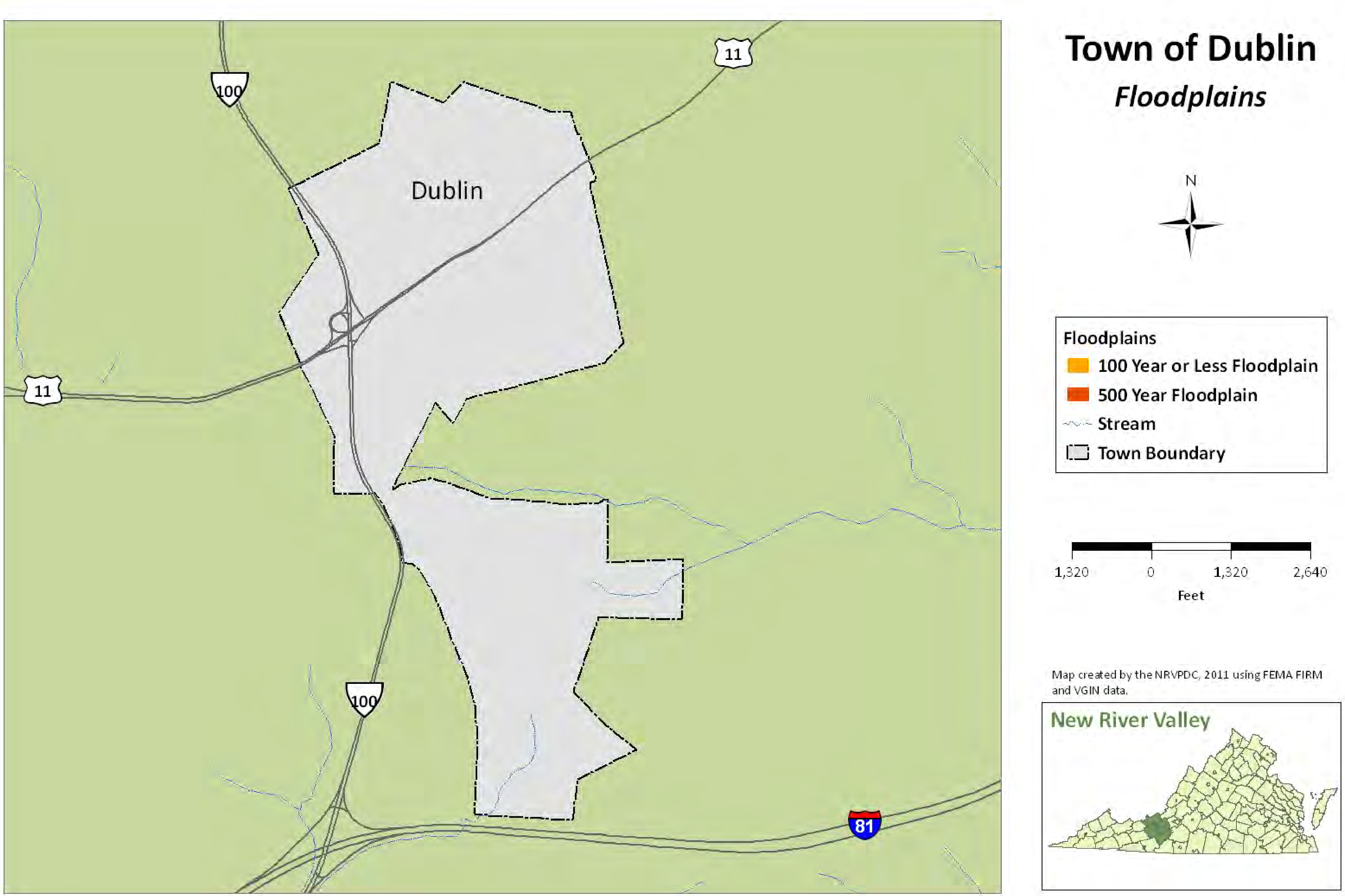
Map 26. Town of Pulaski Floodplains



4.5.2.26 Town of Dublin

There are also flooding problems reported in the downtown area of the Town of Dublin, according to the 1999 comprehensive plan, but Dublin did not participate in this planning process. There is no FIRM for Dublin, and they do not participate in the program. However, their comprehensive plan lists flood mitigation in high hazards areas as a top concern.

Map 27. Town of Dublin Floodplains



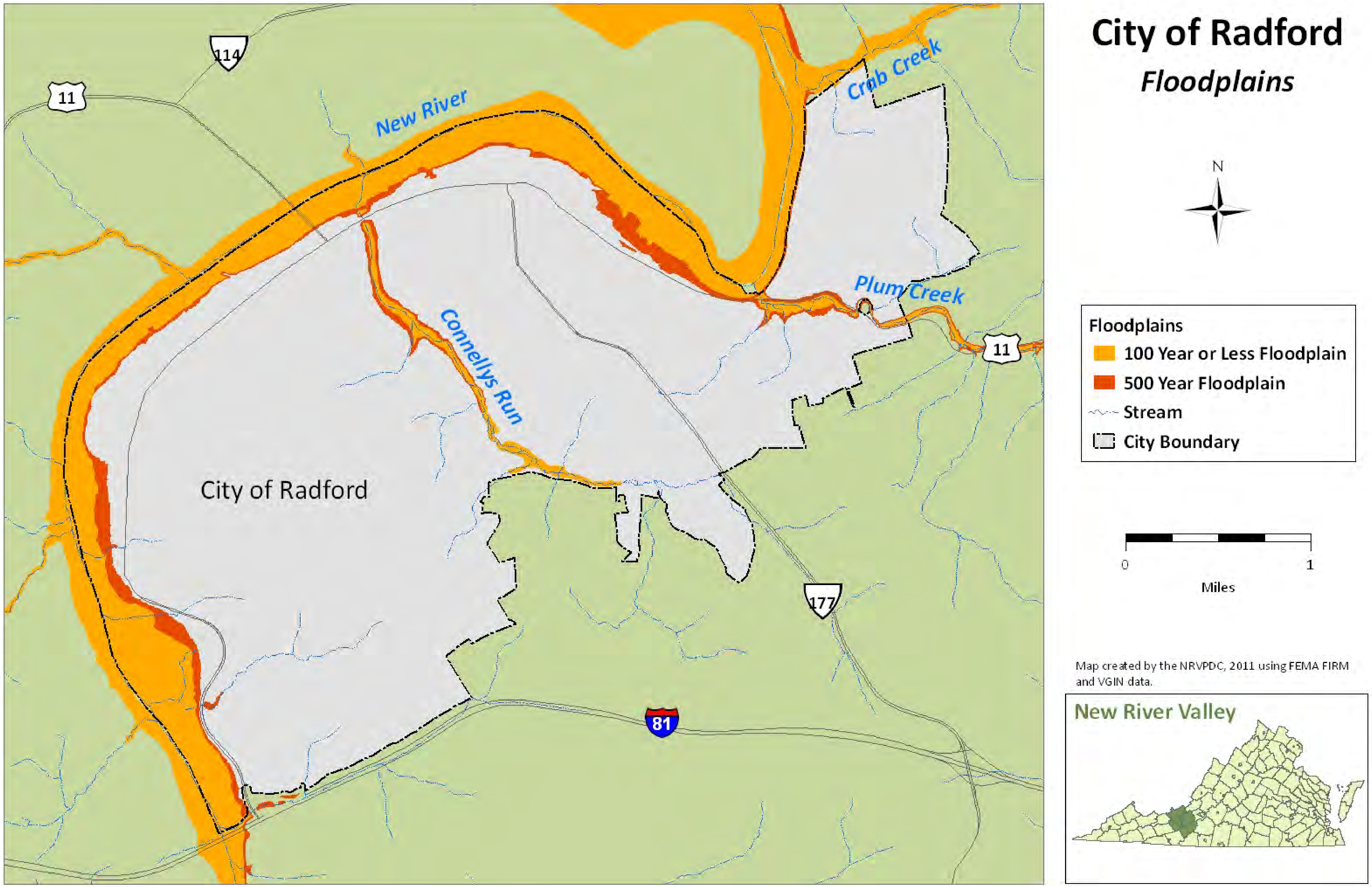
4.5.2.27 City of Radford

The City of Radford is located within southwestern Virginia and is bounded by Montgomery and Pulaski Counties. With a population of 15,859 in 2000, the area became an independent city in 1892. Located within the City of Radford is Radford University, a comprehensive institution with undergraduate and graduate programs. Radford University first began as an all-women's school in 1910 and then received affiliation from the General Assembly in 1964.

The New River creates Radford's western and northern corporate limits, fully eight miles of its border. The New River flows in a northern direction through the state of Virginia and is Radford's main cause of flooding. Major flooding of the New River has been recorded in 1914, 1940, and 1972 and is primarily the result of tropical storms. Connelly's Run is also a cause of concern for flooding in the area. Low-lying areas near this creek are likely to experience flooding due to a localized storm or frontal system. Located up stream in Pulaski County, Claytor Lake Dam controls most flood elevations. Radford's hydroelectric dam on Little River also has minimal effects on flood elevations.

Radford is essentially built upon the terraces of the New River. The first terrace, just a few feet above the river, is about one-quarter mile wide. Upon the next terrace, more than 50 feet above the first, are the main downtown businesses.

Map 28. City of Radford Floodplains



4.5.2.28 Drowning Risks

Even more important than the risk to structures are the risks to personal safety. Due to the rural, mountainous terrain of much of the New River Valley, many homes are precariously perched along streams. Often the only access is across private bridges. Likewise, many public roads and bridges are impacted by floodwaters. One of the greatest risks to personal safety from flooding comes as people try to drive onto flooded roadways or bridges. Nationally, nearly half of the flood or flash-flood related fatalities are auto-related. An auto will float in less than six inches of moving water and can be swept downstream into deeper waters. Victims of floods have often put themselves in perilous situations by ignoring warnings about travel or mistakenly thinking that a washed-out bridge is still open. This risk is largely preventable when people learn to respect the dangerous power of floodwaters.

4.5.2.29 Dam Inundation

There is, in reality, no way to predict the likelihood of dam failure, and the classification of “significant” and “high” hazards are, at least in part, rather random. The classification into a risk category also changes from one database to another over the period of a year or so. Generally speaking, the possibility of failure generally increases with age. Dams in the NRV are between 110 and 62 years of age. Considering that many dams were designed for an effective life of 50 years, this indicates that dam failure may eventually occur.

There is no history in the NRV of a dam failure among the registered and inspected dams. Thus, an assessment of damages is not probable. Preliminary research results on the areas affected by potential dam failures are still in a preliminary stage for the NRV. All dams in the region have a plan kept by DCR, but those plans are of varying quality and information. Only Claytor Lake has a downstream inundation map should the hydroelectric dam there fail, either partially or fully.

4.5.3 Past or Existing Mitigation

While the risk to lives and property from flooding is substantial in the New River Valley, the opportunities to mitigate those risks are also substantial. Some are as simple as recognizing and valuing the contribution of natural components (such as trees) and functions.

Most jurisdictions have already acted upon some of these opportunities. The level of flood mitigation across the New River Valley varies widely. All of the Counties, the City and most of the Towns participate in the NFIP. Participation requires the jurisdictions to regulate development in the floodway and the flood fringe through zoning or a separate ordinance. This means that in the designated floodway, no expansion of structures may occur. In a designated floodplain, substantial improvements (greater than 50% of current value) must be elevated or floodproofed. Also, floatable objects should be restrained in some manner to help avoid the obstruction of drainage structures. Local government participation means that citizens may then buy flood insurance. Based on preliminary assessment, it appears that from 10 to 50 percent of high-risk property is insured.

Jurisdictions such as the Towns of Blacksburg and Pulaski with major flood losses and large town staffs have been more active and pro-active in flood mitigation. Also some private citizens around the area are demonstrating basic mitigation techniques.

4.5.3.1 Town of Blacksburg

Blacksburg has more stringent stormwater management ordinances than Virginia requires. Blacksburg has initiated studies along Stroubles Creek and identified a series of stormwater detention ponds that would reduce flood elevations. Blacksburg has also digitized its floodplain maps and strictly prohibits any additional floodplain development. Blacksburg is also one of the first localities in the nation to implement a broad community communication network. This system can notify registered users of news through their home phone, cell phone, e-mail, pager, and/or fax.

4.5.3.2 Town of Pulaski

Pulaski initiated flood mitigation planning in 2001. It organized a committee composed of citizens, business owners and Town staff. Town staff digitized floodplain maps. Building upon prior Flood Insurance Studies, Corps of Engineer reports, and new analysis by DCR and the NRVPDC, a mitigation plan was drafted. So far, in accordance with that plan, the Town has

- Completed the removal of six houses from the floodplain using hazard mitigation grant funding,
- Established a flood mitigation section at the local library, and
- Created and mailed a flood mitigation newsletter to all residents in the floodplain.

The Town also wishes to apply to the Community Rating System to help reduce the cost of flood insurance and increase local participation.

4.5.3.3 Montgomery County

In the 1980s and 1990s, Montgomery County pursued federal assistance in the eastern portion of the county. The Corps of Engineers did analysis along Brake Branch, and the Natural Resource Conservation Service provided some streambank clearance assistance. In its current comprehensive planning process, Montgomery County staff and citizens are focusing intensely on environmental elements. The county zoning ordinance has been updated to require new construction to be at least one foot above base flood elevation. New structures must also have elevation certificates to show they meet this requirement. Staff also receive floodplain management training, including the Certified Floodplain Manager qualification. The county’s FIRMs were updated in September 2009. In addition to local government action, citizens are increasing demonstrating mitigation propensities.

4.5.3.4 Giles County and the Town of Pembroke

Since the 2002 flooding in Pearisburg and Pembroke, Giles County has successfully sought streambank clearance assistance from the Natural Resource Conservation Service. Also since that flooding, the Town of Pembroke has increased its attention to drainage-system components and maintenance. The Town and County are seeking help from VDOT to assess culvert sizes and maintenance programs along primary and secondary roads in flood-prone areas. The Town also makes regular drainage system maintenance checks before and after flood events. Also, the Town of Pembroke hosted a special flood hazard and mitigation meeting as part of its comprehensive plan update in 2003. The Town is also including a sizable hazard mitigation section in the new comprehensive plan.

4.5.3.5 City of Radford

In part due to the City's enforcement of the floodplain zones, other entities in Radford are mitigating against flood damage. Hunter Ridge Apartments were built upon a mound, to ensure elevation out of the flood elevation levels. Radford University built a berm along the river to help protect the parking lot at the Dedmon Center.

4.5.3.6 Other Existing Mitigation Programs

The region also benefits from another federal program, the National Weather Service (NWS). With a local office in Blacksburg, the NWS distributes forecasts, statements, severe weather watches and warnings through local media outlets and the Emergency Alert System. The NWS also coordinates and monitors the Automated Flood Warning System (also Integrated Stream Flows (IFLOWs), a network of rain gauges in the eastern U.S. including the New River Valley. The system is automated and updated every 15 minutes and is available online at www.afws.net.

Additionally, the NWS and the National Oceanic and Atmospheric Administration (NOAA) operate NOAA Weather Radio, which makes statements and warnings ever-accessible. Moreover, new technology has enabled the "Specific Area Message Encoder" (SAME) program, which activates special radios in only the affected area when there is an imminent threat. These radios are available on the market for $30-40. Unfortunately, reception is spotty in the mountainous areas of the NRV. There are similar services available from private vendors for cell phones, fax machines, etc., including "Notify!" from the Weather Channel. In these and the new Town of Blacksburg service, people may choose which the types of events for which they wish to be notified.

4.5.4 Mitigation Opportunities

A complete listing of NRV hazard mitigation goals, objectives, and strategies can be found in Chapter 5: Mitigation Strategy. Below are the goals, objectives, and strategies identified by the flooding working group to specifically lessen the impacts of flooding in the region.

3. **Minimize flood-related deaths and losses of existing and future structures.**
    a. *Save lives at imminent risk.*
        i. Seek grant funding to develop early warning systems in high-risk areas utilizing new technology.
        ii. Develop regional capacity for swift-water rescue, including training and equipment purchase.
        iii. Encourage localities to participate in the Storm Ready Program offered by the National Weather Service.
        iv. Promote the NOAA, NWS campaign "Turn Around, Don't Drown" by utilizing signage and other awareness activities.
        v. Increase 2-way communication between NWS and emergency managers during flooding events, as well as communication with residents potentially affected by flooding.
        vi. Educate homeowners and residents in vulnerable areas about the dangers of floods.
        vii. Improve regional communication to improve flood response.
    b. *Reduce risks to critical facilities.*

i. Do not build new critical facilities in high hazard areas (may be a general policy decision or more strict zoning).
ii. Identify critical facilities in high-risk areas.
iii. Replace critical facilities currently located in high-risk areas.
iv. Identify measures to reduce risk of critical facilities in high hazard areas.

c. *Offer mitigation assistance to owners of flood-prone properties, especially repetitive loss properties.*
i. Pursue mitigation grant opportunities to buy out, elevate or water-proof flood-prone properties through FEMA, VDEM, and Community Development Block Grant.
ii. Study feasibility of mitigation in historic districts or with historic properties.

d. *Educate citizens about the inevitability of flooding, the dangers it poses to life and property, and the opportunities for mitigation.*
i. Seek to update flood insurance studies and maps to understand risks more accurately.
ii. Encourage the development of statewide databases and geographic information systems layers to assist local government planning efforts.
iii. Encourage collection and development of better hazard history locally and incorporate into geographic information systems.
iv. Incorporate hazard mitigation information in the future in the local comprehensive planning process.
v. Utilize existing documents and programs from FEMA, the NFIP, VDEM, and the NWS to educate the public about hazards and mitigation opportunities.
vi. Produce and distribute local newsletters and/or other mitigation documents to residents in high-hazard areas.
vii. Coordinate with and support Community Emergency Response Team (CERT) information distribution activities in the community.
viii. Provide community workshops.
ix. Educate citizens about the availability and value of NFIP policies and encourage greater participation.
x. Notify and educate property owners of structures in floodplain about the potential impacts.
xi. Include a notice that property is in floodplain in deed or plat.

e. *Limit future development in floodplains.*
i. Utilize zoning ordinances to further restrict undeveloped floodplains.
ii. Encourage standards above NFIP standards when considering floodplain development.

f. *Develop adequate drainage structures and maintenance procedures to prohibit "back-up" flooding in high-hazard areas.*
i. Seek grant and/or state funding for replacement of inappropriately sized culverts and drainage.
ii. Pursue streambed clearance through citizen groups and/or the Natural Resources Conservation Service as needed to eliminate bottlenecks.

iii. Encourage bottomland farm fences to catch debris before reaching culverts.
iv. Schedule regular drainage system maintenance including before and after storms.
v. Work with VDOT to inventory culverts in the region.
vi. Ensure that future culverts are adequately sized for the estimated run-off from storms.
vii. Educate landowners about culvert maintenance to ensure culverts continue to efficiently handle stormwater.

g. *Develop stormwater facilities or upgrades as needed to limit flooding in high hazard areas.*
   i. Seek grant funding for regional stormwater detention facilities as needed. Reconsider design frequency of occurrence.
   ii. Seek channel improvements or upgrades as needed to reduce peak flood flows.
   iii. Pursue combinations of regional stormwater management strategies and onsite strategies.
   iv. Encourage alternative stormwater management options in both new and existing facilities.
   v. Inventory stormwater infrastructure to ensure adequate future maintenance.
   vi. Utilize floodplains as community assets such as parks or other open spaces.
   vii. Develop strategies for addressing impervious surfaces and their impact on stormwater.

h. *Pursue mitigation projects that achieve multiple community goals.*
   i. Pursue partnerships with land trusts to promote conservation easements on undeveloped floodplains and wetlands to aid flood mitigation.
   ii. Pursue the affordable housing alternatives for low-income families now living in floodplains.
   iii. Seek economic development opportunities, such as brownfields, which turn current “liabilities” into community assets.

4.6 Severe Weather: Severe Winter Weather, High Winds, and Tornados

The New River Valley experiences a variety of severe weather events. Most of these do not cause catastrophic damages, however. Rather, most threats to life can generally be minimized through attention to personal safety. Threats to property may be minimized in a variety of ways. Most of these hazard events are not associated with particular places. In this update of the New River Valley Hazard Mitigation Plan, several changes and updates have been made to this severe weather HIRA. The HIRA includes severe winter weather (freezing temperatures and significant snowfall), high non-rotational winds, and tornados. Severe winter weather and high non-rotational winds are common hazards in the NRV. The previous plan did a cursory analysis of history and frequency of hail and lightning that are not included in this revision due to lack of consistent data.

4.6.1 Severe Winter Weather

Severe Winter Weather in the New River Valley includes freezing temperatures, snowfall, and ice storms. These three events can occur independently or concurrently when the right atmospheric conditions exist. The NRV can have relatively mild winters with little snowfall and only moderately frosty days; it can have relatively severe winters with long periods of moderate to severe frost and significant snow accumulations; or it can have what statistically would be "average winters" with a little of everything. There is no definite character for winter weather in this region due to the geographic location and the typical weather patterns that occur over the winter period.

The New River Valley is a mountainous region that is subject to weather systems entering predominantly from the west and the northwest (moisture from the west, sometimes from the southwest, e.g., Gulf influence). Arctic fronts with cold and dry air come in from the northwest (Upper Midwest and Canada), and moist air masses are brought in by Atlantic Coastal storms that are moving in a north-westerly direction. The moist Atlantic air that is pushed upwards from the coastal plains and the Piedmont into this region loses its capacity to hold moisture due to orographic uplifting, causing the air mass to cool and release its moisture as precipitation. When this occurs, the region will experience anything from a severe snow storm, to a severe ice storm, to high volumes of precipitation consisting of near-freezing rain (which can locally then turn into ice-rain). Heavy snow storms followed almost immediately by a thaw resulting in flooding of local streams are relatively common. This is particularly sudden when prolonged periods of frost have preceded the snow, rendering the soil impermeable due to freezing. In such cases, the melt water cannot filter through the soil, but has to run off across the surface, resulting in rapid peak-flows and flooding.

4.6.1.1 History

Severe winter weather is not unusual in the New River Valley, but the region can have back-to-back mild winters with no significant weather events. Since the early 1990s, the NRV has recorded 73 winter weather events, including extreme cold, ice storms, and heavy snows, with just under $6.6 million reported in damages, as recorded by the National Climatic Data Center.

The NRV does have a history of memorable winter storm events, such as the Blizzard of 1993, the Ice Storm of 1994, the Blizzard of 1996, the flooding as a result of rapid snow melt of 1996, the Winter Storm of 1998, the Ice Storm of 1998, the Winter Storm of February 2000, the Ice

Storm of December 2002, the flooding from rapid melting in February 2003, and the extreme cold in the winter of 2001/2002. Impacts from a few of those storms can be seen in Figure 4-17 and Figure 4-18. Significant snowfall levels, such as in 2009, do not necessarily imply an emergency. As in 2009, the cumulative snowfalls that year were sufficiently spread out to allow for clearing of the roads in between. The winter of 2009-2010 brought several significant snowfall events to the region. Due to a December 2009 snowfall that left 12-16" of snow across the region, Montgomery County was part of a Presidential Disaster Declaration. In addition to that event, February 2010 brought more snow to the region. On February 5, 2010, approximately 8-11" of snow fell across the region.

Figure 4-17. Heavy Ice, Floyd County, December 2002

Figure 4-18. Wind Damage, Pembroke, February 2003

Similar to the Fujita and Saffir-Simpson scales used to characterize the magnitude of tornadoes and hurricanes, Paul Kocin and Louis Uccellini of the National Weather Service developed the Northeast Snowfall Impact Scale (NESIS) to characterize the impact of snow events (http://www.ncdc.noaa.gov/snow-and-ice/nesis.php). The NESIS characterizes and ranks high-impact snowstorms occurring in the northeastern United States. NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. Table 4-22 below summarizes the NESIS categories. The storms that occurred in December 2009 and February 2010 were both categorized by this system as Significant and Major, respectively.

Table 4-22. NESIS Categories

Category	NESIS Value	Description
1	1-2.499	Notable
2	2.5-3.99	Significant
3	4-5.99	Major
4	6-9.99	Crippling
5	10.0+	Extreme

Map 29 shows the average number of days with at least 6 inches of snow, while Map 30 illustrates the average annual days with temperatures below 32° F (source: CGIT analysis of

NCDC data for VDEM, 2008). High snowfall levels as well as low temperatures are particularly common in the mountainous areas of the NRV.

4.6.1.2 Risk Assessment and Vulnerability

Ice storms are of high concern in the region. Damage to trees can significantly increase the fire-danger in subsequent years, as dead biomass accumulates on the forest floor. Damage to infrastructure from ice storms (roads rendered impassable because of ice, fallen trees, accidents; power lines downed because of ice buildup or because of trees/branches falling on lines after breakage due to ice build-up; failure of communication systems due to breakage of lines) do occur frequently. Since the temperature that leads to ice storms rather than rain are often only a degree or two different and with local variations in conditions conducive to a build-up of ice (e.g., cold valleys, areas where cold air falls from higher elevations) predicting the effect of ice storms for specific areas of the NRV is difficult at best. Observations have been made where one valley had ice build-up, while the next valley had rain, and another had snow. Locally, there are tremendous differences in microclimatic situations causing these variations from place to place.

Whenever a major winter storm occurs, it is likely to severely affect the highways and power lines. Heavy snowfall and ice storms can immobilize an entire region such as the NRV and adjoining areas. Snow and ice storm-related deaths are typically the result of accidents, overexertion, and exposure. Flooding may follow major winter storms. Heavy snow built-up on some roofs may lead to their collapse, resulting in structural damage. There is no known way to predict damage from winter storms to a particular region, nor is there data to support such predictions. The National Climatic Data Center reports damage by storm events, but not by locality.

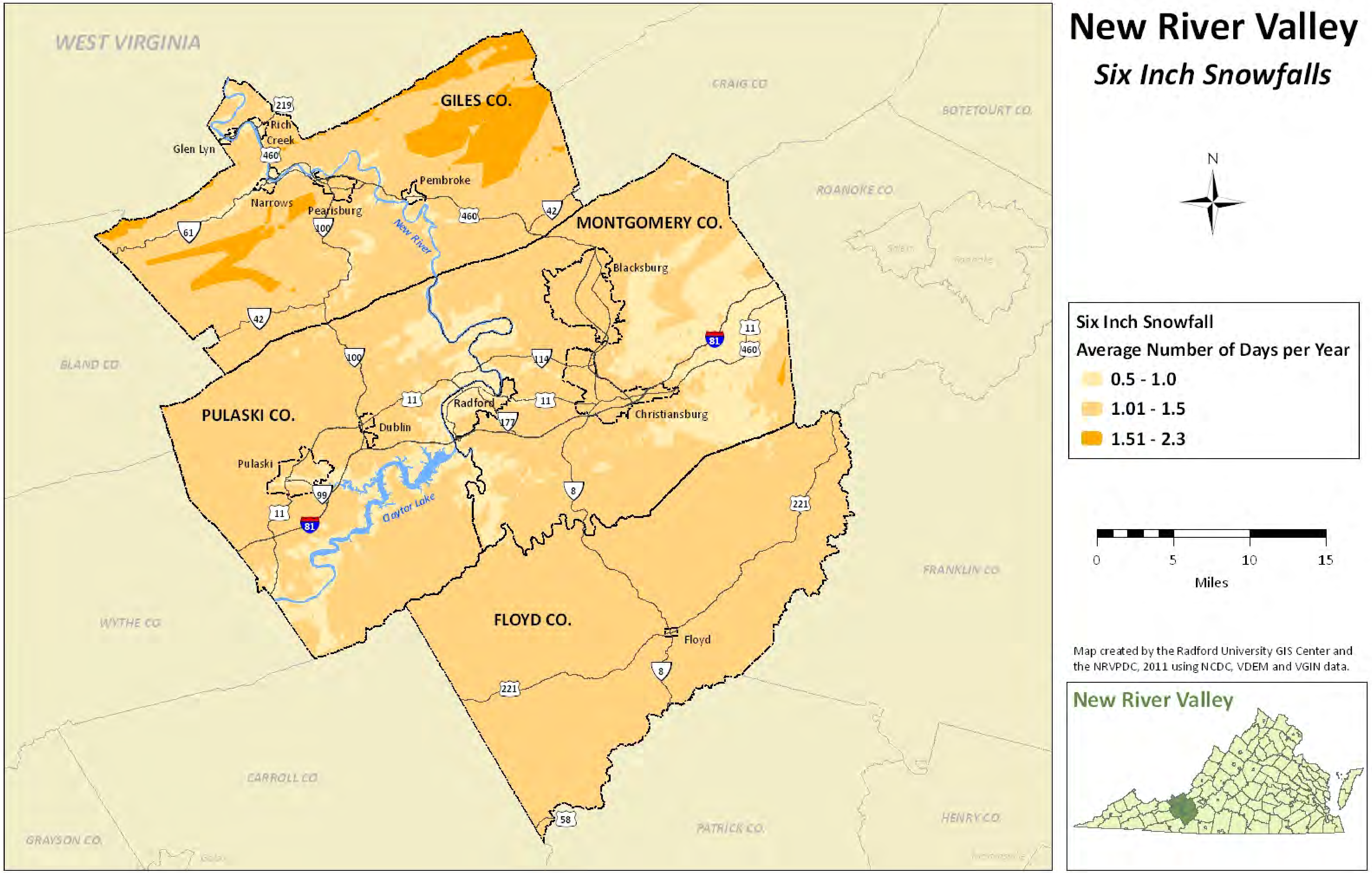
The occurrence of winter storms and ice can cause death and injury. Such storms can trap people in their vehicles or in their homes due to impassable roads. Downed power lines may further exasperate the situation by limiting the access of residents to heat and potentially also to clean water.

4.6.1.3 Past or Existing Mitigation

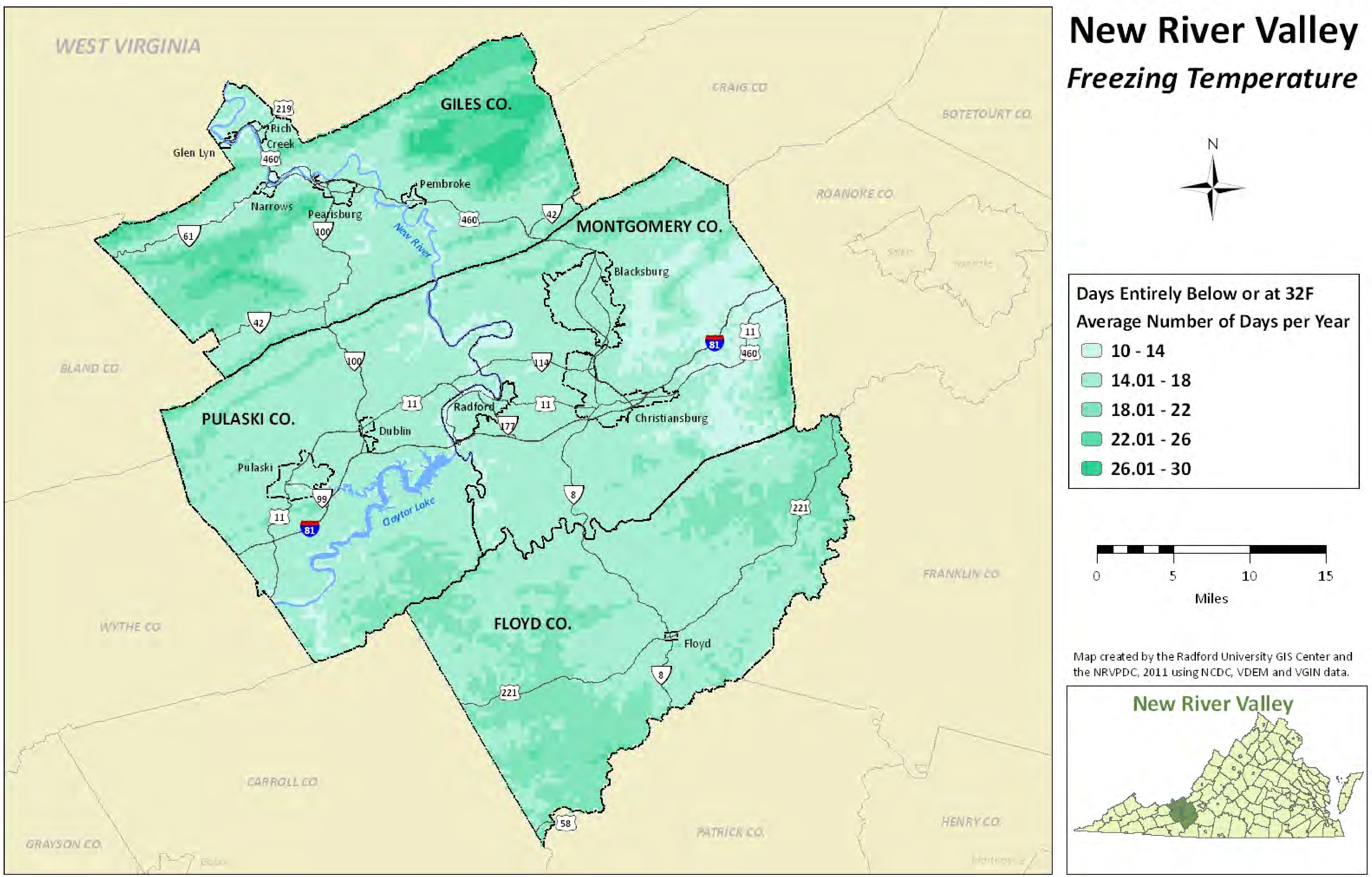
Winter storms (snow and ice) regularly result in closure of schools. Storm forecasts commonly result in early school closings to reduce the risk from accidents that may occur with buses on snow covered or icy roads. Business activities are regularly affected by winter storms, in part because customers and clients chose to stay home rather than venture out during or right after winter storms.

VDOT deals directly with the effect of winter storms. Clearing of primary roads is a major concern (Interstate, US highways), before secondary roads and residential areas are cleared. VDOT has been pro-active in recent years by applying liquid chloride when storms are forecast.

Map 29. NRV Six-inch Snowfalls



Map 30. NRV Freezing Temperature



4.6.2 High Winds (Non-Rotational)

High winds occurring in the New River Valley are of two primary types: winter high winds and high winds associated with thunderstorms. High winds can be particularly damaging to structures, pulling off roofing or siding. Additionally, high winds can cause objects to become airborne, causing additional damage to structures and property loss. In particularly wet conditions, high winds can cause trees to fall. Downed trees can cause damage to property and disruptions in utility services to surrounding areas should the tree fall on a utility line.

Wind events generally do not cause death, but six injuries were reported during wind events in the NRV over the period of record. Only one injury was associated with winter wind events; the other injuries were associated with thunderstorm events.

Sporadic reports from the 1960s, 1970s, and 1980s, and more consistent records from 1990 to the present indicate that there have been almost 200 notable wind events in the NRV. Approximately 156 of the recorded events are associated with thunderstorms, predominately in the summer months. Severe thunderstorms are storms with wind gusts in excess of 58 mph and hail stones larger than ¾ of an inch. The remaining 42 high wind events were recorded during the winter months as individual events, generally not associated with a winter storm event. The winter high wind events caused significantly more damage to structures and crops with $1.6 million and $215,000 reported respectively over the period of record. In contrast, wind events associated with thunderstorms caused only $590,000 in damages and no reported damages to crops or agriculture. Historical records show that wind events occur multiple times a year, so the probability of future occurrences is high.

The Beaufort Wind Scale estimates the speed and strength of high winds on a scale of F0 through F12 (from http://www.spc.noaa.gov/faq/tornado/beaufort.html),

Table 4-23. Beaufort Wind Scale

Force	Wind (Knots)	WMO Classification	Appearance of Wind Effects	
			On the Water	**On Land**
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps,	Small trees in leaf begin to sway

			some spray	
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-20 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (13-20 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
9	41-47	Strong Gale	High waves (20 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (20-30 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (30-45 ft) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

4.6.2.1 Risk Assessment and Vulnerability

High wind events are generally common in the region and can cause significant structural damage; wind events can be highly unpredictable. Figure 4-19 below illustrates the overall risk assessment for the state as conducted by VDEM and CGIT for the 2010 State Plan. NRV localities have varying risk:

- Giles and Radford are ranked medium risk which suggest hazards in the range of 60 to 73.9 mp wind speed;
- Pulaski is rated low; indicating winds likely to be less than 60 mph;
- Floyd is rated high, with winds likely to be more than 95 mph in a significant event; and
- Montgomery is rated at medium high risk, in the 74 to 94.9 mph category..

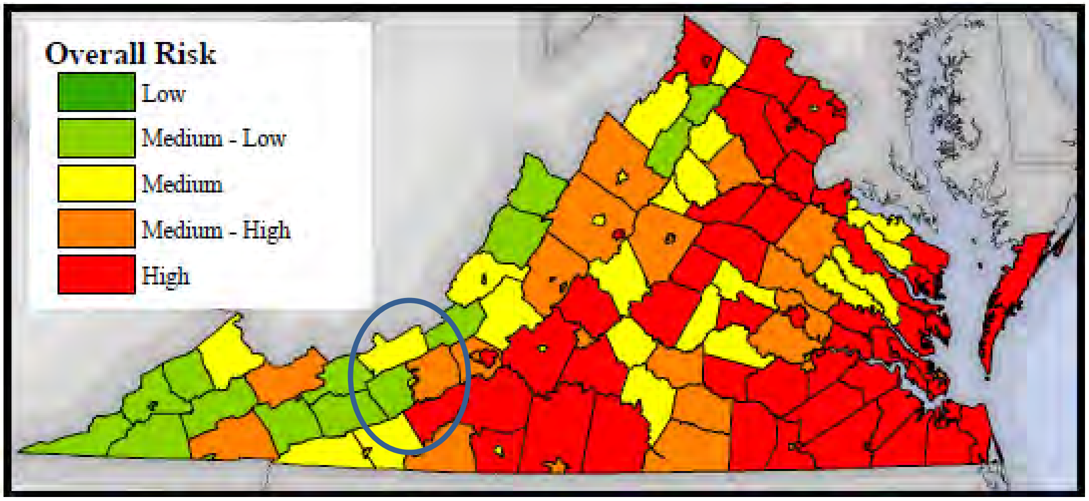


Figure 4-19. Non-Rotation Wind Risk Assessment (2010 State Plan, Figure 3.8a-6)

The following table shows the annualized loss estimates for the region as determined through the HAZUS analysis conducted for this plan for a 100-year event (modeling suggested no significant economic loss to buildings in a 50-year event). The total amounts below include potential damage to residential, commercial and industrial buildings. The loss estimates show that even where risk may be low, damage to in the event of a severe windstorm will have significant impact to the structures in the region.

Table 4-24. HAZUS-MH Hurricane Wind Annualized Losses

Locality	Annualized Loss Amount
Montgomery County	$106,000
Floyd County	$90,000
Pulaski County	$174,000
Giles County	$87,000
City of Radford	$106,000

4.6.3 Tornado

A tornado is a highly intense, destructive cyclonic rotation of air that develops in response to extremely low air pressure, often associated with a cumulonimbus cloud. A tornado is commonly associated with a mesocyclone formation. As more moisture-laded air is drawn up into the circulation of a mesocyclone, more energy is liberated, and the rotation becomes more rapid. A tornado can then develop as the dark funnel cloud that pulses from the bottom side of the parent cloud. When and where this funnel cloud reaches down to the surface, tremendous destructive winds that can reach speeds of over 300 mph have been measured. The destructive force of tornadoes is measured in the Enhanced Fujita Tornado Measurement Scale (http://www.spc.noaa.gov/faq/tornado/ef-scale.html).

Table 4-25. Enhanced Fujita Scale

EF Number	3 Second Gust Speed (MPH)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

4.6.3.1 History

The New River Valley does not have an extensive record of tornados in the region. Since the 1980s until 2010, four tornados have been recorded in the NRV. Table 4-26 below describes these events. The EF-1 and EF-2 tornadoes that struck two different areas of Pulaski County on April 8, 2010. They affected Draper and the Town of Pulaski, damaging or destroying as many as 400 homes, at an estimated value of $5.25 million. The associated storm left 4,600 customers without power and water system users were advised to boil water.

Table 4-26. NRV Tornados 1987-2011

Location	Date	Intensity	Property Damage
Montgomery County	3/30/1987	F1	$2.5 Million
Radford	6/11/1998	F0	$0
Indian Valley, Floyd County	1/23/1999	F1	$12,000
Indian Valley, Floyd County	5/2/2009	F0	$10,000
Draper, Pulaski County	4/8/2010	EF-1	$3.57 Million
Town of Pulaski, Pulaski County	4/8/2010	EF-2	$1.68 Million

4.6.3.2 Risk Assessment and Vulnerability

F0 and F1 tornados are considered weak and generally are short lived. Tornados of these intensities make up approximately 80% of all tornado reports nationwide.

During an F0 tornado, damage is characterized by superficial damage to structures and vegetation. Well-built structures are typically unscathed, sometimes sustaining broken windows, with minor damage to roofs and chimneys. Billboards and large signs can be knocked down. Trees may have large branches broken off and can be uprooted if they have shallow roots.

During an F1 tornado, damage has caused significantly more fatalities than that caused by EF0 tornadoes. At this level, damage to mobile homes and other temporary structures becomes significant, and cars and other vehicles can be pushed off the road. Permanent structures can suffer major damage to their roofs.

VDEM and CGIT have modeled the annual probability of both a tornado event and an F2+ tornado occurring throughout the state. Map 31 shows the NRV's probability of experiencing any tornado in a given year in the state, while Map 32 shows a slightly reduced probability of experiencing an F2+ tornado event. Both show the locations of tornado events in the region [dates of data]. Figure 4-20 and Figure 4-21 below show the entire state model for tornado probability. The unpredictable nature of these storms, and the fact that they typically involve relatively small areas at a time, makes a prediction of costs highly unrealistic. The map does show, however, that along the eastern edge of the NRV there is a higher probability for tornadoes than in the western half of the region.

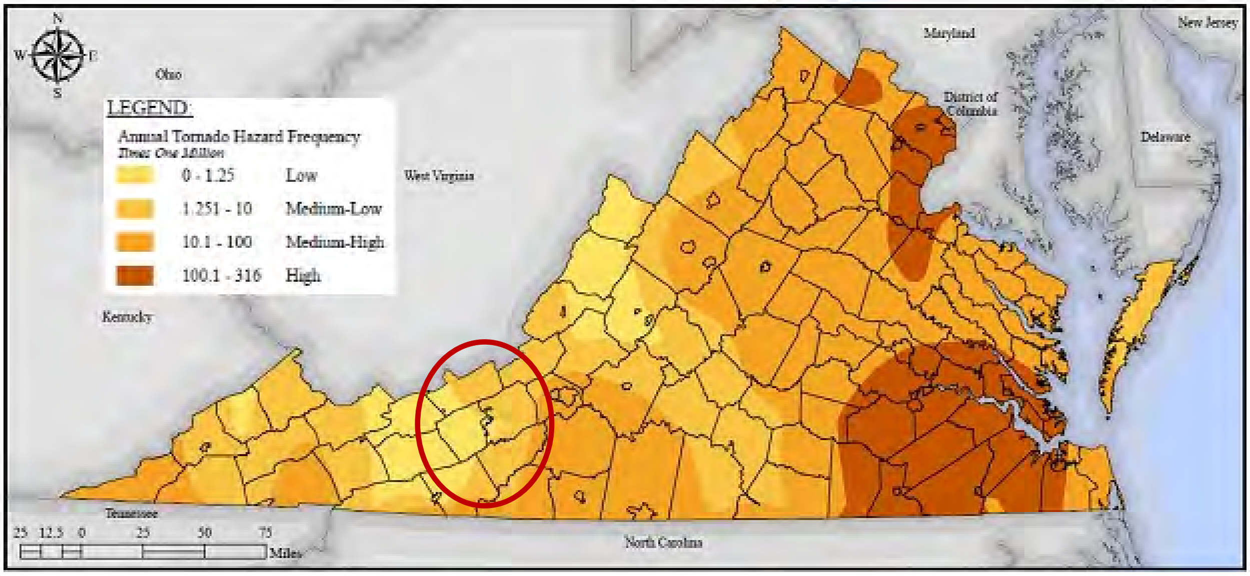


Figure 4-20. Virginia Tornado Hazard Frequency (2010 State Plan, Figure 3.8b-3)

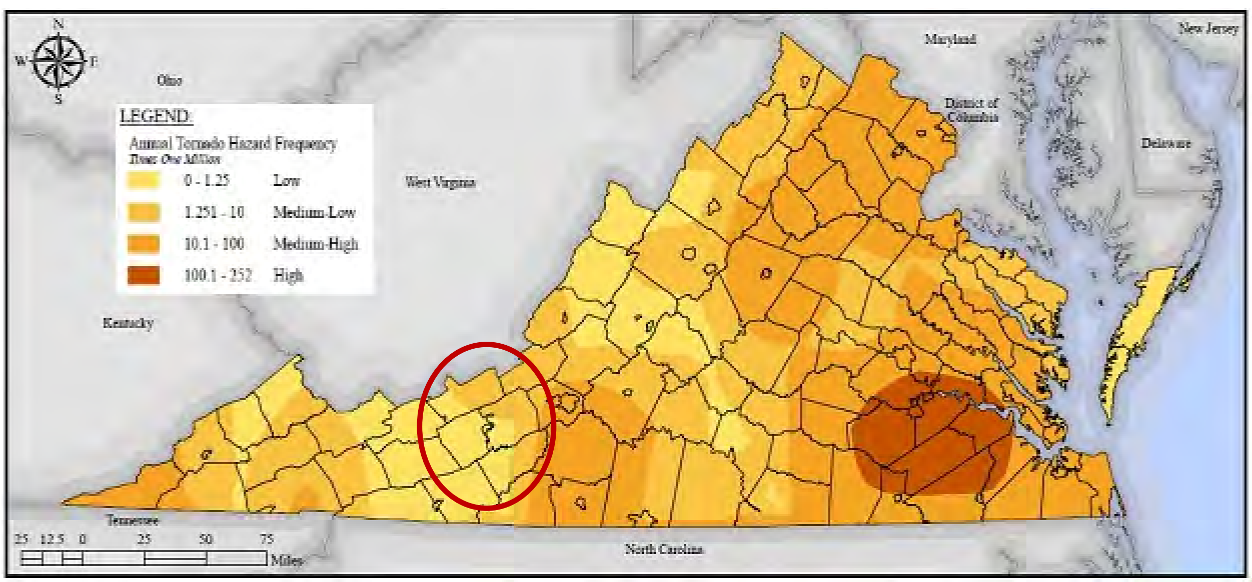


Figure 4-21. Virginia Significant Tornado Hazard Frequency F2+ (2010 State Plan, Figure 3.8b-4)

The maps below indicate the relative risk of tornado based on a statewide analysis. Table 4-27 below describes the probability and risk of tornado based on this analysis.

Table 4-27. Tornado Hazard and Frequency

Tornado Hazard	Annual Tornado Hazard Frequency (times 1 million)
Low	<1.25
Medium-Low	1.25-10
Medium-High	10-100

4.6.3.3 Past or Existing Mitigation

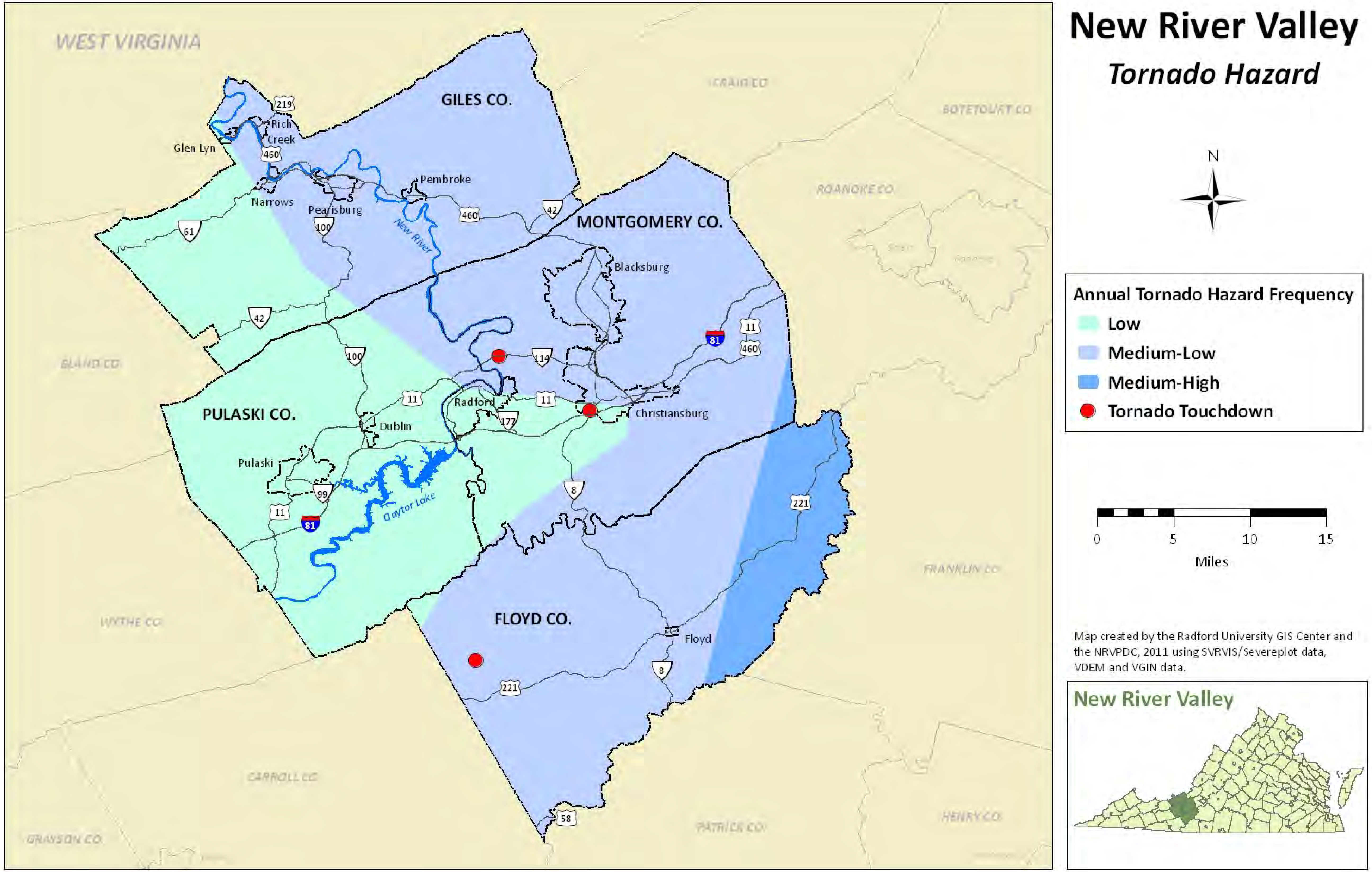
The only tornado mitigation currently in effect is the statewide building code and notifications of tornado watches and warnings issued by the National Weather Service.

4.6.3.4 Mitigation Opportunities

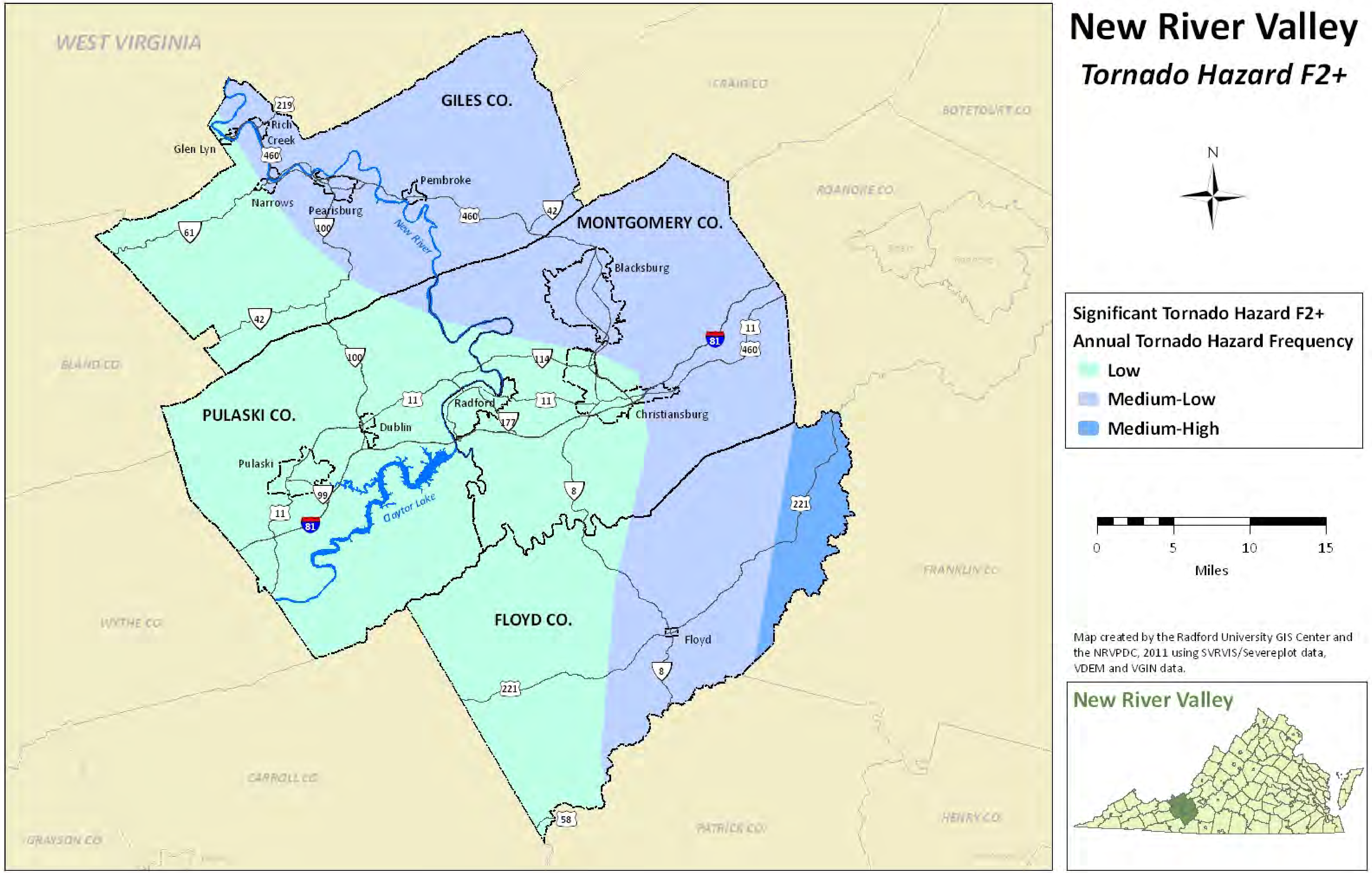
A complete listing of NRV hazard mitigation goals, objectives, and strategies can be found in Chapter 5: Mitigation Strategy. Below are the goals, objectives, and strategies identified by the severe weather working group to specifically lessen the impacts of severe weather hazards in the region.

4. **Minimize impacts of significant weather events, such as winter weather and severe weather events in the NRV.**
    a. *Encourage activities to prevent impacts during storm events.*
        i. Promote the installation and maintenance of drift fences to maintain access during snow events.
        ii. Emphasize that all road maintenance be done prior to storms to prevent access issues.
    b. *Develop educational materials and events to prevent loss of life and property in severe weather events.*
        i. Emphasize what should be done during a storm event (i.e., lightning) to maintain safety.
        ii. Educate landowners about how overhanging utility lines and trees can cause property damage during a storm.
        iii. Continue educational efforts during times when events are not occurring (i.e., brochures, websites, awareness weeks-promotions coordination).
        iv. Create a brochure or handout of local hazards to provide to the community.
        v. Pursue Storm Ready designation for the region’s communities.
    c. *Encourage preparation and planning activities that ensure minimal impacts to life and property*.
        i. Encourage personal planning for storm events and their impacts.
        ii. Inventory public facilities to determine the need for back-up power generation.
        iii. Inventory of possible roof collapses through an analysis of building permits to determine need for future mitigation efforts.
        iv. Engage in regional emergency management exercises (table-top and field) to train responders.

Map 31. NRV Tornado Hazard


New River Valley
Tornado Hazard
N
Annual Tornado Hazard Frequency
Low
Medium-Low
Medium-High
Tornado Touchdown
0
5
10
15
Miles
Map created by the Radford University GIS Center and the NRVPDC, 2011 using SVRVIS/Severeplot data, VDEM and VGIN data.
New River Valley
WEST VIRGINIA
GILES CO.
MONTGOMERY CO.
PULASKI CO.
FLOYD CO.
CRAIG CO.
BOTETOURT CO.
ROANOKE CO.
BLAND CO.
WYTHE CO.
CARROLL CO.
GRAYSON CO.
PATRICK CO.
HENRY CO.
FRANKLIN CO.
Glen Lyn
Rich Creek
Narrows
Pearisburg
Pembroke
New River
Blacksburg
Radford
Christiansburg
Dublin
Pulaski
Claytor Lake
Floyd
219
460
100
61
42
114
11
177
99
81
8
221
58

Map 32. NRV Tornado Hazard F2+



4.7 Wildfire

This section of the HIRA has been updated from the previous New River Valley Hazard Mitigation Plan. New information has been provided for the risk assessment and vulnerability section, as well as the past or existing mitigation section by the Virginia Department of Forestry (DOF). Specific communities have been identified by DOF as being at risk on the urban-wildland interface and are discussed as special hazard areas below.

4.7.1 History

The New River Valley has not suffered any devastating fires of the scale that now seem frequent in the western U.S. Yet, small fires are relatively frequent in the New River Valley. For the years 1998-2003, Table 4-28 illustrates the average acreage involved in wildfires based on data from DOF.

Table 4-28. Acreages and Averages for Wildfires 1998-2003

County	Total Fires	Total Acreage	Average Acreage
Floyd	47	71	1.5
Giles	9	44	4.9
Montgomery	68	147.9	2.1
Pulaski	55	229	4.1
New River Valley	179	491.9	3.15

Approximately 68% of the New River Valley is forested. Figure 4-22 below illustrates the various general land uses in the region. Additionally, there is a significant portion of the Jefferson National Forest in the region, also indicated in Figure 4-22.

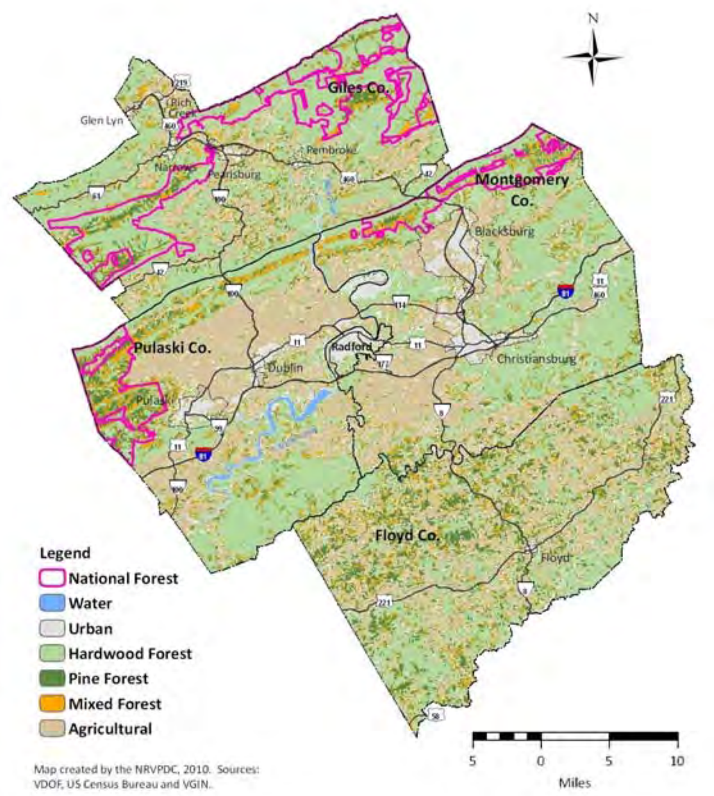


Figure 4-22. Forested Lands in the New River Valley

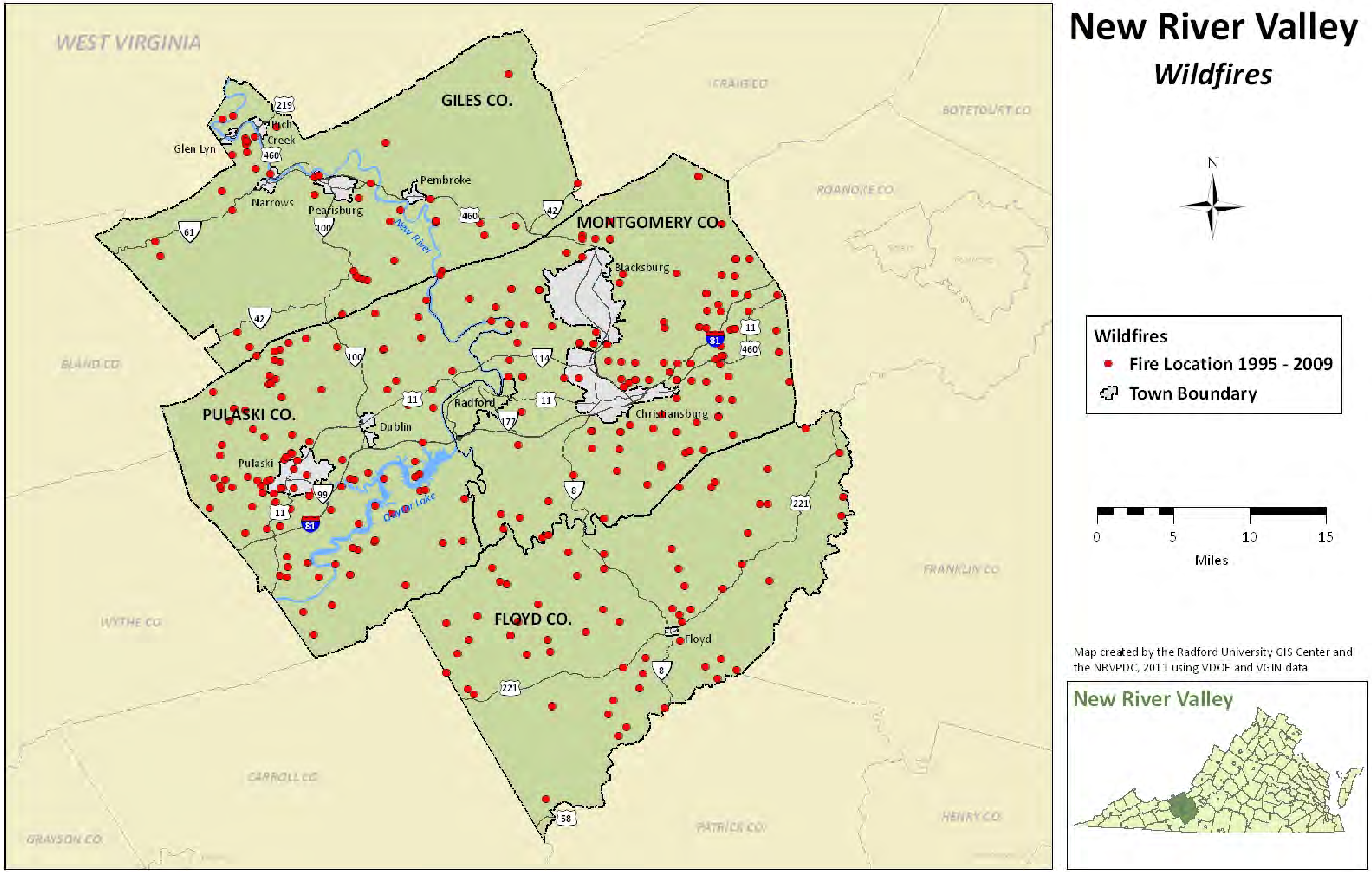
Between 1995 and 2009, there were 345 recorded wildfires in the New River Valley. On average, that is approximately 18 fires each year throughout the region. Map 33 below indicates the location of all these fires.

Two significant wildfires occurred simultaneously in 2003 despite the heavy moisture in the winter and spring. From April 16-19, 2003, 142 acres burned on Draper Mountain in Pulaski County and about 100 acres burned on Poor Mountain in Montgomery County (Figure 4-23).

Wildfires sometimes damage homes and structures, as well as destroying wildlife habitat, merchantable timber and critical watersheds. While the NRV has been spared devastating fires, numerous fires have caused thousands of dollars of damage.

Figure 4-23. Helicopter flies over Poor Mountain Fire, 2003

Map 33. NRV Wildfires



4.7.2 Risk Assessment and Vulnerability

The DOF has created a very useful wildfire risk assessment map that illustrates areas of high, medium, and low risk for wildfire. When creating this model, DOF used six factors to determine the level of risk. These factors include land cover and railroad buffer, density of wildfires, aspect, percent slope, population density, road density and developed areas, and distance to roads. Land cover affected the wildfire risk as different fuels ignite more easily, burn with greater intensity and can facilitate more rapid fire advancement. Proximity to railroads increased fire risk as a small percentage of wildfires has been found to be ignited by railroad operation or maintenance. It was assumed that the density of historic wildfires would remain similar and risk was assessed using that assumption.

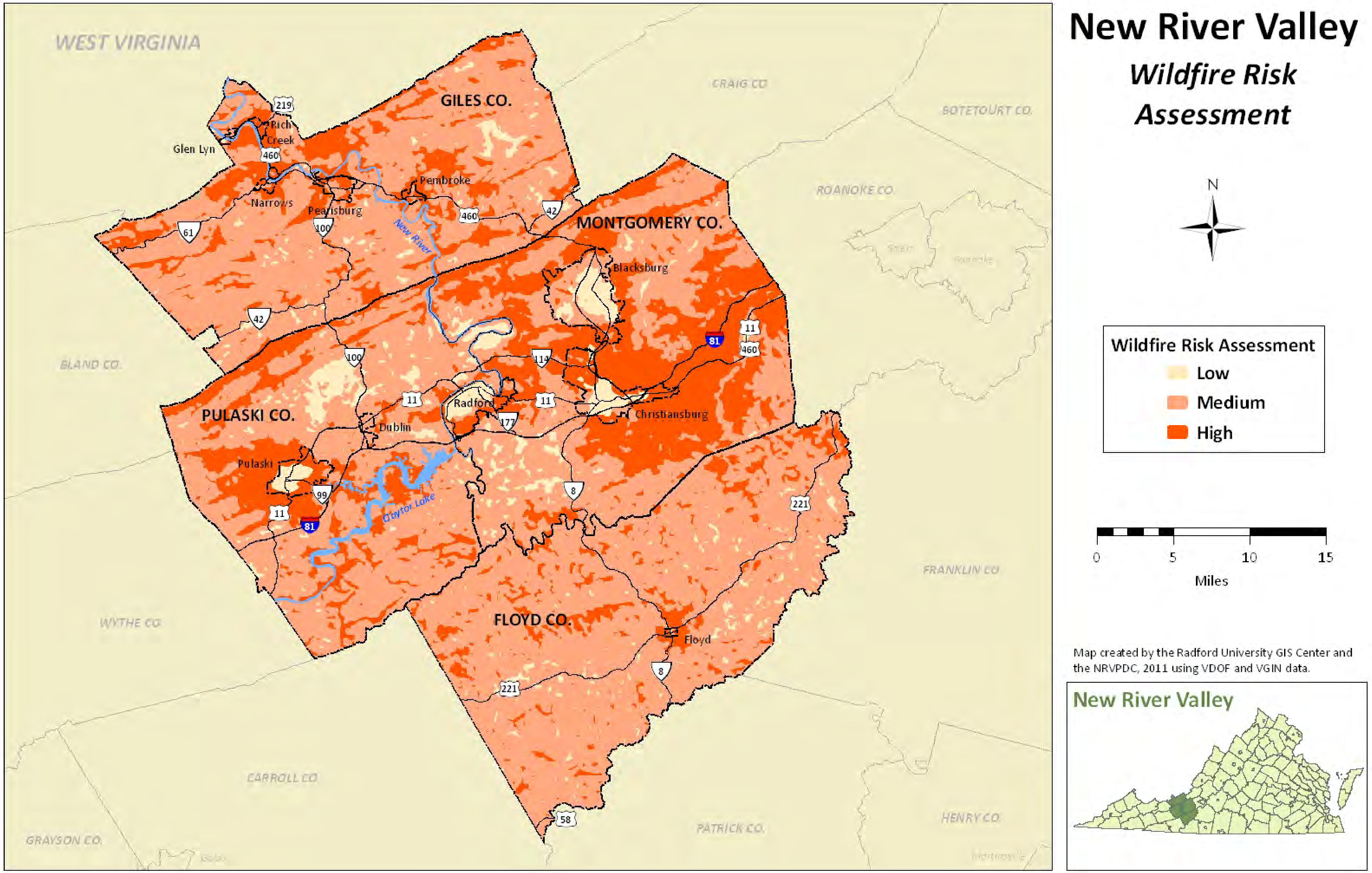
Slope can have an effect on wildfire in two regards, slope face and steepness. Slopes that face south receive more direct sunlight drying fuels and creating more favorable conditions for wildfires to ignite. Additionally, steeper slopes facilitate convective pre-heating for wildfires that can cause fires to advance uphill. Steeper slopes increase this pre-heating effect and thus increase the potential for wildfire ignition.

Human populations can also affect wildfire risk, as over 82% of wildfires in Virginia between 1995 and 2001 were started by humans. Despite this, urban areas were considered to have a much lower risk of wildfires than rural areas. To account for at least some of the human cause of wildfires, areas in close proximity to road corridors were ranked with a higher risk of wildfire due to the higher probability of human presence.

Map 34 below illustrates DOF's wildfire risk assessment for the New River Valley.

While considering the relative risk of all hazards possible in the New River Valley, the steering committee considered frequency of the event and severity, as well as the area affected by the hazard. Using these considerations, wildfire was ranked as a low risk in the region. The steering committee noted that relative to other hazards, wildfires are likely to occur, on average several occurring every year, though most have negligible to moderate impacts and occur in an isolated area.

Map 34. NRV Wildfire Risk Assessment



4.7.3 Special Hazard Areas

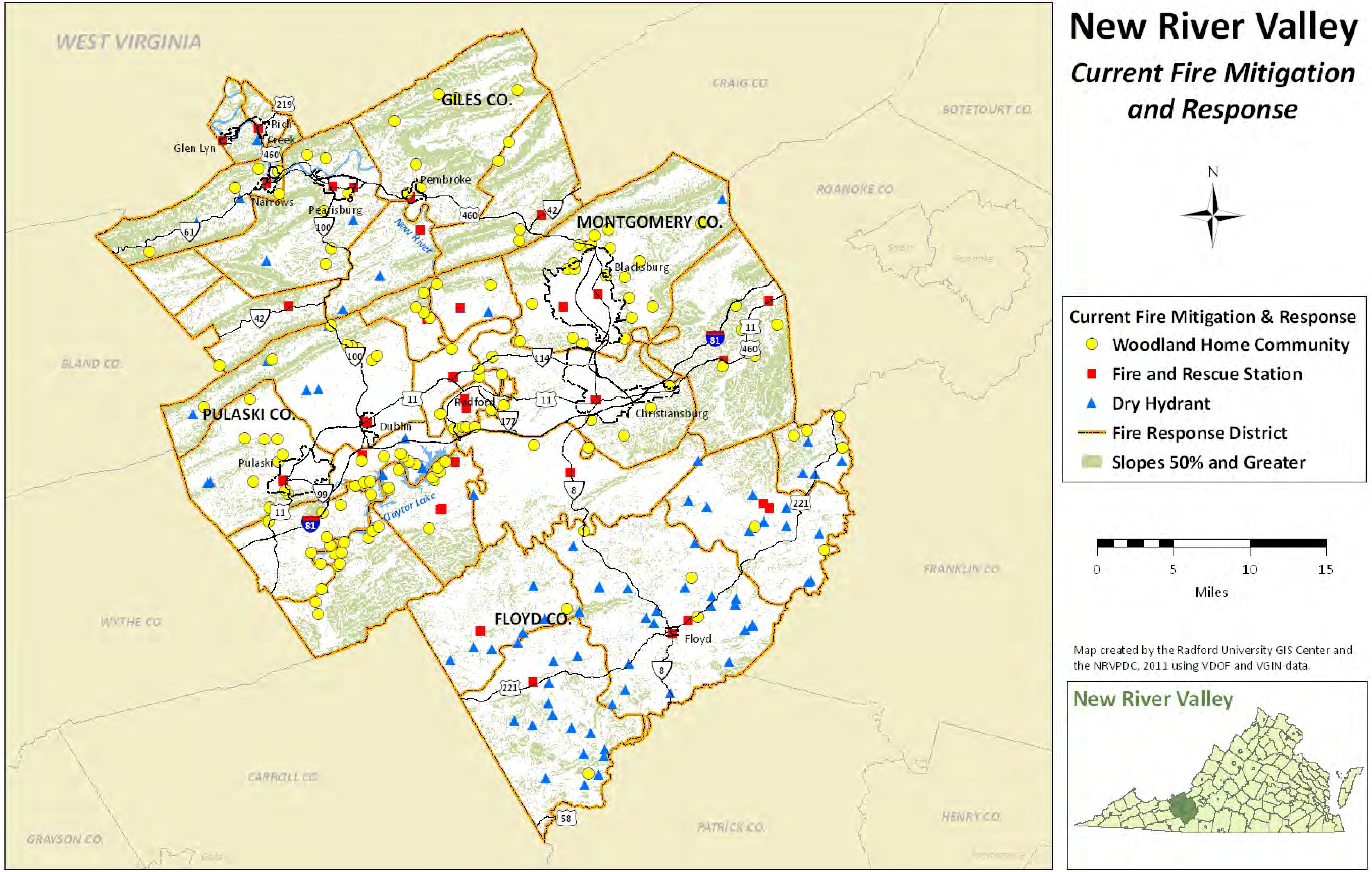
Several special hazard areas have been identified as well by DOF. The wildland-urban interface tends to be especially vulnerable to wildfire risks. DOF identified Woodland Home Communities where this interface could potentially put numerous homes and lives at risk during a wildfire. These communities are identified on Map 35 as part of the existing wildfire mitigation and response. In identifying the woodland home communities, DOF also prioritized these communities and their risk and has begun outreach efforts with those at the most risk of severe impacts from wildfires.

4.7.4 Past or Existing Mitigation

The NRV benefits from many national and state forestry initiatives. These include the Virginia Forestry Smokey the Bear program, the Fire Risk Index, outdoor burn laws, dry hydrant programs, the Firewise program and geographic information system development. Dry hydrants are a non-pressurized pipe system installed in a stream, pond or lake to provide a suction source for water to a fire truck. The Firewise program enables the DOF to work with communities to assess wildfire risk and create plans to reduce them. Additionally, the US Forest Service's Federal Wildland Fire Policy emphasizes community initiatives including cross-training among structural and wildland (local, state and federal) firefighters. The U.S. Fire Administration and USDA's Rural Development program administer grant programs to help equip fire departments.

Map 35 below outlines some of these traditional mitigation techniques from fire and rescue districts to dry hydrant locations and areas with slopes greater than 50% than inhibit access for emergency response equipment.

Map 35. Current Fire Mitigation and Response



4.7.5 Mitigation Opportunities

A complete listing of NRV hazard mitigation goals, objectives, and strategies can be found in Chapter 5: Mitigation Strategy. Below are the goals, objectives, and strategies identified by the wildfire working group to specifically lessen the impacts of wildfire hazards in the region.

5. **Minimize wildfire losses in the "urban wildland interface" areas.**
    a. *Educate residents and landowners on possible wildfire mitigation techniques.*
        i. Educate the public about where building is occurring and the need to clear debris to prevent loss to wildfire.
        ii. Increase awareness of conditions that could enhance wildfire impacts.
        iii. Educate homeowners about the possibility of wildfires.
        iv. Conduct practice "tagging" exercises to educate homeowners about the realities of wildfire.
        v. Engage with landscaping companies to encourage and utilize Firewise techniques on customers' property.
    b. *Engage in mitigation and planning activities to minimize wildfire impacts.*
        i. Ensure that new wildland communities are built to Firewise standards through inclusion in subdivision ordinances, building permits, set-back ordinances and covenants.
        ii. Limit future development in areas with slopes greater than 50% that prevent access by fire equipment.
        iii. Work with insurance to improve incentives for homeowners engaging in Firewise activities.
        iv. Improve physical access to community for fire and rescue personnel and equipment.
        v. Encourage county-wide fire plans and Community Wildfire Protection Plans.
        vi. Search for funding to increase equipment and personnel to fight wildfires.
        vii. Enforce existing regulations that home numbers at the road are easily visible for first responders.
        viii. Improve 911 mapping systems for improved access by first responders.
        ix. Work with land and home owners with gates or locks to improve fire access.
        x. Encourage mitigation activities that prevent wildfire damage to structures, including creating a defensible space around a vulnerable structure, structural protection through ignition resistant construction activities, and hazardous fuels reduction activities.

4.8 Human-caused Hazards

There are three primary types of human-caused hazards; accidental, criminal and terrorist. Accidental human-caused hazards occur due to human error with no intent to do harm. Criminal acts are events carried out by humans with the intent to do harm to either persons or property. Terrorist activities are similar to criminal activities, but are defined by FEMA as the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives. Though these hazards tend to be more difficult to predict due to the unpredictable nature of human actions, it is still important to understand the risks associated with them and plan to mitigate their potential impacts.

This section will briefly discuss community assets and infrastructure that can be negatively impacted by human activities. This section will also include a brief discussion of vulnerable populations within the community that can be impacted by all of the discussed hazards in very unique ways.

4.8.1 History

The most memorable human-caused event in recent memory in the New River Valley was the April 16, 2007 shooting at Virginia Tech. During this incident, a lone gunman killed 32 students and staff members at the university. Since that time, the university has put in many new procedures and tools to prevent another tragedy at the same scale.

Both universities in the region have completed a hazard mitigation plan to earn the designation as "Disaster Resistant University." Both plans include sections regarding human-caused events focusing on structural fires, hazardous materials and acts of terrorism. For more information about these plans, please contact the Radford University Office of Emergency Preparedness at (540) 831-7155 or the Virginia Tech Office of Emergency Management at http://www.emergency.vt.edu/.

Outside this notable criminal act, very few major human-caused incidents have been noted in the region. The region does serve as a major transportation corridor via both the interstate highway system and railways. As a major corridor, accidents involving hazardous materials are not uncommon, but rarely cause interruptions to the daily life of the region's citizens. Records of these accidents or incidents are scattered and very difficult to compile, thus there is no good historical record.

There is no notable historical record of additional criminal or terrorist activities focused on this region.

4.8.2 Risk Assessment and Vulnerability

4.8.2.1 Hazardous Materials

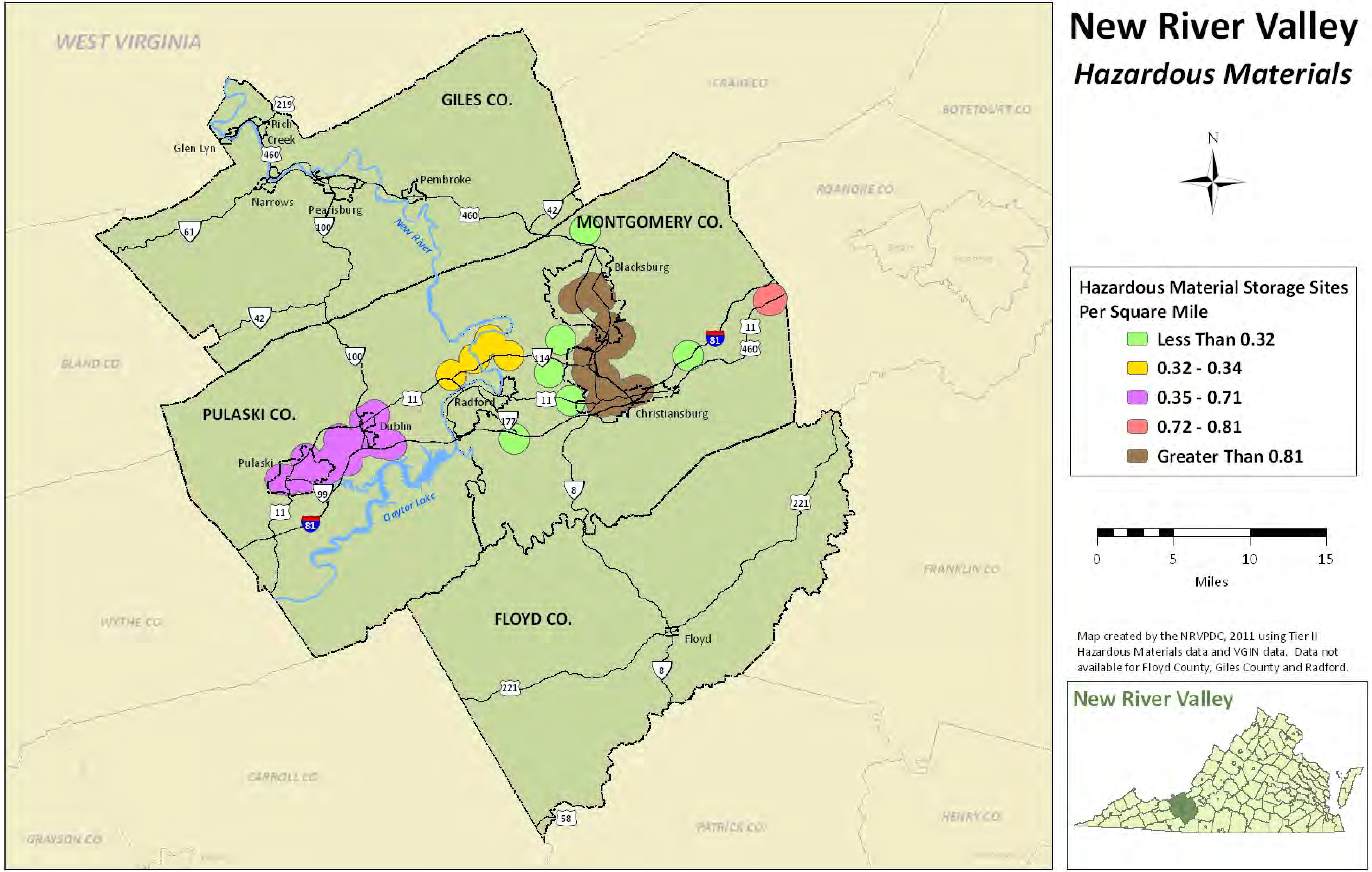
Hazardous materials are routinely stored and transported throughout the New River Valley. For planning purposes these storage sites could be impacted by any of the three types of human-cause hazards; accidental, criminal or terrorist. Additionally, these sites could be impacted by a variety of natural hazards based on their location. The Environmental Protection Agency (EPA) requires reporting of hazardous chemical storage for compliance with the Emergency Planning and Community Right-to-Know Act (EPCRA). Various facilities are required to report the hazardous chemicals used or stored in the workplace. Facilities that meet the thresholds below are required to report to annually to the Virginia Department of Environmental Quality, their Local Emergency Planning Committee, as well as the local fire department with jurisdiction for the storage facility. Facilities must report their hazardous materials storage if:

- They store either 500 pounds or the Threshold Planning Quantity (TPQ), whichever is lower, of Extremely Hazardous Substances (EHSs);
- For gasoline (all grades combined) at a retail gas station, they store 75,000 gallons (or approximately 283,900 liters), if the tank(s) was stored entirely underground and was in compliance at all times during the preceding calendar year with all applicable Underground Storage Tank (UST) requirements at 40 CFR part 280 or requirements of the State UST program approved by the agency under 40 CFR part 281;
- For diesel fuel (all grades combined) at a retail gas station, they store 100,000 gallons (or approximately 378,500 liters), if the tank(s) was stored entirely underground and the tank(s) was in compliance at all times during the preceding calendar year with all applicable UST requirements at 40 CFR part 280 or requirements of the State UST program approved by the agency under 40 CFR part 281;
- For all other hazardous chemicals, they store 10,000 pounds.

Map 36 below illustrates the density of facilities submitting Tier II reports in 2010. There is currently no data available for Giles or Floyd Counties. Typically these facilities include retail gas stations and public utility facilities, among others. The facilities were mapped using their listed addresses and then buffered by a mile to prevent specific location identification. Density was calculated by combining overlapping buffers and then calculating the number of facilities per square mile inside the buffered area. It will be important in future revisions of this plan to obtain better and more complete data from all jurisdictions on locations storing these types of hazardous materials.

Additional future analysis of the risks associated with hazardous materials storage should include an analysis of the risks posed to these sites by natural hazards.

Map 36. Hazardous Materials



4.8.2.2 Critical Facilities and Utilities

Critical facilities and critical utilities both play key roles in mitigating hazards. Critical facilities are those identified in the community that provide key services to residents and would have significant detrimental effects should they be destroyed or disrupted. Critical facilities are most likely to be affected by natural hazards, but some may be targeted for criminal or terrorist activities. The facilities identified throughout the region include emergency shelters, government buildings, hospitals, schools and emergency communications tower locations. Map 37 below depicts the locations of these facilities throughout the region. Additional facilities may be identified in the future and mitigation actions could be taken to ensure their proper functioning throughout the course of a given hazard event.

Critical utilities include those utilities that provide essential functions to maintain the health and safety of residents. These utilities primarily consist of water and sewer infrastructure and major gas and electrical transmission lines (Map 39). Additional data for the next plan update, especially for water and sewer infrastructure, could improve the analysis of these community assets. Utilities are most likely to be impacted by natural hazards such as high winds or ice, but some may also be the targets of criminal or terrorist activities.

Over the past 70 years, a nationwide system of collection, transmission, and distribution pipelines has been constructed to transport almost 100 percent of the natural gas and about 66 percent of the ton-miles of oil and refined petroleum products consumed in the United States. Many portions of the transmission pipelines were originally constructed in sparsely populated areas; subsequent growth has transformed some of these previously rural and sometimes remote areas into urban and suburban areas with housing subdivisions, shopping centers, and business parks.

The goal of the Pipelines and Informed Planning Alliance (PIPA) is to reduce risks and improve the safety of affected communities and transmission pipelines through implementation of recommended practices related to risk-informed land use near transmission pipelines. The PIPA recommended practices describe actions that can be taken by key stakeholders relative to proposed changes in land use or new development adjacent to existing transmission pipelines. Local governments, property developers/owners, transmission pipeline operators, and state real estate commissions have key roles to enhance pipeline safety and ensure the protection of people, the environment and the pipeline infrastructure.

To address increasing trends of excavation damage to pipelines and to fulfill the requirements of the Transportation Equity Act for the 21st Century, the US Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) undertook a study of damage prevention practices associated with existing one-call notification systems. In 1999, PHMSA published the landmark *Common Ground Study of One-call Systems and Damage Prevention Best Practices*. Building on the success of the Common Ground Study, PHMSA facilitated the founding of the Common Ground Alliance to provide stewardship to help ensure acceptance and implementation of the damage prevention best practices across the country.

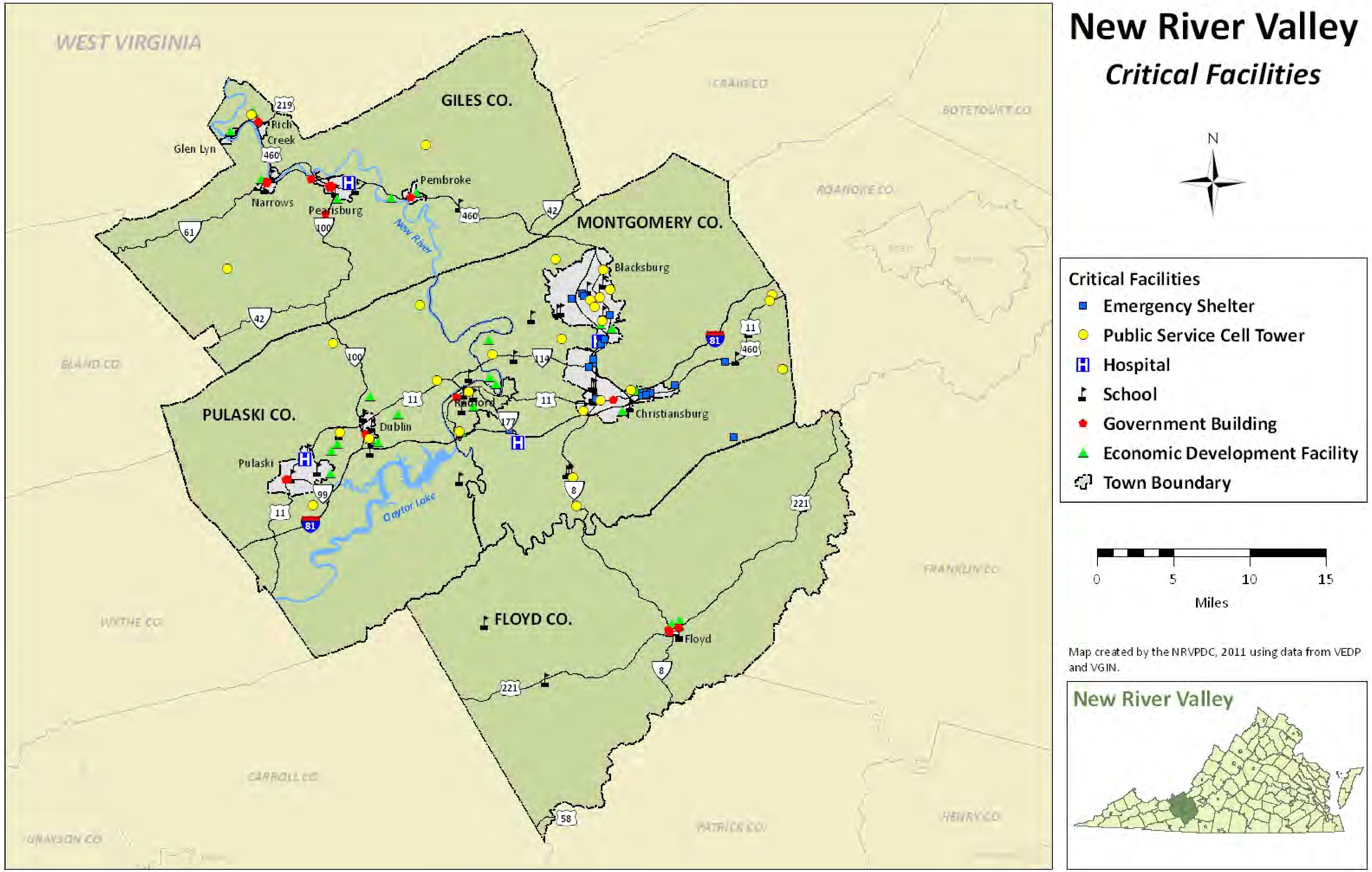
To further address the impact of community growth on pipeline safety, and the requirements of the Pipeline Safety Improvement Act of 2002, the Transportation Research Board (TRB) of the National Academies conducted a comprehensive study of pipeline safety and land use practices to better understand land use planning issues. The results, published in 2004 as TRB Special Report 281, “Transmission Pipelines and Land Use: A Risk-Informed Approach,” included several recommendations for PHMSA. To address these recommendations, in August 2007 PHMSA facilitated the establishment of the PIPA.

Approximately 130 stakeholder participants undertook the work to develop the PIPA recommended practices. The initial PIPA effort has resulted in recommended practices for local governments, property developers and owners, transmission pipeline operators, and real estate boards to be aware of and to implement as appropriate. PHMSA plans to continue working with stakeholders to ensure that a sound implementation strategy is developed and that the PIPA recommended practices are communicated to and understood by those that need to adopt them.[4]

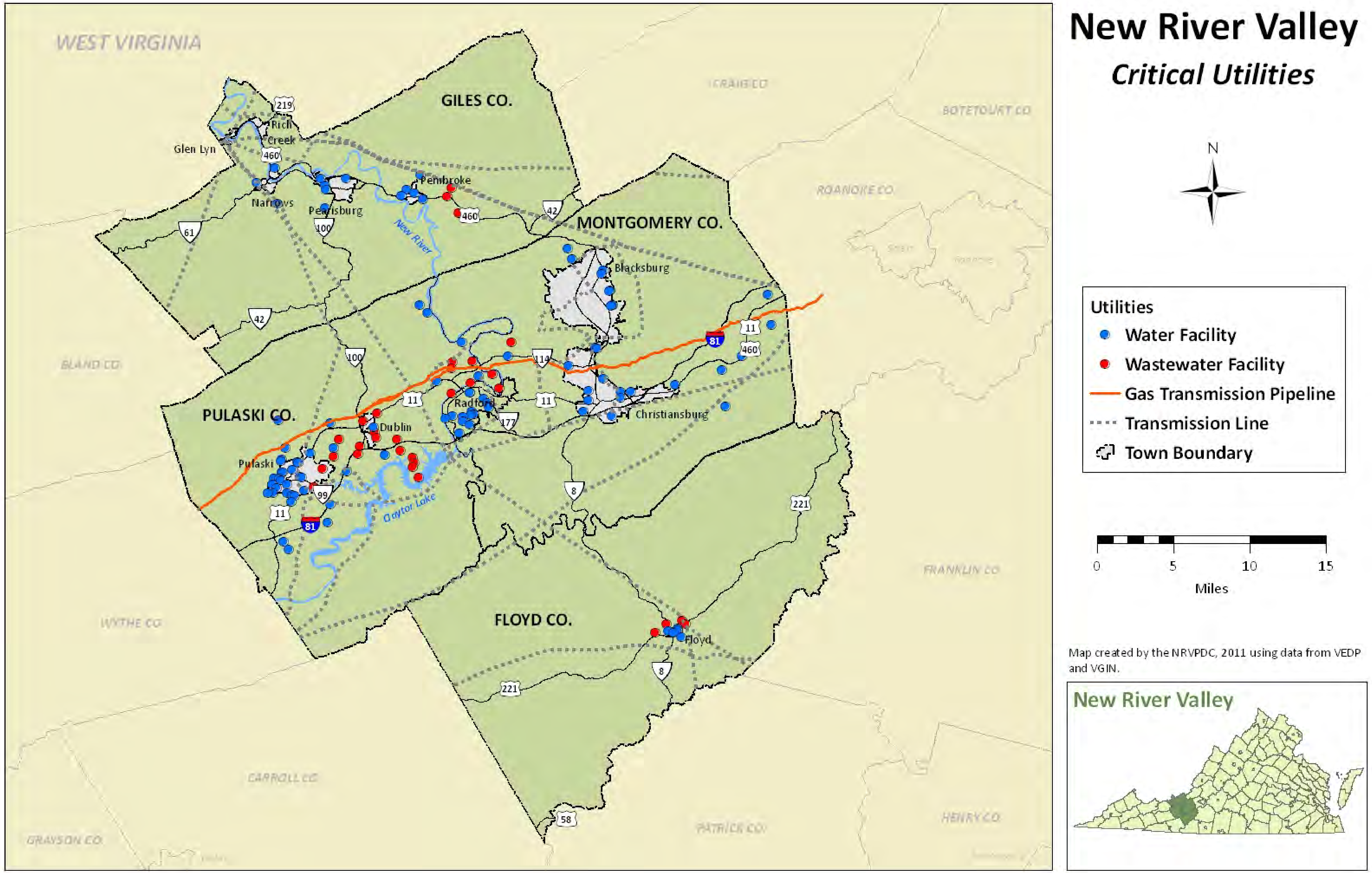
Broadband infrastructure is another critical utility that is essential in the proper functioning of numerous community services, including policy and fire, as well as hospitals. Every day, society becomes more reliant upon broadband access to provide critical services to the community, outside individual access to the internet. While there is no publicly available data indicating the location of major fiber transmission lines, this does provide an opportunity for emergency services staff and planners to partner with the private broadband providers to discuss mitigation in the event of natural or human-caused hazard events. Similar to other public utilities, especially water and sewer, it is critical to include broadband providers in planning discussions for future community growth and how to provide critical services to residents.

[4] *PIPA Report Final Draft, 7/21/10, available at:* www.pipelineinformedplanning.com.

Map 37. Critical Facilities



Map 38. Critical Utilities



4.8.2.3 Transportation Infrastructure

4.8.2.3.1 Evaluating Potential Hazards

The New River Valley has passenger and freight transportation modes inclusive of roadway, railway and aviation facilities. The region's transportation system is similar to that of many in Appalachia, featuring a variety of rolling topographical rural areas that integrate with a mixture of small urban communities. Typical hazards that may impact the existing transportation infrastructure are flooding, geologic failures, acts of terrorism and severe weather. The majority of the transportation network is located in predominately rural areas.

The region currently facilitates a mixture of passenger and freight traffic north-south by Interstate 81, US Route 11, US Route 221 and VA Primary Route 61 (roadway), Norfolk Southern's Crescent Corridor (railway), and the New River Valley Airport (airway-freight). East-west passenger and freight traffic is facilitated by US Route 460, US Route 8, VA Primary Route 114, VA Primary Route 42 and VA Primary Route 100 (roadway), Norfolk Southern's Heartland Corridor (railway), and the New River Valley Airport (airway-freight).

The future of these corridors includes a vast improvement schedule to advance the freight railway corridors and associated facilities. A passenger rail service as part of the TransDominion Express from Richmond, VA, to Bristol, NC, is also planned. Capacity improvements to Virginia Routes 114, 100 and 8 are planned.

The New River Valley also has mass public transportation fixed routes and on-demand services for several of the local communities. Currently fixed route services are provided in the Towns of Blacksburg, Christiansburg and Dublin. Currently, on-demand services are provided in the Towns of Pulaski, Dublin, Blacksburg, Christiansburg and City of Radford. There is also a multi-jurisdictional, fixed route that links Blacksburg and Christiansburg to Salem and Roanoke.

The future of transit in the New River Valley may include fixed-route services in the City of Radford and connections between Montgomery and Pulaski Counties and the City of Radford. Additionally, Giles and Floyd Counties have expressed interest in exploring rural transit options in the near future. These communities have been identified by the Virginia Department of Rail and Public Transportation as having characteristics to support transit.

4.8.2.3.2 Identifying Critical Roadways

The primary roadway network for the region consists of one interstate which bi-sects the region from north-east to south-west. Interstate 81 provides access to the Towns of Pulaski, Dublin, Christiansburg and the City of Radford. This corridor has been identified as a mobility corridor that will incorporate roadway, railway and airway modes of transportation as part of Virginia's long range plan. This corridor predominately facilitates transportation for passenger and freight traffic between Tennessee and Washington, D.C.

I-81 serves as the region's only freeway which is defined by the Highway Capacity Manual as a divided highway with full control access and two or more lanes for the exclusive use of traffic in each direction. A freeway is the only facility that provides completely uninterrupted traffic flow. Freeways are unique in that there are no signalized or stop-controlled at-grade intersections, and access is limited to ramp locations. All other roadways are classified as rural or suburban 2-4 lane highways that generally have posted speed limits between 25 and 65 mph. These highways generally have signalized intersections at widely spaced intervals, occurring at major junctions that are not grade separated.

Highway critical facilities that are essential to the health and welfare of the whole population and are especially important following hazard events include: I-81, U.S. 460, U.S. 11, U.S. 221, U.S. 219, Virginia 114, Virginia 100, Virginia 8, Virginia 177, Virginia 232, Virginia 99, Virginia 61 and Virginia 42. Each of these facilities provide connectivity to emergency operations, public works facilities, schools, other special needs populations, major employers, financial centers, businesses, high density residential, institutional, industrial areas, as well as historical and natural resource areas. Estimated vehicle capacities, otherwise known as average daily traffic (ADT), have been estimated and highlighted in Map 39. Estimates are based on the present roadway typical section operating at a level of service (LOS) E. A more detailed study should be considered along corridors of particular concern analyzing intersections, driveways, topography and other forms of delay for a more accurate capacity estimate.

The average year that critical roadway infrastructure was built in the NRV was 1968 and has an average value of $7,047,150.33. For the purpose of this plan, 95 critical bridges have been identified located along primary corridors and could cause substantial negative impacts following hazard events. The spans of these bridge structures range from 20 feet to nearly 1700 feet in length and provide crossings over waterways and railways and assist in navigating undulated terrain. The total estimated value of roadway bridges is nearly $670 million. It is recommended that 2,000 linear feet (LF) of temporary structure be kept on-hand by a regional authority to provide accessibility to primary corridors that could experience structure loss. Current research shows that there are numerous design alternatives that provide reliable alternatives to loss of structures in critical areas.

4.8.2.3.3 Identifying Critical Railways

The NRV is estimated to have over one million LF (nearly 200 miles) of active Class 1 freight rail track (multiple lines in parallel are accounted for separately), seven tunnels, and numerous bridge and culvert structures. Norfolk Southern is the area's railway operator. The Heartland (east-west) and Crescent (north-south) corridors cross in the center of the NRV. These alignments are major East Coast commodity shipment corridors that play a major role in the movement of goods on a national level. The total estimated value of railroad assets in the region exceeds $600 million. Nearly all railways follow valley bottoms alongside tributaries and steeply carved slopes. Flooding and slope failures are regular hazards for daily operations, but major damages have a ripple effect of delaying the movement of freight.

4.8.2.3.4 Identifying Critical Aviation

The NRV has two aviation facilities that accommodate a range of commodity shipments and private flights. The first is the NRV Airport in Dublin, constructed in 1962. The facility primarily serves general aviation, but is also an official U.S. Customs Service Port of Entry. The airport is estimated to have a net value of approximately $9 million.

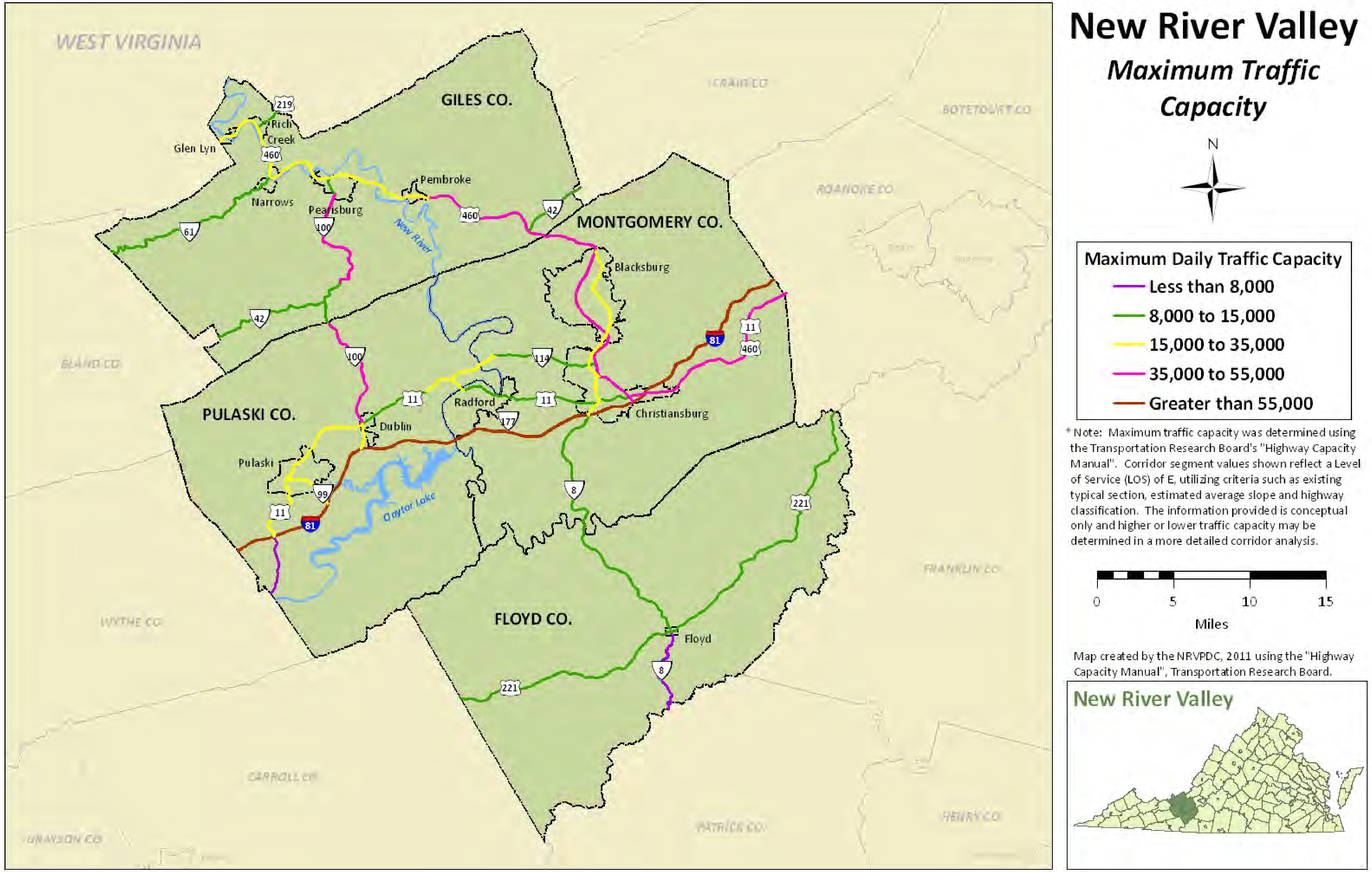
The second airport, Virginia Tech Montgomery Executive Airport was constructed in 1929 and is located on the Virginia Tech campus. The original airport was constructed to accommodate the large aircraft of the time. The facility officially opened in 1931. The purpose of the airport has changed over time from training cadets in the 1940s to primarily serving the community and corporate jets. The Virginia Tech Executive Airport and associated assets are valued at nearly $20 million.

4.8.2.3.5 Identifying Critical Public Transportation Systems

The NRV currently has a mixture of fixed route, paratransit, senior services and on-demand transit services. Transit providers are often used to assist emergency response agencies to evacuate the elderly, low income and persons with disabilities. Currently services are offered within the Counties of Montgomery and Pulaski and the City of Radford. Giles and Floyd Counties currently do not provide transit services. Critical infrastructure for local transit providers includes vehicles, maintenance and office facilities, and local roadway networks. The estimated value for the region's public transportation assets is over $30 million.

Provisional 2009 numbers show that nearly 173,000 people live in the New River Valley. Population varies throughout the year because of the two universities in the region. The Town of Blacksburg is home to the Commonwealth's largest institution, Virginia Tech, which has an enrollment of nearly 30,000 students and consists of nearly 75% of the community's overall population each year. The City of Radford is home to Radford University which has an enrollment of nearly 9,000 students that more than doubles the community population. The Town of Dublin is home to the New River Community College which has an enrollment of nearly 3,000 commuter students that more than doubles the community's population any given day of the week. Each of these facilities has varying impacts on the local transportation system. For the purpose of this plan it is important to take into account the additional 40,000 persons that live in the NRV 75% of the year.

Map 39. NRV Maximum Traffic Capacity



4.8.2.4 Risk Assessment

Vulnerability is based on service losses as well as the interruption of service. For the purpose of mitigation planning these transportation assets are critical to emergency operations and accessibility.

In the NRV, there are a total of 95 identified roadway bridges on primary roads with a total linear length of 36,958 feet and an average length of 389 feet. The total estimated value of all identified bridges is $669,479,281 with an average value of $7,047,150 and on average built in 1968. Public transportation assets in the region have a total estimated value of $32 million. There are 11,367 LF of aviation infrastructure in the NRV with a total estimated value of $29,000,000.

Railways are an important component of the transportation infrastructure in the NRV. There is approximately 1,053,250 LF of railway in the region, with 1,030,000 feet of mainline track. The total estimated value of railway infrastructure in the NRV is $643,400,000 with the average structure's value being $17,872,222. There are 25 railway bridges in the region with lengths over 100 feet, the average being 280 feet. There is a total of 2,030 feet of bridges of less than 100 feet. Eight tunnels serve the NRV railway system, with an average length of 1,776 feet.

The following tables provide detailed 2010 data from VDOT about specific and critical transportation assets and their estimated value. Map 40 provides a basic illustration of the transportation infrastructure in the region.

Table 4-29. Floyd County Roadway Bridges

Route	Structure Number	Over	Year Built	Length*	Lanes	Width*	ADT**	Estimated Value
8	1001	Dodds Creek	1936	64.94	2	28.86	1807	$749,817.45
8	1002	Dodds Creek	1976	122.02	2	41.98	6788	$2,049,087.90
8	1003	W Fork Little River	1976	137.10	2	41.98	6788	$2,302,469.73
221	1017	W Fork Little River	1939	96.10	2	26.57	3436	$1,021,316.43
221	1019	Dodd Creek	1938	97.48	2	29.99	3436	$1,169,401.04
221	1021	Pine Creek	1938	112.47	2	26.29	2675	$1,182,894.13
221	1022	Little River	1998	320.78	2	37.72	8051	$4,839,988.99
221	1023	Beaverdam Creek	1936	127.92	2	26.57	2675	$1,359,431.42
221	1025	Big Run	1936	64.94	2	32.47	2152	$843,544.63
221	1026	Pine Branch	1936	112.83	2	32.47	2152	$1,465,552.28

* in Linear Feet
** ADT = Average Daily Traffic

Table 4-30. Giles County Roadway Bridges

Route	Structure Number	Over	Year Built	Length (LF)	Lanes	Width (LF)	ADT	Estimated Value
42	1012	Sinking Creek	1941	84.95	2	30.83	1286	$1,047,696.03
61	1023	Dry Branch @ Narrows	1998	30.83	2	28.86	4586	$355,973.94
61	1037	New River & Rte 460	1952	1266.74	2	46.00	4356	$23,307,942.40
61	1078	Wolf Creek @ Narrows	1963	221.07	2	37.39	2411	$3,306,529.69
61	1079	Wolf Creek	1969	440.83	2	27.22	538	$4,800,484.15
61	1080	Wolf Creek	1969	252.89	2	27.22	538	$2,753,849.16
100	1015	Big Walker Creek	1987	182.04	2	45.92	4262	$3,343,710.72
100	1017	Walker Creek	1977	246.00	2	41.98	2216	$4,131,225.60
100	1042	Walker Creek	1990	362.77	4	87.90	3897	$12,755,503.31
100	1050	Walker Creek @ Bane	1977	246.00	2	41.98	2216	$4,131,225.60
219	1929	Rich Creek	1931	98.07	2	24.93	8979	$977,895.53
219	6215	Rich Creek	1930	129.89	2	47.56	8979	$2,470,989.31
460	1001	NS Rwy/Prvt Ent Celnse	1978	170.89	2	41.98	6304	$2,869,824.72
460	1002	New River & N&W Railway	1978	1317.58	2	41.98	6304	$22,126,844.31

Route	Structure Number	Over	Year Built	Length (LF)	Lanes	Width (LF)	ADT	Estimated Value
460	1010	New River/ Rt640/Ns Rwy.	2001	1300.00	2	48.87	6304	$25,413,440.00
460	1011	NS Rwy/Prv Ent To Plant	2001	1285.00	2	48.87	6304	$25,120,208.00
460	1019	East River	1986	276.83	2	40.02	4614	$4,431,083.72
460	1020	New River	1986	1653.45	2	41.66	4614	$27,550,411.96
460	1021	Rich Creek	1973	118.08	4	92.82	6826	$4,384,263.17
460	1075	Sinking Creek	1977	216.81	2	41.98	4990	$3,640,986.83
460	1076	Stream	1932	5.90	4	85.00	12609	$200,736.00
460	1077	Sinking Creek	1961	220.09	2	33.13	4990	$2,916,430.11
460	1081	East River	1969	274.86	2	46.25	4614	$5,084,764.11
460	1082	New River	1969	1649.51	2	37.06	4614	$24,455,005.11
460	1083	New River/Ns Railway	1974	1272.64	2	38.05	5904	$19,368,562.69
460	1084	New River/Ns Railway	1974	1272.64	2	38.05	5904	$19,368,562.69
460	1085	Rte 460 Bus	1981	212.87	2	41.66	5904	$3,546,958.41
460	1086	Rt 460 Bus	1981	212.87	2	41.66	5904	$3,546,958.41

Table 4-31. Montgomery County Roadway Bridges

Route	Structure Number	Over	Year Built	Length (LF)	Lanes	Width (LF)	ADT	Estimated Value
8	1007	Mill Creek	1990	21.98	3	51.82	7359	$455,553.69
8	1902	Little River & Rte 716	1984	312.91	2	41.98	7359	$5,254,918.96
11	1002	S Fork Roanoke River	1981	211.89	2	41.66	4044	$3,530,562.61
11	1006	S Fork Roanoke River	1926	143.99	2	24.93	3782	$1,435,773.03
11	1027	S Fork Roanoke River	1950	202.05	2	32.14	4044	$2,597,852.36
11	1028	S. Fork Roanoke River	1950	261.09	2	32.14	4044	$3,356,965.07
11	1029	South Fork Roanoke River	1950	259.78	2	32.14	4044	$3,340,095.90
11	1031	S Fork Roanoke River	1952	173.84	2	33.13	3782	$2,303,588.61
81	2004	NS Railway & Rte 641	1970	173.84	2	41.98	22672	$2,919,399.42
81	2005	NS Rwy, Den Hill Rd/641	1970	165.97	2	41.98	19500	$2,787,200.20
81	2006	NS Railway & Roanoke Rv	1970	345.06	3	56.09	22728	$7,741,400.37
81	2007	NS Railway & Roanoke Rv	1970	326.03	2	43.95	19500	$5,731,903.39

Route	Structure Number	Over	Year Built	Length (LF)	Lanes	Width (LF)	ADT	Estimated Value
81	2900	New River, Ns Rwy, Rt605	1965	1657.71	2	41.98	14500	$27,838,952.24
81	2901	New River, Ns Rwy, Rt605	1965	1599.66	2	41.98	19455	$26,863,983.00
114	1045	New River	1990	1036.81	2	45.92	7942	$19,044,089.34
114	1046	NS Railway	1990	147.93	2	45.92	7471	$2,717,141.50
114	1092	Rte. 460 Bypass	2003	194.83	4	111.52	13324	$8,691,065.86
177	1062	Rte I 81	1965	306.02	2	35.10	5274	$4,296,087.32
177	1065	Rte I 81	1965	306.02	2	35.10	5274	$4,296,087.32
232	1044	Rte. I-81	1965	293.89	2	46.90	6647	$5,513,809.10
460	1032	Toms Creek	1978	18.04	4	85.00	12437	$613,360.00
460	1067	Rte 723	1969	98.07	2	42.64	15989	$1,672,716.03
460	1068	Rte 723	1969	98.07	2	42.64	15989	$1,672,716.03
460	1074	Jennelle Rd./Rt642	2002	360.80	2	42.64	17734	$6,153,804.80
460	1075	Rte. 642/ Jennelle Rd.	2002	450.02	2	42.64	17734	$7,675,472.90
460	1086	Ramp C 460 W Bus	2002	369.00	2	42.64	15989	$6,293,664.00

Table 4-32. Pulaski County Roadway Bridges

Route	Structure Number	Over	Year Built	Length (LF)	Lanes	Width (LF)	ADT	Estimated Value
11	1904	New River & Ns Railway	2005	1494.70	3	55.76	13562	$33,337,699.58
11	1905	New River & Ns Railway	2002	1494.70	3	55.76	13562	$33,337,699.58
81	2000	Rtes 100 & 11	1959	194.83	3	44.94	17071	$3,501,988.30
81	2001	Rtes 100 & 11	1959	194.83	3	44.94	14500	$3,501,988.30
81	2002	Rt99/Count Pulaski Dr.	1960	246.98	3	45.92	17774	$4,536,602.11
81	2003	Rt99/Count Pulaski Dr.	1960	225.99	2	43.95	14500	$3,973,120.15
81	2004	Peak Creek	1960	371.95	2	42.64	17774	$6,344,013.31
81	2005	Peak Creek	1960	371.95	2	42.64	14500	$6,344,013.31
81	2006	New River Trail St. Park	1960	175.81	2	43.95	17774	$3,090,845.29
81	2007	New River Trail S. P.	1960	175.81	2	43.95	14500	$3,090,845.29
81	2024	Rte 644_Miller Lane	1965	123.98	2	43.95	17774	$2,179,737.91
81	2025	Rte 644_Miller Lane	1965	123.98	2	43.95	14500	$2,179,737.91

Route	Structure Number	Over	Year Built	Length (LF)	Lanes	Width (LF)	ADT	Estimated Value
81	2026	Rte 611_Newbern Rd.	1965	129.89	2	43.95	17774	$2,283,534.95
81	2027	Rte 611_Newbern Rd.	1965	125.95	2	43.95	14500	$2,214,336.92
81	2028	Rte 100	1965	253.87	2	42.31	19215	$4,296,732.83
81	2029	Rte 100	1965	247.97	2	42.31	14500	$4,196,808.81
81	2030	Rte 799	1965	136.12	2	43.95	19455	$2,393,098.50
81	2031	Rte 799	1965	130.87	2	43.95	14500	$2,300,834.46
99	1009	Branch Peak Creek	1960	5.90	4	85.00	6892	$200,736.00
100	1015	Back Creek	1936	127.92	2	30.83	2506	$1,577,611.78
100	1016	Little Walker Creek	2001	275.00	5	89.22	5012	$9,813,760.00
100	1018	Back Creek	1974	140.06	2	41.98	2506	$2,352,044.44
100	1022	Rte 11 @ Dublin	1950	88.89	2	39.03	2756	$1,387,790.57
100	1024	Ns Railway & Rte 689	1952	195.82	2	38.05	8943	$2,980,162.87
100	1041	Rte 11 @ Dublin	1966	86.92	3	46.90	2881	$1,630,758.27
100	1042	Ns Railway & Rte 689	1966	193.85	2	36.41	8943	$2,823,047.19

Table 4-33. City of Radford Roadway Bridges

Route	Structure Number	Over	Year Built	Length (LF)	Lanes	Width (LF)	ADT	Estimated Value
Univ Blvd	NA	Ns Railway	NA	450.00	4	62.00	NA	$11,160,000.00
11	NA	New River & Railway	NA	1505.00	3	55.00	NA	$33,110,000.00
11	NA	New River & Railway	NA	1525.00	3	55.00	NA	$33,550,000.00
11	NA	Tributary	NA	180.00	2	50.00	4600	$3,600,000.00
11	NA	Tributary	NA	150.00	2	50.00	4600	$3,000,000.00

Table 4-34. NRV Aviation Infrastructure

Asset Description	Yr Built	Length (LF)	Strips	Width (LF)	ADT	Estimated Value
NRV Airport, Dublin, VA	1962	6201	1	150	10044	$9,000,000.00
Virginia Tech Airport, Blacksburg, VA	1929	5166	2	100	16780	$20,000,000.00

Table 4-35. NRV Railway Infrastructure

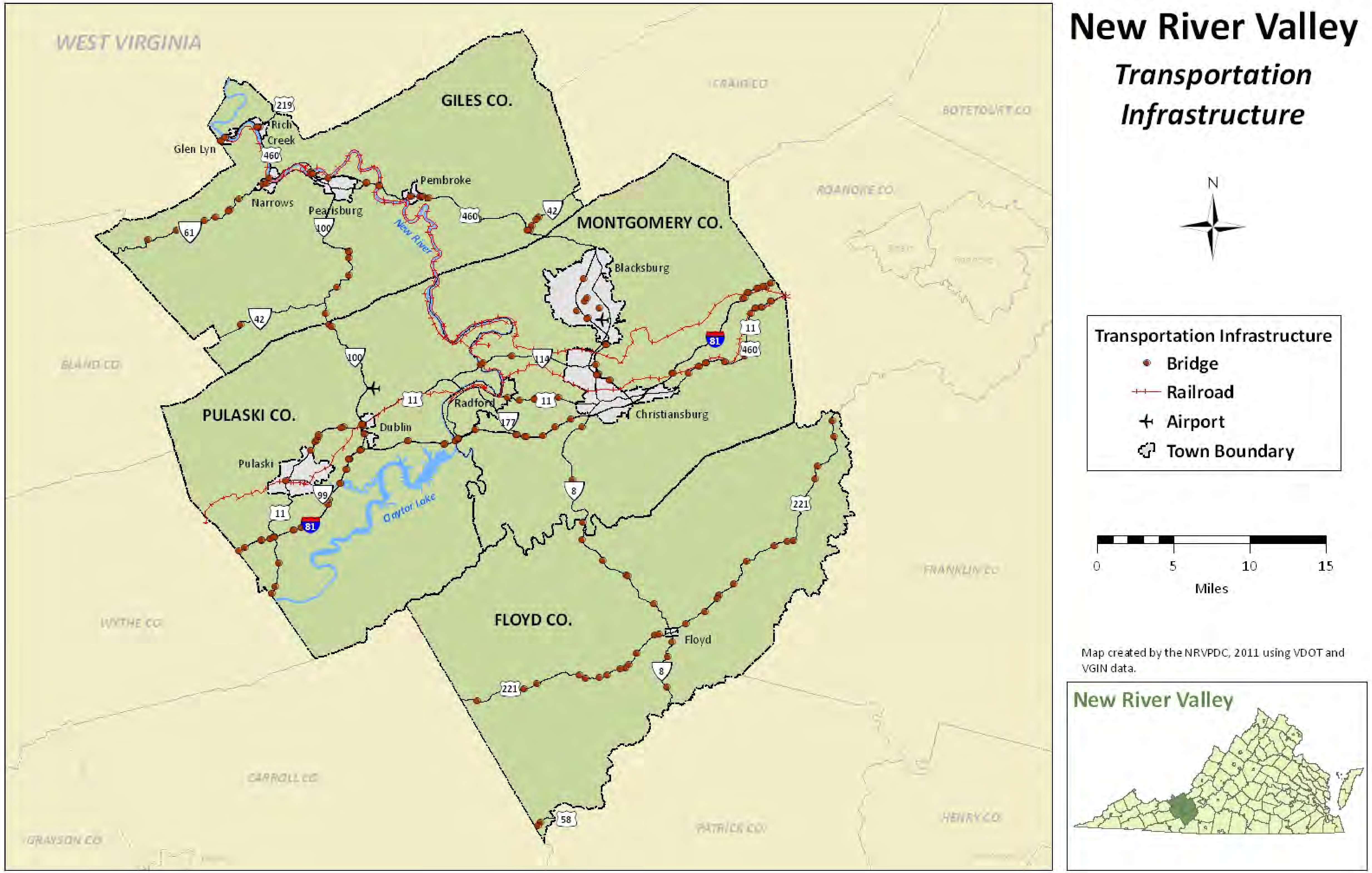
Asset Description	Length (LF)	Lines	Estimated Value
Estimated Norfolk Southern Doublestack Mainline Track	665000	1-3	$232,750,000.00
Estimated Norfolk Southern Mainline Track	365000	1-2	$127,750,000.00
Norfolk Southern Cowan Tunnel	3650	1	$18,250,000.00
Norfolk Southern Tunnel (Giles Co.)	575	1	$2,875,000.00
Norfolk Southern Tunnel (Giles Co. 2)	1285	1	$6,425,000.00
Norfolk Southern Tunnel (Giles Co. 3)	1700	1	$8,500,000.00
Norfolk Southern Tunnel (Montgomery Co./Prices Fork Rd.)	500	1	$2,500,000.00
Norfolk Southern Tunnel (Montgomery Co. Merrimac)	4850	1	$24,250,000.00
Norfolk Southern Tunnel (Montgomery Co.)	750	2	$7,500,000.00
Norfolk Southern Tunnel (Montgomery Co./N Fork Rd.)	900	1	$4,500,000.00
Norfolk Southern Estimated Total of Bridges 100 ft. or less	2030	1	$40,600,000.00
Norfolk Southern Bridge (Giles Co. West of Narrows)	225	2	$9,000,000.00
Norfolk Southern Bridge (Giles Co. Narrows/New River)	1300	1	$26,000,000.00
Norfolk Southern Bridge (Giles Co. Ripplemead/New River)	650	1	$13,000,000.00
Norfolk Southern Bridge (Giles Co.)	325	2	$13,000,000.00
Norfolk Southern Bridge (Giles Co./Pembroke)	135	1	$2,700,000.00
Norfolk Southern Bridge (Pulaski Co. West of RAAP)	150	1	$3,000,000.00
Norfolk Southern Bridge (Pulaski Co. South of Gatewood Reservoir)	215	1	$4,300,000.00
Norfolk Southern Bridge (Pulaski Co. East of Hogan Lake)	125	1	$2,500,000.00
Norfolk Southern Bridge (Pulaski Co. East of Hogan Lake 2)	180	1	$3,600,000.00
Norfolk Southern Bridge (Pulaski Co. West of Town)	175	1	$3,500,000.00
Norfolk Southern Bridge (Pulaski Co. West of Town 2)	200	1	$4,000,000.00
Norfolk Southern Bridge (Pulaski Co. West of Town 2)	180	1	$3,600,000.00
Norfolk Southern Bridge (Town of Pulaski)	140	1	$2,800,000.00
Norfolk Southern Bridge (Town of Pulaski 2)	150	1	$3,000,000.00

Asset Description	Length (LF)	Lines	Estimated Value
Norfolk Southern Bridge (Town of Pulaski 3)	150	1	$3,000,000.00
Norfolk Southern Bridge (City of Radford)	960	1	$19,200,000.00
Norfolk Southern Bridge (Montgomery Co./East of Christiansburg)	120	1	$2,400,000.00
Norfolk Southern Bridge (Montgomery Co./East of Christiansburg 2)	200	1	$4,000,000.00
Norfolk Southern Bridge (Montgomery Co./N Fork Road)	215	1	$4,300,000.00
Norfolk Southern Bridge (Montgomery Co./North of Elliston)	150	1	$3,000,000.00
Norfolk Southern Bridge (Montgomery Co./North of Elliston 2)	125	1	$2,500,000.00
Norfolk Southern Bridge (Montgomery Co./North of Elliston 3)	125	1	$2,500,000.00
Norfolk Southern Bridge (Montgomery Co./West of Elliston)	415	2	$16,600,000.00
Norfolk Southern Bridge (Montgomery Co./West of Elliston 2)	185	2	$7,400,000.00
Norfolk Southern Bridge (Montgomery Co./Elliston)	215	2	$8,600,000.00

Table 4-36. NRV Public Transportation Assets

Asset Description	ADT	Estimated Value
Blacksburg Transit Vehicles and Facilities	3,000,000	$27,500,000.00
Community Transit Vehicles and Facilities	100,000	$1,750,000.00
Pulaski Area Transit Vehicles and Facilities	65,000	$1,750,000.00
Smart Way Vehicles	75,000	$1,000,000.00

Map 40. Transportation Infrastructure



4.8.2.5 Vulnerable Populations

For the purposes of this plan, vulnerable populations are generally defined as persons with either short-term or long-term disabilities and elderly persons. These populations may be particularly susceptible to the impacts of hazard events and have very specific needs in the event of a hazard event. To begin evaluating those specific needs, the NRVPDC attended and led a facilitated discussion with the region’s Disability Services Board (DSB). The DSB provides input to state and local agencies on service needs and priorities of persons with physical and sensory disabilities, to provide information and resource referral to local governments regarding the Americans with Disabilities Act and to provide such other assistance and advice to local governments as may be requested. The DSB is comprised of individuals representing businesses, consumers, each locality and liaisons. A primary activity of the DSB is to conduct a region-wide needs assessment focused on the disabled population, from transportation and housing to services.

During this facilitated discussion, the group identified numerous needs of these communities and how those needs could be addressed. The two main themes emerging from this discussion were that communication is a critically unaddressed issue, as well as the need for access to resources and supplies during a hazard event.

Communication during a hazard event, whether natural or human-caused, is critical in the mitigation of negative impacts in vulnerable populations. This communication must be two-way, both from the authorities to the population in a way that they can access the information, as well as from the population to the authorities to express their needs. As the group identified this need, it became evident that there is a fine line to be balanced between identifying vulnerable populations and not violating their right to privacy. To prevent many of the potentially negative impacts of hazard events, it is critical for government agencies and service providers to conduct outreach and provide persons within these populations the opportunity to self-identify themselves. Maintaining a database of these individuals should assist authorities in providing the necessary assistance to those who want it. A self-maintained database of the location and needs of permanently disabled or elderly persons should be adequate, but additional staff support at either a government agency or other service provider may be necessary to keep track of the self-reported individuals with short-term disabilities or needs.

Communication during a hazard event is also critical to ensure that vulnerable populations are aware of the situation and what they need to do to maintain their personal safety. Typically, notifications are sent to the general public through crawlers on TV screens or announcements on radio stations. The crawlers are not sufficient for the visually impaired or those with cognitive disabilities that limit their ability to read the information provided. This communication also needs to be in multiple forms, beyond TV, radio and the internet to be sure that the necessary information is reaching all the concerned individuals. Some alternative communications methods, especially for critical situations, include door-to-door notifications as well as working with church groups to get information distributed. Reverse 911 with an option to receive a text message would enable a good portion of these vulnerable populations to receive notifications.

Access to resources and supplies can be critical for vulnerable populations during a hazard event. Many times these individuals rely on specific medical devices and/or medications that may be difficult to access or transport in emergency situations. It is important for both emergency sheltering authorities and individuals to identify where to obtain necessary equipment and/or medications prior to an emergency or to identify a storage location if the resource can be stored for periods of time. The group emphasized the need to individuals with disabilities to create and maintain their own personalized “To Go” kit, and possibly a back-up kit, with all necessary medications and equipment. A suggested strategy to further this idea was to propose training sessions at agencies and service providers for individuals on how to create and maintain their own kit. One idea for ensuring that all necessary equipment and medications are available to disabled populations is to shelter these individuals directly in hospitals or other care facilities during emergency events.

In addition to these resources, access to transportation is critical for many in the disabled population. For evacuation situations, it is necessary that all regional authorities know what accessible vehicles are available and where they are to provide a means for evacuation for disabled populations. The group identified the need to establish community locations for evacuation pick-up that are available for disabled persons and would facilitate their timely egress from a potentially dangerous situation.

A primary strategy identified to help address these identified needs was to increase outreach by government agencies and other service providers to these vulnerable populations that may not be currently receiving aid or assistance. Providing a workshop with clients at agencies and working directly with clients will create an awareness of how to respond in time and promote readiness within the vulnerable populations.

4.8.2.5.1 Mitigation Opportunities

A complete listing of NRV hazard mitigation goals, objectives, and strategies can be found in Chapter 5: Mitigation Strategy. Because so little information is available on human-caused hazards and is a relatively new hazard being considered, the Steering Committee developed a mitigation goal. The Steering Committee elected to delay developing specific objectives and strategies until the next revision of this plan.

1. **Develop information on man-made hazards that impact human health and quality of life, e.g., air, water and soil quality in the NRV.**

Chapter 5. Mitigation Strategy

The mitigation goals, objectives, and strategies outlined below were developed by both the steering committee and working groups. Prior to the beginning the working group meetings, the steering committee reviewed and revised the hazard mitigation goals from the original 2005 plan. The original eight goals were reviewed and modified into ten goals in the current plan. Some goals were simply reworded for consistency with other goals, while others were clarified and condensed. In the 2011 plan, there are seven goals directly related to the various hazards in the region, including a new goal associated with human-caused hazards. The final three goals address regional issues for how to handle mitigation and capitalize on resources within the region.

At each of the working group meetings, participants discussed the goals related to the specific hazard at hand. During these brainstorming sessions, participants identified specific strategies that could be implemented via projects to mitigate hazard impacts and then classified the strategies into groups or objectives. The flooding working group utilized a different method for reviewing and updating the objectives and strategies related to flooding. Since flooding is a high risk hazard in the New River Valley, the group felt it was more appropriate to modify the strategies and objectives from the original plan and add any new objectives or strategies where necessary.

5.1 Mitigation Goals and Objectives

1. **Minimize flood-related deaths and losses of existing and future structures.**
    a. *Save lives at imminent risk.*
        i. Seek grant funding to develop early warning systems in high-risk areas utilizing new technology.
        ii. Develop regional capacity for swift-water rescue, including training and equipment purchase.
        iii. Encourage localities to participate in the Storm Ready Program offered by the National Weather Service.
        iv. Promote "Turn Around, Don't Drown" by utilizing signage and other awareness activities.
        v. Increase 2-way communication between NWS and emergency managers during flooding events, as well as communication with residents potentially affected by flooding.
        vi. Educate homeowners and residents in vulnerable areas about the dangers of floods.
        vii. Improve regional communication to improve flood response.
    b. *Reduce risks to critical facilities.*
        i. Do not build new critical facilities in high hazard areas (may be a general policy decision or more strict zoning).
        ii. Identify critical facilities in high-risk areas.
        iii. Replace critical facilities currently located in high-risk areas.
        iv. Identify measures to reduce risk of critical facilities in high hazard areas.

c. *Offer mitigation assistance to owners of flood-prone properties, especially repetitive loss properties.*
    i. Pursue mitigation grant opportunities to buy out, elevate, relocate or water-proof flood-prone properties through FEMA, VDEM, and Community Development Block Grant.
    ii. Study feasibility of mitigation in historic districts or with historic properties.

d. *Educate citizens about the inevitability of flooding, the dangers it poses to life and property, and the opportunities for mitigation.*
    i. Seek to update flood insurance studies and maps to understand risks more accurately.
    ii. Encourage the development of statewide databases and geographic information systems layers to assist local government planning efforts.
    iii. Encourage collection and development of better hazard history locally and incorporate into geographic information systems.
    iv. Incorporate hazard mitigation information in the future in the local comprehensive planning process.
    v. Utilize existing documents and programs from FEMA, the NFIP, VDEM, and the NWS to educate the public about hazards and mitigation opportunities.
    vi. Produce and distribute local newsletters and/or other mitigation documents to residents in high-hazard areas.
    vii. Coordinate with and support Community Emergency Response Team (CERT) information distribution activities in the community.
    viii. Provide community workshops.
    ix. Educate citizens about the availability and value of NFIP policies and encourage greater participation.
    x. Notify and educate property owners of structures in floodplain about the potential impacts.
    xi. Include a notice that property is in floodplain in deed or plat.

e. *Limit future development in floodplains.*
    i. Utilize zoning ordinances to further restrict undeveloped floodplains.
    ii. Encourage standards above NFIP standards when considering floodplain development.

f. *Develop adequate drainage structures and maintenance procedures to prohibit "back-up" flooding in high-hazard areas.*
    i. Seek grant and/or state funding for replacement of inappropriately sized culverts and drainage.
    ii. Pursue streambed clearance through citizen groups and/or the Natural Resources Conservation Service as needed to eliminate bottlenecks.
    iii. Encourage bottomland farm fences to catch debris before reaching culverts.
    iv. Schedule regular drainage system maintenance including before and after storms.
    v. Work with VDOT to inventory culverts in the region.

vi. Ensure that future culverts are adequately sized for the estimated run-off from storms.
vii. Educate landowners about culvert maintenance to ensure culverts continue to efficiently handle stormwater.

g. *Develop stormwater facilities or upgrades as needed to limit flooding in high hazard areas.*
   i. Seek grant funding for regional stormwater detention facilities as needed. Reconsider design frequency of occurrence.
   ii. Seek channel improvements or upgrades as needed to reduce peak flood flows.
   iii. Pursue combinations of regional stormwater management strategies and onsite strategies.
   iv. Encourage alternative stormwater management options in both new and existing facilities.
   v. Inventory stormwater infrastructure to ensure adequate future maintenance.
   vi. Utilize floodplains as community assets such as parks or other open spaces.
   vii. Develop strategies for addressing impervious surfaces and their impact on stormwater.

h. *Pursue mitigation projects that achieve multiple community goals.*
   i. Pursue partnerships with land trusts to promote conservation easements on undeveloped floodplains and wetlands to aid flood mitigation.
   ii. Pursue the affordable housing alternatives for low-income families now living in floodplains.
   iii. Seek economic development opportunities, such as brownfields, which turn current "liabilities" into community assets.

2. Minimize economic losses and health risks during droughts.

a. *Develop a set of planning tools that mitigate the impacts of drought.*

   i. Improve data and inventory of water users to better assess the vulnerability of water supplies to drought.

   ii. Identify back-up water sources or increase storage capacity for public water systems.

   iii. Develop a system of notification of precipitation predictions that will assist agricultural producers in short-term decision making.

   iv. Pursue Memorandums of Understanding between localities and companies to haul in water as an alternative source of water during drought conditions.

   v. Encourage water providers in the region to take advantage of programs designed to prevent leaks and water losses in their systems.

   vi. Continue efforts to promote interconnections of municipal water systems for use should an emergency situation arise.

b. *Encourage research and development of prediction capabilities that will assist in decision-making during drought conditions.*

   i. Support the improvement of drought forecasting and predictions available from government sources (i.e., NOAA, NWS).

   ii. Support efforts to develop and improve simulation modeling that provides information regarding all potential impacts and outcomes for decision-makers.

c. *Promote educational efforts to assist residents in dealing with the impacts of drought.*

   i. Provide information to residents of existing conservation measures and the sliding scale of prescriptive measures to assist in mitigating the impacts of drought.

   ii. Promote educational efforts developed for private well owners about proper care and maintenance of their well, as well as the potential impacts associated with drought.

3. Minimize structural damage due to landslides.

a. *Develop strategies to protect existing structures from the impacts of landslides and debris flows.*

   i. Identify areas where potential debris flow could be diverted to avoid existing structures.

   ii. Re-vegetate areas in danger of becoming slides.

b. *Develop educational materials and notification systems to better inform residents of landslide hazards.*

   i. Create a database or reporting system for landslides.

   ii. Notify permit applicants of site vulnerability to landslide and debris flow.

   iii. Develop appropriate signage that warns of the danger of landslide and rockfall, especially during heavy rain periods.

   iv. Install warning devices on extremely vulnerable sites that have remote notification for emergency and response personnel.

c. *Encourage planning practices that mitigate the impacts of landslides and rockfall on new and existing developments.*

   i. Ensure that the most accurate data is available while making planning decisions (i.e., zoning, subdivisions).

   ii. Restrict future development in landslide prone areas.

   iii. Continue to improve data available for future planning and mitigation.

   iv. Incorporate additional language into ordinances to mitigate impacts from landslides.

v. Continue to monitor A-rated rockfall cuts for future slope movement.

vi. Encourage projects that expand catchment areas (i.e., ditches and shoulders) in potential rockfall areas of roads.

vii. Encourage slope protection, reinforcement and reconstruction projects to prevent future rockfall events.

viii. Engage in pre-demolition activities that control rockfall events.

d. Engage in activities to plan for and avoid future landslide and rockfall impacts.

i. Gather existing route information for detours that may be necessary in the event of a rockfall event.

4. Minimize risks to developments and structures in areas prone to earthquakes and new sinkholes.

a. Encourage activities to protect structures from future events.

i. Ensure that seismic requirements are included in building codes.

ii. Reinforce critical facilities to withstand seismic events.

b. Develop educational programs to increase residents' awareness of likelihood of geologic events.

i. Develop training/education activities for all government staff on appropriate response for geologic events.

ii. Maintain awareness of regional seismic activity.

iii. Develop informational materials about potential for sinkholes in vulnerable areas.

c. Engage in planning activities to minimize impacts of earthquakes and sinkholes.

i. Identify and mark known sinkholes.

ii. Conduct aerial surveys of hazardous conditions resulting from sinkholes.

iii. Survey local surveyors, well diggers, septic installers, soil scientists and other local experts to identify new sinkhole locations.

iv. Ensure that identified sinkholes are marked on plats, easements, and building permits.

v. Conduct water quality assessments to determine impacts of sinkholes on water sources.

vi. Encourage further dye tracing to track water as it moves between the surface and below ground.

vii. Ensure that groundwater sources are protected from contamination by requiring septic drainfields to be a minimum distance from a known sinkhole.

viii. Ensure structures are not placed near known sinkholes.

5. **Minimize impacts of significant weather events, such as winter weather and severe weather events in the NRV.**

    a. *Encourage activities to prevent impacts during storm events.*

        i. Promote the installation and maintenance of drift fences to maintain access during snow events.

        ii. Emphasize that all road maintenance be done prior to storms to prevent access issues.

    b. *Develop educational materials and events to prevent loss of life and property in severe weather events.*

        i. Emphasize what should be done during a storm event (i.e., lightning) to maintain safety.

        ii. Educate landowners about how overhanging utility lines and trees can cause property damage during a storm.

        iii. Continue educational efforts during times when events are not occurring (i.e., brochures, websites, awareness weeks-promotions coordination).

        iv. Create a brochure or handout of local hazards to provide to the community.

        v. Pursue Storm Ready designation for the region's communities.

    c. *Encourage preparation and planning activities that ensure minimal impacts to life and property.*

        i. Encourage personal planning for storm events and their impacts.

        ii. Inventory public facilities to determine the need for back-up power generation.

        iii. Inventory of possible roof collapses through an analysis of building permits to determine need for future mitigation efforts.

        iv. Engage in regional emergency management exercises (table-top and field) to train responders.

6. **Minimize wildfire losses in the "urban wildland interface" areas.**

    a. *Educate residents and landowners on possible wildfire mitigation techniques.*

        i. Educate the public about where building is occurring and the need to clear debris to prevent loss to wildfire.

        ii. Increase awareness of conditions that could enhance wildfire impacts.

        iii. Educate homeowners about the possibility of wildfires.

        iv. Conduct practice "tagging" exercises to educate homeowners about the realities of wildfire.

v. Engage with landscaping companies to encourage and utilize Firewise techniques on customers' property.

b. *Engage in mitigation and planning activities to minimize wildfire impacts.*

i. Ensure that new wildland communities are built to Firewise standards through inclusion in subdivision ordinances, building permits, set-back ordinances and covenants.

ii. Limit future development in areas with slopes greater than 50% that prevent access by fire equipment.

iii. Work with insurance to improve incentives for homeowners engaging in Firewise activities.

iv. Improve physical access to community for fire and rescue personnel and equipment.

v. Encourage county-wide fire plans and Community Wildfire Protection Plans.

vi. Search for funding to increase equipment and personnel to fight wildfires.

vii. Enforce existing regulations that home numbers at the road are easily visible for first responders.

viii. Improve 911 mapping systems for improved access by first responders.

ix. Work with land and home owners with gates or locks to improve fire access.

x. Encourage mitigation activities that prevent wildfire damage to structures, including creating a defensible space around a vulnerable structure, structural protection through ignition resistant construction activities, and hazardous fuels reduction activities.

7. **Develop information on man-made hazards that impact human health and quality of life, e.g., air, water and soil quality in the NRV.**

8. **Promote community awareness and knowledge of hazards and programs available to encourage personal safety and property protection.**

i. Develop a warning system and evacuation procedures to be available for use by the emergency response community.

ii. Create a system for utilizing event data in real time during a response.

iii. Encourage research that develops effective thresholds for issuing warnings to the general public regarding possible hazard events.

9. **Capitalize on available mitigation information, services and funding from various local, regional, state, federal, and non-profit agencies for mitigation planning and implementation.**
    i. Provide information and support the utilization of multiple grant sources to maximize a project's potential.
    ii. Weigh the interactions of all natural hazards before acting to address one.
    iii. Give highest priority to projects which achieve multiple goals.
    iv. Develop diverse partnerships, government, private, non-profit, etc.

    a. *Encourage research and development in the most effect means for notifying citizens of impending hazards.*
        v. Support research efforts to determine the most effective ways to notify the public of impending events that elicit the desired response.

10. **Use regional coordination and cooperation, as needed, to enhance mitigation.**
    i. Create a system for local government and residents to provide feedback on mapping and historical data for future plan updates.
    ii. Improved regional coordination between localities and agencies for data sharing.
    iii. Continue to gather data and develop more information related to hazards and their potential impacts throughout the region.

    a. *Develop tools for local government staff to most effectively notify citizens of impending events.*
        iv. Develop a regional strategy for using notification system to be most effective, including ways to utilize the existing system for additional notifications.
        v. Develop a set of actions that can be taken by the public to be correlated with specific notifications.

5.2 Implementation Projects

Implementing these mitigation strategies includes developing and completing projects that address different hazards. Some of these projects could include educational campaigns covering all hazards or specific construction projects to prevent flooding. With limited local budgets, there is a need to prioritize identified projects to provide the most benefit for the cost. Based on recommendations from VDEM, the steering committee suggested the use of STAPLEE criteria to prioritize the projects. STAPLEE stands for: Social, Technical, Administrative, Political, Legal, Economic, and Environmental. Under the social criteria, localities were encouraged to consider community acceptance of the project. The technical criteria included the feasibility of the project, how quickly it could be implemented, and whether the project could be implemented in phases. Administratively, localities considered previous time investment into the project or hazard area and staffing availability to implement the project. The potential to implement a project at the regional level and the ability or willingness of the locality to provide matching funds should a grant become available were included in the political criteria. Legally, the localities were asked to consider whether they have the authority to implement a certain action. Economically, the cost of the project, funding availability and a known funding source were considered important issues. Finally the environmental issues related to a project were considered, including the relative risk level assigned to the hazard, the potential effects of the project on surrounding land and water resources, and whether the project was consistent with previous community goals.

Table 5-1 below is a listing of projects identified at the regional level and their relative priority based on these criteria. A full description of the projects is available in Appendix 4, along with listings of locality projects.

Table 5-1. Regional Projects and Priority Rankings

Project Description	Relative Regional Ranking
Additional hazard, risk, damage and scientific data points	High
Regional Water Supply Planning	High
Create all hazards educational materials	High
Develop a regional strategy for participation in "Turn Around, Don't Drown"	High
Wildfire prevention and mitigation such as Firewise training at more woodland home communities, creating defensible space, hazardous fuels reduction, and ignition resistant retrofitting	High
Acquisition and demolition, acquisition and relocation, retrofitting, elevation, floodproofing, mitigation reconstruction of NFIP defined SRL properties, or other mitigation for properties in flood-prone areas	High
Regional Telecommunication Capacity and Interoperatibility	Medium
Regional inventory of emergency response equipment and personnel	Medium
Provide weather radios to vulnerable populations	Medium
Create all hazards educational program & distribute preparedness kits	Medium
Inventory culverts & identify those that need attention	Medium
Identify emergency shelters & coordinate their use and equipment	Medium
Inventory potential rockfall areas for mitigation benefits	Medium
Identify rockfall issues on trails and walkways	Medium
Coordinate with VDEM too identify companies to provide large, reliable water supplies	Medium
Create karst program to actively map and educate landowners	Medium
Minor localized flood control projects to include but not limited to stormwater management improvements	Medium

Upgrade and implementation of emergency response systems	Medium
Hazard education and outreach	Medium
Regional Damage Assessment Team	Low
Regional Infrastructure and Debris Management Planning Model	Low
Create maps of inaccessible areas for emergency equipment	Low
Rockfall inventory for secondary roads	Low
Improve detour signage	Low
Install notification systems at likely rockfall locations	Low
Inventory smaller and private bridges	Low

5.3 Capabilities Assessment

The capabilities assessment in the original *New River Valley Hazard Mitigation Plan* consisted primarily of an overview of staff available to assist in hazard mitigation and the geographic information systems capability of the localities. While both important components of a successful mitigation strategy and mitigation projects, there are some additional characteristics that can be important when implementing long-term mitigation actions, such as policy changes and capital improvement investments. As a result, the capabilities assessment in this plan includes these additional characteristics and a narrative assessment of each locality.

In an effort to objectively measure the capabilities of the participating localities, a spreadsheet was designed to identify critical elements in of each localities. The purpose of the spreadsheet was to ensure that each locality was examined through the same framework.

The capabilities of the localities are largely defined through four characteristics: 1) staff and organizational capacity, 2) technical capacity, 3) fiscal capacity, and 4) regulatory capacity. Each of these characteristics has indicators that were uniformly examined in each locality. Below is a summary of each locality's capabilities based on these four characteristics and their indicators.

5.3.1 Floyd County

5.3.1.1 Staff and Organizational Capacity

Floyd County operates with a Board of Supervisors form of government. The County Administrator is hired by the Board to carry out the day-to-day operations of the County. The County has a number of departments that could be a part of any hazard mitigation actions, including

- Building Inspections
- Community/Economic Development
- Emergency Services Coordinator
- Fire Department

- Sheriff
- Recreational Parks Authority
- Health department

5.3.1.2 Technical Capacity

Floyd County has limited technical expertise to engage in hazard mitigation activities. Many County employees fill more than one role within the government structure. The County does operate and maintain a GIS database of important spatial information for the County. Internet and email access are provided to County employees by the County.

5.3.1.3 Fiscal Capacity

For Fiscal Year 2010, Floyd County had an operational budget of $31 million. Actual budget spent on public safety or capital improvements was unavailable at the time of plan drafting. With current trends it is unlikely that the County would be able to provide cash matching for potential mitigation funds.

5.3.1.4 Regulatory Capacity

Floyd County does participate in the NFIP, but does not engage in any Community Rating System activities. As required by NFIP, the County does maintain floodplain regulations. Per Virginia State Code, the County does have and maintain a comprehensive plan to identify goals and areas for growth and development in the county. The County is currently revising their comprehensive plan. Adoption of the new comprehensive plan is expected in early 2011. Floyd County does have a subdivision ordinance to guide how land is divided in the county, but does not utilize a zoning ordinance.

5.3.2 Town of Floyd

5.3.2.1 Staff and Organizational Capacity

The Town of Floyd in Floyd County operates under a mayor/town council form of government with only two town employees, a town manager and a clerk/treasurer. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town.

5.3.2.2 Technical Capacity

The Town of Floyd has very limited technical expertise. The two Town employees are provided internet and email access, but the Town does not maintain its own GIS database. The Town relies on Floyd County for many of its services to residents.

5.3.2.3 Fiscal Capacity

The Town of Floyd has a very limited budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding.

5.3.2.4 Regulatory Capacity

The Town of Floyd adopts a joint comprehensive plan with Floyd County. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits. As the Town does not participate in the NFIP, it also does not maintain any floodplain regulations.

5.3.3 Giles County

5.3.3.1 Organizational and Staff Capacity

Giles County operates under a board of supervisors/county administrator form of government. The County Administrator is hired by the Board of Supervisors to oversee the day-to-day operations of the County. The County has multiple departments that could be involved in mitigation activities including

- Building and Zoning
- Sheriff
- Health Department
- Public Service Authority

5.3.3.2 Technical Capacity

Giles County employs several full-time dedicated employees that would assist in identifying and implementing hazard mitigation activities. Among these are a planning and zoning administrator, a county engineer, a code enforcement officer, and a building official. The County does not have a full-time dedicated Emergency Services Coordinator, rather several employees fill that role. The County is interested in finding funding to hire such a dedicated position. The County does operate and maintain a GIS database with important spatial data for the county. Internet and email is provided by the County for employees.

5.3.3.3 Fiscal Capacity

During Fiscal Year 2010, Giles County had an operational budget of just over $51 million, with just over $4 million dedicated to public safety. With a limited budget, it is unlikely that Giles County would be able to easily meet the matching requirements for obtaining mitigation funding.

5.3.3.4 Regulatory Capacity

Giles County does participate in the NFIP, but does not engage in any Community Rating System activities. The County does have floodplain regulations, but County contacts have limited knowledge of a county floodplain management plan. The County does utilize both a subdivision and zoning ordinance based on the County comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by the Board of Supervisors in 2005. The County does have an emergency operations plan, but information about the plan and its implementation is limited.

5.3.4 Town of Glen Lyn

5.3.4.1 Staff and Organizational Capacity

The Town of Glen Lyn in Giles County operates under a mayor/town council form of government with a town manager and other Town employees. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town.

5.3.4.2 Technical Capacity

The Town of Glen Lyn has very limited technical expertise. The Town employees are not provided internet and email access. The Town does not maintain its own GIS database. The Town relies on Giles County for many of its services to residents.

5.3.4.3 Fiscal Capacity

The Town of Glen Lyn has a very limited budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding.

5.3.4.4 Regulatory Capacity

The Town of Glen Lyn does participate in the NFIP and utilizes a floodplain regulation. It is unclear whether the Town has a floodplain management plan. The Town of Glen Lyn adopted its most recent comprehensive plan in 2001. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits.

5.3.5 Town of Narrows

5.3.5.1 Staff and Organizational Capacity

The Town of Narrows in Giles County operates under a mayor/town council form of government with a town manager and several other Town employees. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town.

5.3.5.2 Technical Capacity

The Town of Narrows has very limited technical expertise. The Town employees are provided limited internet and email access. The Town does not maintain its own GIS database. The Town relies on Giles County for many of its services to residents.

5.3.5.3 Fiscal Capacity

The Town of Narrows has a very limited budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding.

5.3.5.4 Regulatory Capacity

The Town of Narrows does participate in the NFIP and utilizes a floodplain regulation. It is unclear whether the Town has a floodplain management plan. The Town of Narrows adopted its most recent comprehensive plan in 2001. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits.

5.3.6 Town of Pearisburg

5.3.6.1 Staff and Organizational Capacity

The Town of Pearisburg in Giles County operates under a mayor/town council form of government with a town manager and several other Town employees. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town. The Town has several departments that could be involved in mitigation activities including

- Public Works
- Building Inspections
- Fire Department
- Police Department

5.3.6.2 Technical Capacity

The Town of Pearisburg has more technical expertise than other towns in Giles County, but is still relatively limited. The Town employees are provided internet and email access. The Town does not maintain its own GIS database.

5.3.6.3 Fiscal Capacity

The Town of Pearisburg has a very limited budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding.

5.3.6.4 Regulatory Capacity

The Town of Pearisburg does participate in the NFIP and utilizes a floodplain regulation. It is unclear whether the Town has a Floodplain Management Plan. The Town of Pearisburg adopted its most recent comprehensive plan in 2007. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits.

5.3.7 Town of Pembroke

5.3.7.1 Staff and Organizational Capacity

The Town of Pembroke in Giles County operates under a mayor/council form of government with a town manager and several other Town employees. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town.

5.3.7.2 Technical Capacity

The Town of Pembroke has very limited technical expertise. The Town employees are provided limited internet and email access. The Town does not maintain its own GIS database. The Town relies on Giles County for many of its services to residents.

5.3.7.3 Fiscal Capacity

The Town of Pembroke has a very limited budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding.

5.3.7.4 Regulatory Capacity

The Town of Pembroke does participate in the NFIP and utilizes a floodplain regulation. It is unclear whether the Town has a floodplain management plan. The Town of Pembroke adopted its most recent comprehensive plan in 2003. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits.

5.3.8 Town of Rich Creek

5.3.8.1 Staff and Organizational Capacity

The Town of Rich Creek in Giles County operates under a mayor/council form of government with a town manager and several other Town employees. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town.

5.3.8.2 Technical Capacity

The Town of Rich Creek has limited technical expertise. The Town employees are not provided internet and email access. The Town does not maintain its own GIS database. The Town relies on Giles County for many of its services to residents.

5.3.8.3 Fiscal Capacity

The Town of Rich Creek has a very limited budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding.

5.3.8.4 Regulatory Capacity

The Town of Rich Creek does participate in the NFIP and utilizes a floodplain regulation. It is unclear whether the Town has a floodplain management plan. The Town of Rich Creek adopted its most recent comprehensive plan in 2008. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits.

5.3.9 Montgomery County

5.3.9.1 Organizational and Staff Capacity

Montgomery County operates under a board of supervisors/county administrator form of government. The County Administrator is hired by the Board of Supervisors to oversee the day-to-day operations of the County. The County has 36 departments, some of which could be involved in mitigation activities including

- Building and Zoning
- Sheriff
- Emergency Services
- Health Department
- Public Service Authority

5.3.9.2 Technical Capacity

Montgomery County employs several full-time dedicated employees that would assist in identifying and implementing hazard mitigation activities. Among these are a planning director, a planning and zoning administrator, a county engineer, a code enforcement officer, GIS manager, an emergency services coordinator, and a building official. The County does operate and maintain a GIS database with important spatial data for the county. Internet and email is provided by the County for employees.

5.3.9.3 Fiscal Capacity

During Fiscal Year 2010, Montgomery County had an operational budget of just over $158 million. With current economic stressors in the county, as well as around the country, it is unlikely that the County would be able to meet the matching requirements for obtaining mitigation funding.

5.3.9.4 Regulatory Capacity

Montgomery County does participate in the NFIP and engages in many Community Rating System activities though it is not in the Community Rating System. The County does have floodplain regulations, but County contacts have limited knowledge of a county floodplain management plan. The County does utilize both a subdivision and zoning ordinance based on the county comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by the Board of Supervisors in 2004 and has been updated several times, as recently as 2010. The County does have an emergency operations plan, but information about the plan and its implementation is limited. Additionally, Montgomery County does have an open space plan that guides acquisition and development of open spaces and parks around the county.

5.3.10 Town of Blacksburg

5.3.10.1 Organizational and Staff Capacity

The Town of Blacksburg operates under a town council/town manager form of government. The Town Manager is hired by the Town Council to oversee the day-to-day operations of the Town. The Town has 18 departments, some of which could be involved in mitigation activities including:

- Engineering and GIS
- Parks and Recreation
- Planning and Building
- Police
- Public Works

5.3.10.2 Technical Capacity

The Town of Blacksburg employs several full-time dedicated employees that would assist in identifying and implementing hazard mitigation activities. Among these are a planning and zoning administrator, a town engineer, a code enforcement officer, and a building official. The

Town does operate and maintain a GIS database with important spatial data for the town. Internet and email is provided by the Town for employees.

5.3.10.3 Fiscal Capacity

During Fiscal Year 2010, the Town of Blacksburg had an operational budget of just over $27 million, with a public safety budget of just over $7 million. With current economic stressors in the town, as well as around the country, it is unlikely that the Town would be able to meet the matching requirements for obtaining mitigation funding.

5.3.10.4 Regulatory Capacity

The Town of Blacksburg participates and is in good standing with the NFIP. The town zoning ordinance consists of the Floodplain Overlay and Creek Valley Overlay districts to regulate uses, activities, and development in flood prone areas defined by FEMA and the Town of Blacksburg. The Town Floodplain Management Program meets and or exceeds the minimum standards set forth by the NFIP and employs Certified Floodplain Managers (CFM) to manage the program. The Floodplain Overlay section of the zoning ordinance was updated to reflect new FEMA maps and regulations in 2009. The Town does utilize both a subdivision and zoning ordinance based on the town comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by the Town Council in 2006. Additionally, the Town of Blacksburg does have an open space plan that guides acquisition and development of open spaces and parks around the town.

Emergency Operation Plans are in place in the Police Department, Fire Department, Rescue Squad, and the Public Works Department. Plans covering various situations are in place in the Engineering Department, Finance Department, and the Technology Department. There is also a draft Emergency Management Plan that the Emergency Preparedness Committee has reviewed.

In the event of a significant emergency the Virginia Department of Emergency Management (VDEM) coordinates assistance through Montgomery County who in turn assists the Town. Depending on the type of emergency the Town Manager may designate the Police Chief, Fire Chief, Rescue Chief, or another Department Director as the lead individual depending on the specifics of the situation.

In the next year the Emergency Preparedness Committee will finalize the Emergency Management Plan and review it with all Town Departments.

5.3.11 Town of Christiansburg

5.3.11.1 Organizational and Staff Capacity

The Town of Christiansburg operates under a town council/town manager form of government. The Town Manager is hired by the Town Council to oversee the day-to-day operations of the Town. The Town has 10 departments, some of which could be involved in mitigation activities including:

- Building Inspections
- Engineering

– Planning & Zoning

– Public Works

5.3.11.2 Technical Capacity

The Town of Christiansburg employs several full-time dedicated employees that would assist in identifying and implementing hazard mitigation activities. Among these are a planning and zoning administrator, a town engineer, a code enforcement officer, and a building official. The Town does operate and maintain a GIS database with important spatial data for the town. Internet and email is provided by the Town for employees.

5.3.11.3 Fiscal Capacity

No current budget information is available for the Town of Christiansburg. With current economic stressors in the Town, as well as around the country, it is assumed that it is unlikely the Town would be able to meet the matching requirements for obtaining mitigation funding.

5.3.11.4 Regulatory Capacity

The Town of Christiansburg does participate in the NFIP, but does not engage in any Community Rating System activities. The Town does have floodplain regulations, but Town contacts have limited knowledge of a town floodplain management plan. The Town does utilize both a subdivision and zoning ordinance based on the town comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by the Town Council in 2003. The Town has an emergency operations plan, but information about the plan and its implementation is limited.

5.3.12 Pulaski County

5.3.12.1 Organizational and Staff Capacity

Pulaski County operates under a board of supervisors/county administrator form of government. The County Administrator is hired by the Board of Supervisors to oversee the day-to-day operations of the County. The County has several departments which could be involved in mitigation activities including:

– Building

– Zoning

– Sheriff

– Emergency Management

– Public Service Authority

– Health department

5.3.12.2 Technical Capacity

Pulaski County employs several full-time dedicated employees that would assist in identifying and implementing hazard mitigation activities. Among these are a planning and zoning administrator, a county engineer, a code enforcement officer, a building official, and an emergency services coordinator. The County does operate and maintain a GIS database with important spatial data for the county. Internet and email is provided by the County for employees.

5.3.12.3 Fiscal Capacity

During Fiscal Year 2010, Pulaski County had a limited budget. With current economic stressors in the county, as well as around the country, it is unlikely that the County would be able to meet the matching requirements for obtaining mitigation funding.

5.3.12.4 Regulatory Capacity

Pulaski County does participate in the NFIP, but does not engage in any Community Rating System activities. The County does have floodplain regulations, but County contacts have limited knowledge of a county floodplain management plan. The County does utilize both a subdivision and zoning ordinance based on the county comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by the Board of Supervisors in 2009. The County does have an emergency operations plan, but information about the plan and its implementation is limited.

5.3.13 Town of Dublin

5.3.13.1 Staff and Organizational Capacity

The Town of Dublin in Pulaski County operates under a mayor/council form of government with a town manager and several other Town employees. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town.

5.3.13.2 Technical Capacity

The Town of Dublin has limited technical expertise. Town employees are provided internet and email access by the Town. The Town does not maintain its own GIS database. The Town relies on Pulaski County for many of its services to residents.

5.3.13.3 Fiscal Capacity

The Town of Dublin has a very limited operational budget of just over $1 million in Fiscal Year 2009, with public safety accounting for almost half of that budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding. The most recent capital improvement plan was adopted in 1998.

5.3.13.4 Regulatory Capacity

The Town of Dublin does participate in the NFIP and utilizes a floodplain regulation, but does not participate in Community Rating System activities. It is unclear whether the Town has a floodplain management plan. The Town of Dublin adopted its most recent comprehensive plan in 1999. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits.

5.3.14 Town of Pulaski

5.3.14.1 Staff and Organizational Capacity

The Town of Pulaski in Pulaski County operates under a mayor/council form of government with a town manager and several other Town employees. The Town Manager is hired by Town Council to carry out the day-to-day operations of the Town.

5.3.14.2 Technical Capacity

The Town of Pulaski has limited technical expertise. Town employees are provided internet and email access by the Town. The Town does maintain its own GIS database.

5.3.14.3 Fiscal Capacity

The Town of Pulaski has a very limited operational budget. It is highly unlikely that the Town would be able to meet matching requirements of mitigation funding.

5.3.14.4 Regulatory Capacity

The Town of Pulaski does participate in the NFIP and utilizes a floodplain regulation, but does not participate in Community Rating System activities. It is unclear whether the Town has a floodplain management plan. A stormwater management plan is maintained by the Town engineering department. The Town of Pulaski adopted its most recent comprehensive plan in 2004. The Town does utilize zoning and subdivision ordinances to determine growth and development within Town limits. While there is limited knowledge of an emergency operations plan, the Town may have a joint plan with Pulaski County.

5.3.15 City of Radford

5.3.15.1 Organizational and Staff Capacity

The City of Radford operates under a city council/city manager form of government. The City Manager is hired by the City Council to oversee the day-to-day operations of the City. The City has 18 departments, some of which could be involved in mitigation activities including has several departments which could be involved in mitigation activities including:

- Building
- Engineering
- Projects
- Planning
- Health department
- Fire
- Police

5.3.15.2 Technical Capacity

The City of Radford employs several full-time dedicated employees that would assist in identifying and implementing hazard mitigation activities. Among these are a planning and zoning administrator, a city engineer, a code enforcement officer and a building official. The City does operate and maintain a GIS database with important spatial data for the city. Internet and email is provided by the City for employees.

5.3.15.3 Fiscal Capacity

During Fiscal Year 2010, the City of Radford had an operational budget of approximately $47 million with almost $6 million dedicated to public safety and about $2.5 million dedicate to health and welfare. With current economic stressors in the city, as well as around the country, it is unlikely that the City would be able to meet the matching requirements for obtaining mitigation funding.

5.3.15.4 Regulatory Capacity

The City of Radford does participate in the NFIP, but does not engage in any Community Rating System activities. The City does have floodplain regulations, but City contacts have limited knowledge of a city floodplain management plan. The City does utilize both a subdivision and zoning ordinance based on the city comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by City Council in 2009. The City does have an emergency operations plan, but information about the plan and its implementation is limited. Additionally, the City of Radford does have an open space plan adopted in 2007 that guides acquisition and development of open spaces and parks around the City.

Chapter 6. Community Summaries

Participating localities submitted updated community summaries for this plan revision. Each summary includes a brief overview of the hazards of concern for that locality, current or ongoing mitigation efforts, and an updated list of projects identified for future mitigation opportunities.

6.1 Floyd County

6.1.1 Hazards and Risks

Floyd County's principal natural hazards are severe drought and wildfire. About 95% of county residents rely on private water systems. The 1998-2002 drought caused at least 500 households to lose their spring or well, requiring a new well. However, even many new wells have very limited yields. Housing developments on sloped, wooded areas are at significant risk of wildfire damage. Floyd County also experiences some flooding, though there is no larger concentrated area. The United States Geological Survey also suggests that Floyd County is particularly prone to landslide incidents, though there have been no significant events in recent history. In terms of man-made hazards, the location of gas/oil storage facilities in or near the Town of Floyd poses a risk.

6.1.2 Mitigation

Floyd County is seeking to better understand the water issues and related mitigation opportunities. Floyd County is also participating in the regional water supply planning effort. Floyd County will seek help from the Virginia DOF to do more dry hydrants and have more Firewise training and planning to enhance wildfire mitigation. Also training, perhaps from the VDEM, is needed related to potential gas leakage disasters.

From information and training gained during the preparation of the 2005 plan, Floyd added a wildfire mitigation component to their manufactured home park plan. It notes the importance of keeping the parks free of debris which might communicate fire between homes and other structures.

Floyd County is preparing their first full Comprehensive Plan update since that 2005 plan was approved. The current draft has substantial policy language regarding preventing development from over-burdening groundwater supplies, improving groundwater recharge. It also notes the following as not suitable for development: lands in the 100-year floodplain, lands with a degree of wildfire risk, land with steep slopes, and lands with unsuitable soils.

Floyd County participates in the NFIP, regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The Town of Floyd does not participate in the program.

6.1.3 Mitigation Opportunities

Floyd County has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance.

Table 6-1. Floyd County Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Expanding public water and wastewater capacity and service area	Drought	High
Firewise training at more woodland home communities	Wildfire	High
Communication equipment interoperability	All natural and human-caused	High
Water resource study	Drought, Wildfire, Flooding	High
Develop drought contingency plan	Drought, Wildfire	High
Additional water sources and reserves	Drought, Wildfire	High
Table-top exercise for hazardous materials storage in or near Town of Floyd	Human-caused	Medium
Hazard related GIS layers	All natural and human-caused	Medium
Additional dry hydrants	Wildfire	Medium
Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	Flooding	Medium

6.2 Giles County

6.2.1 Hazards and Risks

Giles County's principal natural hazard is recurring flooding in its towns and along Doe Creek and Little Stony. Giles County also has some risks associated with drought and wildfire that can be mitigated. Moreover, there is the predominance of forest land in Giles County and increasing residential development nearby. Also, Giles County was the epicenter of the 1897 earthquake, the 3rd largest in eastern United States history. Giles County is also prone to sinkholes and landslides.

6.2.2 Mitigation

Giles County as well as the Towns of Narrows, Pearisburg, Pembroke and Rich Creek participate in the NFIP, regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The County also benefits from the IFLOWs of rain and stream gauges operated by the NWS. Giles County has also worked with the Natural Resources Conservation Service to improve streambeds and streambanks in critical areas. Also County, Town and VDOT officials have stepped up drainage maintenance, before and after major weather events. The County's volunteer emergency personnel are also participating in the formation of a regional swift water rescue team.

In terms of drought, Giles County is participating in the regional water supply planning effort, to help ensure reliability and maximum cost-effectiveness. Concerning wildfire mitigation, Giles County collaborates with the Virginia DOF and the national forest service to do firefighter training and outreach. Giles County received a "Storm Ready" designation from the NWS on May 13, 2009. The County was the 6th locality out of 52 eligible to receive the designation.

Giles County participates in the "Code RED" emergency notification network to communicate potentially hazardous situations to citizens by telephone (both cellular and land-line numbers).

This system has been used by the sheriff's office to notify residents of rising water and road closures due to flooding.

6.2.3 Mitigation Opportunities

Giles County and the towns have identified several mitigation opportunities. Cost-effective projects are listed in the tables below. These projects would only be possible with federal and/or state funding assistance.

Table 6-2. Giles County Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Identify culvert replacement needs	Flooding	High
Replace culverts to reduce flooding	Flooding	High
Full-time forester for Giles County	Wildfire	High
Emergency Services Coordinator position	All natural and human-caused	Medium
Pursue additional water sources	Drought, Wildfire	Medium
Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	Flooding	Medium

Table 6-3. Town of Narrows Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Debris containment	Flooding	High
Stormwater facilities	Flooding	High
Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	Flooding	Medium

Table 6-4. Town of Pearisburg Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Upgrade stormwater system	Flooding	High
Business 460 stormwater mitigation	Flooding	High
Monitor and update the Town's zoning ordinance as needed to reflect any change in NFIP standards	Flooding	Medium

Table 6-5. Town of Pembroke Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Engineering study of structural needs	Flooding	High
Early warning system	Flooding	High
Monitor and update applicable ordinances as needed to reflect	Flooding	Medium

any change in NFIP standards		

Table 6-6. Town of Rich Creek Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Replacement of wastewater treatment plant	Flooding	High
Stormwater drain replacement	Flooding	Medium
Adoption and enforcement of floodplain management requirements, including regulating all and substantially improved construction in the Special Flood Hazard Area	Flooding	Medium
Floodplain identification and mapping, including any local requests for map updates, if needed	Flooding	Medium

6.3 Montgomery County

6.3.1 Hazards and Risks

Montgomery County's principal natural hazard is recurrent flooding in its villages and towns (discussed separately), in the eastern part of the county (Shawsville, Elliston & Lafayette areas) and along Plum Creek. Montgomery County also has some risks associated with drought and wildfire that can be mitigated. Specifically, agricultural interests have proven quite vulnerable to drought. Similarly, the county is experiencing the push of residential development into sloped, wooded areas, posing significant wildfire risks. Montgomery County is also prone to sinkholes and landslides and has slight earthquake risks.

6.3.2 Mitigation

Montgomery County participates in the NFIP, regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The County's floodplain regulation is more stringent than what is required by the NFIP. Montgomery county's FIRMs were last updated in September 2009, when FEMA digitized the previous maps and fit the flood information to topography data provided by the County. One new detailed study was conducted along Plum Creek. In addition, flood zone designations have been incorporated into GIS layers for staff use during the permitting process. Montgomery County also utilizes Land Development Office software (LDO) to track flooding hazards during the permitting process.

Montgomery County has worked with the Natural Resources Conservation Service to improve streambeds and streambanks in critical areas. The County also benefits from the IFLOWs of rain and stream gauges operated by the NWS and a reverse 911 system. Also, several of the County's volunteer fire and rescue squads participated in the formation of a regional swift water rescue team. In an effort to ensure citizens receive timely warnings in a major storm event, Montgomery County has worked to receive "Storm Ready" designation from the NWS. Montgomery County was declared a "Storm Ready Community" in November 2010.

In terms of drought, Montgomery County is participating in the regional water supply planning effort, to help ensure reliability and maximum cost-effectiveness. Concerning wildfire mitigation, Montgomery County has mapped the areas of wildfire risk and collaborates with the Virginia DOF and the national forest service to do firefighter training and outreach.

Montgomery County is actively pursuing several mitigation projects currently, including the development of documents to promote underground pipeline safety, and obtaining additional IFLOWs gauges. These are included in the table below. Hazards and corresponding goals have been detailed in the Environmental Resources section of the 2025 comprehensive plan. In addition to floodplain data, the County has utilized its GIS system capabilities by adding additional layers to identify Claytor Lake inundation zones, wildfire risks, karst areas, shrink-swell soils and underground gas pipeline locations.

6.3.3 Mitigation Opportunities

Montgomery County has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance.

Table 6-7. Montgomery County Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Property acquisition in flood-prone areas	Flooding	High
Equalization basin	Flooding	High
Predevelopment database	Flooding, Geologic, Wildfire, Drought	High
Develop and promote pipeline safety	Human-caused	High
Additional IFLOWs gauges	Flooding	Medium
Expand current karst mapping	Geologic	Low
Residential acquisition (landslide) on Elliot Creek	Flooding, Geologic	Low
Acquisition of Plum Creek area businesses	Flooding	Low
Streambed/streambank restoration	Flooding, Drought	Low
Utilize zoning ordinances to further restrict undeveloped floodplains	Flooding	Medium
Encourage standards above NFIP standards when considering floodplain development	Flooding	Medium

6.4 Town of Blacksburg

6.4.1 Hazards and Risks

The Town of Blacksburg's principal natural hazard is recurrent flooding along Stroubles Creek. Blacksburg also has some risks associated with wildfire, drought and earthquakes that can be mitigated.

6.4.2 Mitigation

The Town of Blacksburg participates and is in good standing with the NFIP. The town zoning ordinance consists of the Floodplain Overlay and Creek Valley Overlay districts to regulate uses, activities, and development in flood prone areas defined by FEMA and the Town of Blacksburg. The Town Floodplain Management Program meets and or exceeds the minimum standards set forth by the NFIP and employs Certified Floodplain Managers (CFM) to manage the program. The Floodplain Overlay section of the zoning ordinance was updated to reflect new FEMA maps and regulations in 2009. The Town does utilize both a subdivision and zoning ordinance based on the town comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by the Town Council in 2006. Additionally, the Town of Blacksburg does have an open space plan that guides acquisition and development of open spaces and parks around the town.

Emergency Operation Plans are in place in the Police Department, Fire Department, Rescue Squad, and the Public Works Department. Plans covering various situations are in place in the Engineering Department, Finance Department, and the Technology Department. There is also a draft Emergency Management Plan that the Emergency Preparedness Committee has reviewed.

In the event of a significant emergency the Virginia Department of Emergency Management (VDEM) coordinates assistance through Montgomery County who in turn assists the Town. Depending on the type of emergency the Town Manager may designate the Police Chief, Fire Chief, Rescue Chief, or another Department Director as the lead individual depending on the specifics of the situation.

In the next year the Emergency Preparedness Committee will finalize the Emergency Management Plan and review it with all Town Departments.

6.4.3 Mitigation Opportunities

The Town of Blacksburg has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance.

Table 6-8. Town of Blacksburg Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Series of stormwater detention ponds	Flooding	High
Hazard related GIS layers	All natural and human-caused	High
New rescue station	All natural and human-caused	High
Development of water supply plan which includes a drought ordinance	Drought	High
Implement remote monitoring system for utility operation	All natural and human-caused	Medium
Provision of back-up power for critical infrastructures	All natural and human-caused	Medium
Increase fireflow for Town's High System	All natural and human-caused	Medium
Emergency water interconnection between High System and Low System	All natural and human-caused	Medium
Provision of backup power at critical intersections	All natural and human-caused	Medium
Creation of development guidelines for wildfire prevention	Wildfire	Low
Undergrounding utilities	Wildfire, wind, winter weather	Low

Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	Flooding	Medium

6.5 Town of Christiansburg

6.5.1 Hazards and Risks

The Town of Christiansburg's principal natural hazard is recurring flooding, including in areas which are not shown as flood hazard areas on the FIRMs. Christiansburg also has some risks associated with drought and earthquakes that can be mitigated.

6.5.2 Mitigation

The Town of Christiansburg participates in the NFIP, regulating future floodplain development and offering residents the opportunity to purchase flood insurance. Christiansburg has participated in flood mapping updates for the area. Those maps have been updated and are being used. The Town's emergency personnel participate in a regional swift water rescue team.

As the Town has not updated its Comprehensive Plan since the Hazard Mitigation Plan was adopted in 2005, it has not been directly incorporated into planning mechanisms. However, the town does include regulations beyond FEMA and NFIP minimums in their zoning ordinance and addresses floodplains in its comprehensive plan descriptively under the natural environment chapter and again in the goals, strategies, and objectives of the comprehensive plan.

6.5.3 Mitigation Opportunities

The Town of Christiansburg has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance.

Table 6-9. Town of Christiansburg Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Home acquisition	Flooding	Low
Undergrounding utility lines	Wildfire, wind, winter weather	Low
Monitor and update the Town's zoning ordinance as needed to reflect any change in NFIP standards	Flooding	Medium

6.6 Pulaski County

6.6.1 Hazards and Risks

Pulaski County's principal natural hazard is recurring flooding, largely near the Town of Pulaski (which will be discussed separately) and along streams like Big Reed Island Creek. The county also has some risks associated with drought and wildfire that can be mitigated. Specifically, agricultural interests have proven quite vulnerable to drought. Similarly, large, steep, wooded tracts with limited access, like Camp Powhatan, pose significant wildfire risks. The county is also prone to sinkholes and landslides, and has slight earthquake risks.

6.6.2 Mitigation

Pulaski County participates in the NFIP (NFIP), regulating future floodplain development and offering residents the opportunity to purchase flood insurance. The Town of Dublin does not participate in NFIP. The county also benefits from the IFLOWs, a system of rain and stream gauges operated by the NWS. Pulaski County also continues to work with the Natural Resources Conservation Service to improve streambeds and stream banks in critical areas, such as along Falling Branch and Little Creek.

In terms of drought, Pulaski County continues to participate in the regional water supply planning effort, to help ensure reliability and maximum cost-effectiveness. Pulaski County collaborates with the Virginia Department of Forestry and the national forest service to do firefighter training and outreach to mitigate some wildfire impacts. Additionally, the County is working with VDOF to develop a county-wide community wildfire plan for numerous communities throughout the County.

6.6.3 Mitigation Opportunities

Pulaski County has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance.

Table 6-10. Pulaski County Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Relocate ECC/Sheriff's Office	All natural and human-caused	High
Elevating homes	Flooding	High
Upgraded rescue and utility communication equipment	All natural and human-caused	High
Wildfire Mitigation -- Creating Defensible Space for High Risk Communities	Wildfire	Medium
Dredging of upper Claytor Lake	Flooding	Low
Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	Flooding	Medium

6.7 Town of Pulaski

6.7.1 Hazards and Risks

The Town of Pulaski's principal natural hazard is recurrent flooding in the downtown, along Dora Highway, and in Kersey's Bottom. According to the Army Corps of Engineers, the town has suffered at least eleven 100-year floods and one 500-year flood in the past 90 years or so. At least 200 structures are affected by flooding in the town.

6.7.2 Mitigation

The Town of Pulaski participates in the NFIP (NFIP), regulating future floodplain development and offering residents the opportunity to purchase flood insurance. Moreover, the Town has set up a special committee, composed of private citizens, Town staff and elected officials, which drafted a Flood Mitigation Plan. The Town is also pursuing the Community Rating System to reduce flood insurance premiums in Town. The town also benefits from the IFLOWs of rain and stream gauges operated by the NWS.

In terms of drought, the Town of Pulaski is participating in the regional water supply planning effort, to help ensure reliability and maximum cost-effectiveness.

6.7.3 Mitigation Opportunities

The Town of Pulaski has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance.

Table 6-11. Town of Pulaski Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Channel dredging, straightening	Flooding	High
Replace or rehabilitate railroad bridge (acting as dam)	Flooding	High
Acquisition of other Repetitive Loss properties	Flooding	High
Flood education/ outreach	Flooding	Medium
Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	Flooding	Medium

6.8 City of Radford

6.8.1 Hazards and Risks

The City of Radford's principal natural hazard is flooding along the New River and Connelly's Run. The city also has some vulnerability to drought and wildfire, particularly the abandoned railroad tie-pile in the western portion of the city.

6.8.2 Mitigation

Fortunately, the City owns most of the floodplain along the New River and has turned much of it into public park space. This limits the amount of private property that could be damaged from floods. The City also adheres to the Radford Riverfront Plan, which emphasizes ecological protection, public access and limited commercial development. The City participates in the NFIP and recently updated their floodplain ordinance, FIRMs and GIS data in cooperation with FEMA. This assists in regulating future floodplain development and the GIS provides citizens with the opportunity to visualize the flood hazards so that they can be more informed about purchasing flood insurance or of their risks. The City's emergency personnel are also participating in the formation of a regional swift water rescue team. The GIS department and engineering department have also made improvements to the City's storm drainage basin maps which helps analyze runoff and flash floods.

In terms of drought, the City is participating in the regional water supply planning effort, to help ensure reliability and maximum cost-effectiveness. There are ongoing improvements to the water distribution system to make it as efficient as possible.

Code Red, a reverse E-911 and emergency notification systems, was also implemented to improve the City's response in the event of an emergency.

Negotiations are underway for removal of the railroad tie-pile; removal is expected to begin in 2011.

6.8.3 Mitigation Opportunities

The City has identified several mitigation opportunities. Cost-effective projects are listed in the table below. These projects would only be possible with federal and/or state funding assistance.

Table 6-12. City of Radford Hazard Mitigation Opportunities

Project	Hazard(s) Mitigated	Priority
Tie-pile removal along New River	Flooding, Wildfire	High
Intermediate Water System Improvement Project	Flooding, Drought	High
Improvements to Impervious Surface Maps	Flooding	Medium
Storm Drainage Basin Map Improvements	Flooding	Medium
Little River Dam Improvements	Flooding	Medium
Regional stormwater detention project: Connelly's Run	Flooding	Low
Mutual aid agreements for emergency response	All natural and human-caused hazards	Low
Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	Flooding	Medium

Chapter 7. Plan Maintenance

This section of the 2011 New River Valley Hazard Mitigation Plan has been updated and revised from the 2005 Plan.

7.1 Plan Adoption

It is anticipated that the 2011 revision of the New River Valley Hazard Mitigation Plan will be adopted in early spring 2011. All resolutions for adoption of the plan by participating localities will be included in Appendix 2. The plan was submitted for public comment at two points in the planning process, during the draft phase and prior to adoption by participating localities. The NRVPDC assisted localities in guiding the plan through the adoption process with all necessary public hearings and providing draft language for adoption resolutions.

7.2 Plan Implementation

The New River Valley Hazard Mitigation Plan will be implemented in two primary ways: 1) policy changes that avoid development in hazard areas or that protect buildings from future impacts, and 2) implementation projects that physically change the environment to reduce impacts or educate landowners and residents on how to protect themselves and their property in the case of an event. The goal of implementing the identified strategies is to reduce the loss of life and/or property due to natural hazard events.

Policy changes are an ongoing way to implement the hazard mitigation plan. As local plans are updated, such as comprehensive plans, zoning and subdivision ordinances, or capital improvement plans, strategies for mitigating hazard impacts can be included. Changes to these plans do require some foresight and public involvement but can be a way for localities to make significant progress with little capital investment. The NRVPDC works regularly with its member localities as they update these plans and is willing to provide technical assistance for including hazard mitigation specific strategies and language when requested.

Implementing projects require more work and investment from the locality or lead agency. Many of the identified projects are contingent on finding grant funding and partnering with other agencies and organizations to complete the project. Grant funding is especially critical in the current economic situation. In addition to finding grant funding, localities will be forced to justify any spending outside of normal budgets. Prioritizing projects and being able to illustrate the benefits outweighing the costs of the project will allow localities to justify these projects.

Appendix 4 contains a list of all projects identified by the region and participating localities, since the 2005 plan and the 2011 plan. This project list includes projects and initiatives that have been completed since the original 2005 plan. Projects were prioritized based on the STAPLEE criteria suggested by FEMA and developed by the Steering Committee. A more detailed discussion of this prioritization strategy is discussed in Chapter 5: Mitigation Strategy.

Some localities have not had an opportunity to incorporate the strategies and objectives of the 2005 hazard mitigation plan into their planning processes. Of those who have incorporated findings from the hazard mitigation plan, the following steps were taken:

- The region's localities are participating in the regional water supply planning effort, to help ensure reliability and maximum cost-effectiveness, with respect to drought hazards.
- From information and training gained during the preparation of the 2005 plan, Floyd County added a wildfire mitigation component to their manufactured home park plan.
- Montgomery County incorporated flood zone designations into GIS layers for staff use during the permitting process. Hazards and corresponding goals have been detailed in the Environmental Resources section of the 2025 comprehensive plan. In addition to floodplain data, the County has utilized its GIS system capabilities by adding additional layers to identify Claytor Lake inundation zones, wildfire risks, karst areas, shrink-swell soils and underground gas pipeline locations.
- The Town of Blacksburg's Floodplain Overlay section of the zoning ordinance was updated to reflect new FEMA maps and regulations in 2009. The Town does utilize both a subdivision and zoning ordinance based on the town comprehensive plan to guide growth and development. The most recent comprehensive plan was approved by the Town Council in 2006. Additionally, the Town of Blacksburg does have an open space plan that guides acquisition and development of open spaces and parks around the town. Emergency Operation Plans are in place in the Police Department, Fire Department, Rescue Squad, and the Public Works Department. There is also a draft Emergency Management Plan that the Emergency Preparedness Committee has reviewed. In the next year the Emergency Preparedness Committee will finalize the Emergency Management Plan and review it with all Town Departments.
- Pulaski County is working with VDOF to develop a county-wide community wildfire plan for numerous communities throughout the County.

Other relevant strategies are described as part of their guidance documents and activities in Chapter 6, under their respective "mitigation" headings.

7.3 Plan Maintenance

The NRV Hazard Mitigation Plan will be reviewed annually by the staff of the New River Valley Planning District Commission with local government staffs to ensure that the project list stays up-to-date (and completed projects are noted). If necessary, the plan will be reviewed and revised after significant hazard events impacting the region. Cost-effective projects may be added to the locality project list each year, with that local government's approval. This review and potential update may be conducted electronically or through an annual meeting of the Hazard Mitigation Steering Committee. The method of review will depend on the events of the previous year and the extent of potential revisions to be made. An annual report of the status of mitigation actions will be reviewed and sent to VDEM to reduce the burden of evaluating strategies for the required five-year revision.

In five years, the NRVPDC will work to find funding to update the NRV Hazard Mitigation Plan. Any update of the plan will include a public input session or strategy to engage the community in this planning effort. At the time of the next update, the effectiveness of the mitigation strategies will be evaluated by determining any reduction in vulnerability to a particular hazard. New vulnerabilities will be identified by looking at event history in the past five years, as well as development that may have occurred in hazard areas. During the interceding five years, the NRVPDC will maintain the hazard mitigation website and will update it periodically with grant funding availability and project updates from localities, if available. This will also allow for continued public input throughout the plan implementation phase.

Appendix 1: Meeting Documentation

NEW RIVER VALLEY PLANNING DISTRICT COMMISSION
6580 Valley Center Drive, Suite 124
Radford, Virginia 24141

Phone: (540) 639-9313 Fax: (540) 831-6093 E-Mail: nrvpdc@nrvdc.org Website: www.nrvpdc.org

David W. Rundgren
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Kick-off Meeting
June 30, 2009
10:00 AM

Agenda

1. Welcome	
2. VDEM Comments	Robbie Coates, VDEM
3. 2008 Annual Report (update for the 2005 plan)	NRVPDC
4. Project overview and schedule for the 2010 Revision	
a. Data update	Dr. Bernd Kuennecke, Radford University
b. Goals and strategies	NRVPDC
c. Public Involvement and Communications	NRVPDC
5. Funding	
a. Leveraging funds	
6. Wrap Up	
a. Question and answer	
b. Set next meeting date	

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New River Valley Planning District Commission
Hazard Mitigation Kick-Off Meeting

Sign In Sheet
June 30, 2009
10:00 AM – 11:30 AM

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New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
July 28, 2009
9:00 AM – 10:30 AM

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David W. Rundgren
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee Meeting
August 25, 2009
9:00 AM

Agenda

1. Welcome
2. Data update — Dr. Bernd Kuennecke, Radford University
3. Planning Process, Brainstorming and Discussion of Working Groups Format — NRVPDC, Steering Committee
4. Tasks to complete before next meeting — Steering committee, NRVPDC, RU
5. Questions and answers
6. Wrap Up
   a. Next meeting date – September 29, 2009
   b. Next meeting topics

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
August 25, 2009
9:00 AM – 10:30 AM

NAME	REPRESENTING	PHONE	EMAIL
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Jerry Higgins	Water Authority	540-639-2575	jhiggins@h2o4u.org
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NEW RIVER VALLEY PLANNING DISTRICT COMMISSION

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Radford, Virginia 24141

Phone: (540) 639-9313 **Fax: (540) 831-6093** **E-Mail: nrvpdc@nrvdc.org** **Website: www.nrvpdc.org**

David W. Rundgren
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee Meeting
September 29, 2009
9:00 AM

Agenda

1. Welcome
2. Data update — Dr. Bernd Kuennecke, Radford University
3. Guest Speaker — TBD
4. Next in addressing: working meetings — Steering committee, NRVPDC, RU
    a. Review materials for future meetings (see attached)
    b. Identify additional participants for working group session at working meetings
5. Questions and answers
6. Wrap Up
    a. Next meeting date – October 27, 2009

Regional Hazard Mitigation Plan
2010 Revision
Hazard Working Groups —
Developing Mitigation Objectives, Strategies, and Projects

- Conducted as part of monthly Steering Committee Meeting
- Work to be completed in three steps

1. Working group meeting 1
    a. Review data sets for hazards
    b. Introduction to the hazard and the data's implications for mitigation
    c. Prepare for working group session at next meeting
        i. Review goals established to date
        ii. Identify additional participants for working group session at next meeting
2. Working group meeting 2
    a. Recap data and interpretation
    b. Brainstorm objectives for specified hazard, discuss
    c. Brainstorm strategies for objectives, discuss
    d. Categorize and rank objectives and strategies of each in terms of general feasibility
    e. Identify resources and capabilities available and potential for strategies
3. Steering Committee meeting after working groups are finished
    a. Divide strategies as regional and individual initiatives
    b. Establish general criteria for prioritizing all strategies
    c. Recommend criteria for localities to prioritize local strategies
    d. Prioritize regional initiatives and convene local input for local strategies

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
September 29, 2009
9:00 AM – 10:30 AM

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Brad Wright	DOF		
~~Bobby~~ Stan Crigger	VDEM		
Craig Whitaker	Giles Co.		
Andsey Foy	Radford Ci.		
Barry Helms	C'burg		
Jamie McLean	Montgomery Co.		
Peter Corrigan	NWS		
Terry Delany	C'burg Fire Dept.		

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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee Meeting
October 27, 2009
9:00 AM

Agenda

1. Welcome
2. Data update — Dr. Bernd Kuennecke, Radford University
3. Flooding and FEMA Pre-disaster Projects — Chuck VanAllman, City Engineer- City of Salem
4. Next in addressing: Discussion — Steering committee, NRVPDC, RU
    a. Next month's speaker
    b. December's meeting
5. Questions and answers
6. Wrap Up
    a. Next meeting date – November 24, 2009

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
October 27, 2009
9:00 AM – 10:30 AM

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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee Meeting
November 24, 2009
9:00 AM

Agenda

1. Welcome
2. Final data issues or questions
3. Guest speakers
   a. Weather Hazards in the NRV — Phil Hysell, National Weather Service
   b. Transportation and Geologic Hazards — David Clarke, VDOT
4. Questions and answers
5. Wrap Up
   a. Next meeting date – January 26, 2010

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
November 24, 2009
9:00 AM – 10:30 AM

NAME	REPRESENTING	PHONE	EMAIL
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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Working Group
February 23, 2010

1. Introduction to drought
    a. Review of data
    b. What the data means for hazard mitigation
2. Review goals established to date — NRVPDC
3. Brainstorm objectives for specified hazard, discuss — Working Group
4. Brainstorm strategies for objectives, discuss — Working Group
5. Categorize and rank objectives and strategies of each in terms of general feasibility — Working Group
6. Identify resources and capabilities available and potential for strategies — Working Group
7. Next meeting topics
    a. Landslides, Rockfall, Earthquake
    b. Identify additional participants for next working group
8. Questions and answers
9. Wrap Up
    a. Next meeting date – March 23, 2010

Goals, Objectives, and Strategies Worksheet

Drought Hazard

Goals
Broad, long-range statements to direct the focus of the planning process.

Goal 1: Minimize economic losses and health risks during droughts.

Goal 2: Promote community awareness and knowledge of hazards and programs available to encourage personal safety and property protection.

Goal 3: Capitalize on available mitigation information, services and funding from various local, regional, state, federal, and non-profit agencies for mitigation planning and implementation.

Goal 4: Use regional coordination and cooperation, as needed, to enhance mitigation activities.

Objectives
Realistic targets that answer the Who, What, When, and Why of achieving established goals.

To focus our brainstorming session, we'll be using the "SMART Objectives" framework. Each objective should be able to address each element of the SMART acronym: Specific, Measurable, Achievable, Relevant, and Time-framed.

Consider how we can restate the following objectives from an earlier session to meet the goals listed above:

- To ensure notification of residents of impending hazard events.
- Develop diverse partnerships, government, private, non-profit, etc.
- Develop more information related to hazards and damages.
- Weigh the interactions of all natural hazards before acting to address one.
- Give highest priority to projects which achieve multiple goals.

Strategies and Projects
Specific projects and programs to implement that will achieve the proposed objectives.

We'll also address the available and needed technical and staffing capacity, potential funding sources, and timeframe required for each strategy and project.

New River Valley Planning District Commission
Hazard Mitigation Drought Working Group

Sign In Sheet
February 23, 2010
9:00 AM – 11:00 AM

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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Working Group
March 23, 2010

1. Introduction to landslides, rockfall and earthquakes — Dr. Skip Watts
    a. Review of data
    b. What the data means for hazard mitigation
2. Review goals established to date — NRVPDC
3. Brainstorm strategies for objectives, discuss — Working Group
4. Categorize objectives and strategies — Working Group
5. Identify resources and capabilities available and potential for strategies — Working Group
6. Next meeting topics
    a. Karst
    b. Identify additional participants for next working group
7. Questions and answers
8. Wrap Up
    a. Next meeting date – April 27, 2010

Previous Geologic Goals/Objectives/Strategies

Minimize structural damage due to landslides and sinkholes.

Limit grading and “cuts” that result in steep hills abutting new structures.

Consider utilizing subdivision and erosion and sediment control ordinances to limit creation of high-risk scenarios, including steep slopes and shrink-swell soils.

Consider development of a regional ridgeline protection ordinance or policy.

Educate code enforcement personnel and contractors on engineering requirements for excavations and slopes.

Recognize that earthquakes are possible in the NRV, especially in 30 km radius of Pearisburg.

Recognize that brick or stone structures and structures places on deep soil (such as old floodplains) are most prone to damage.

Consider limiting new development on undeveloped floodplains, especially gas pipelines and other utilities.

Consider reinforcing stand-alone brick or stone walls in critical facilities or anywhere that groups of people gather in the “earthquake circle” in the NRV.

Educate the public regarding the possibility of earthquakes and mitigation techniques.

Capitalize on available mitigation information and funding through various federal, state and non-profit agencies.

Provide good information to citizens regarding hazards, risks and mitigation opportunities.

Distribute free brochures and information to citizens in high-hazard areas.

Community workshops- work with lenders, insurance and real estate agents, and developers, potentially through extension agents.

Keep hazard mitigation plan up-to-date in the event that an event occurs and new funding opportunities are available.

Review of the plan by staff annually; review every three years by committee, or following any major hazard event.

Use regional coordination and cooperation as needed.

Pursue identified regional priorities.

Develop a regional water supply plan.

Pursue development of a regional swift-water rescue team.

Pursue regional telecommunications and emergency communication equipment interoperability, including regional reverse 911 for events affecting more than one locality.

Improving geographic information system capacity, information and modeling abilities.

- Develop data layers for better risk assessment: floodplain, geologic hazards, dam-failure inundation, groundwater and surface water resources.
- Develop complete GIS databases of critical facilities.
- Develop local/regional disaster records database to better track histories.
- Develop local/regional database of started and completed mitigation projects.

Continue to seek forums and avenues for improved understanding, coordination and cooperation on mitigation efforts.

Continue regional planners' forum and local government managers' forum.

Encourage regular meeting of emergency service providers and coordinators.

Weigh the interactions of natural hazards within and across jurisdictional boundaries before acting to address one.

Give highest priority to projects that meet multiple objectives and/or serve multiple communities.

New River Valley Planning District Commission
Hazard Mitigation Geologic Hazards Working Group

Sign In Sheet
March 23, 2010
9:00 AM – 11:30 AM

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New River Valley Disability Services Board

Montgomery County
Giles County
Floyd County
Pulaski County
Radford City

May 12, 2010

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11				
12				
13				

New River Valley Planning District Commission
Hazard Mitigation Severe Weather Hazards Working Group

Sign In Sheet
May 25, 2010
9:00 AM – 11:30 AM

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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Working Group
June 22, 2010

1. Introduction to Karst and Rockfall	NRVPDC
a. Review of rockfall data	Dr. Skip Watts
b. Review of karst data	NRVPDC
2. Review goals established to date	NRVPDC
3. Brainstorm strategies for objectives, discuss	Working Group
4. Categorize objectives and strategies	Working Group
5. Identify resources and capabilities available and potential for strategies	Working Group

6. Next meeting topics
   a. Flooding – June 29, 2010
   b. Wildfire and Human-Caused – July 27, 2010
   c. Identify additional participants for next working groups
7. Questions and answers
8. Wrap Up
   a. Next meeting dates – June 29, 2010 and July 27, 2010

New River Valley Planning District Commission
Hazard Mitigation Geologic Hazards Working Group

Sign In Sheet
June 22, 2010
9:00 AM – 11:30 AM

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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Working Group
June 29, 2010

1. Introduction to Flooding	NRVPDC
a. Review of Flooding data	Dr. Charles Manyara
2. Review goals established to date	NRVPDC
3. Brainstorm strategies for objectives, discuss	Working Group
4. Categorize objectives and strategies	Working Group
5. Identify resources and capabilities available and potential for strategies	Working Group

6. Next meeting topics
   a. Wildfire and Human-Caused – July 27, 2010
   b. Identify additional participants for next working group
7. Questions and answers
8. Wrap Up
   a. Next meeting dates – July 27, 2010

New River Valley Planning District Commission
Hazard Mitigation Flooding Hazard Working Group

Sign In Sheet
June 29, 2010
9:00 AM – 11:30 AM

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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Working Group
July 27, 2010

1. Introduction to Wildfire — NRVPDC
    a. Review of Wildfire data — Brad Wright, VDOF
2. Review goals established to date — NRVPDC
3. Brainstorm strategies for objectives, discuss — Working Group
4. Categorize objectives and strategies — Working Group
5. Human-Caused Hazards — NRVPDC/Working Group
    a. Introduction to Information Available
    b. Brainstorm strategy for addressing Human-Caused Hazards
6. Questions and answers
7. Wrap Up
    a. Next meeting dates – August 31, 2010

New River Valley Planning District Commission
Hazard Mitigation Wildfire & Human-Caused Hazards Working Group

Sign In Sheet
July 27, 2010
9:00 AM – 11:30 AM

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Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee
August 31, 2010

1. Welcome — NRVPDC
2. Review working group tasks — NRVPDC
   a. Goals, objectives, strategies
3. Review draft mapping — NRVPDC
   a. Approve for public input
4. Public Involvement — NRVPDC
   a. Public meeting dates
   b. Goals for meetings
5. Next Steps — NRVPDC
   a. Project Identification – Regionally, Locally
   b. Plan Review – Regionally, Locally
6. Questions and answers
7. Wrap Up
   a. Next meeting date – September 28, 2010

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
August 31, 2010
9:00 AM – ~~11:30~~ 10:00 AM

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Stan Crigger	VDEM	381-4076	stan.crigger@vdem.virginia.gov
Craig Whittaker	Giles Co.	540 921 2527	cwhittaker@gilescounty.org
Jamie MacLean	Mont Co	394-2148	macleanjr@montgo
Phil Hysell	NWS		
Peter Corrigan	NWS		
Phil Gilbertson	NRVPDC		
Christy Straight	NRVPDC		
Regina Elsner	NRVPDC		
Nichole Hair	Christiansburg		

NEW RIVER VALLEY PLANNING DISTRICT COMMISSION
6580 Valley Center Drive, Suite 124
Radford, Virginia 24141

Phone: (540) 639-9313 Fax: (540) 831-6093 E-Mail: nrvpdc@nrvpdc.org Website: www.nrvpdc.org

Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee
September 28, 2010

1. Welcome	NRVPDC
2. Public Involvement	NRVPDC
a. Meeting summaries	
b. Looking forward	
3. Hazard Screening Activity	NRVPDC
4. Project Identification Session	
5. Next Steps	NRVPDC
a. Plan Review – Regionally, Locally	
6. Questions and answers	
7. Wrap Up	
a. Next meeting date – October 26, 2010	

Relative Hazard Ratings

Hazard	Frequency	Intensity	Area Affected	Relative Risk
	1- Unlikely 2- Seldom 3- Occasional 4- Likely 5- Frequent	1- Negligible 2- Moderate 3- Severe 4- Catastrophic	1- Isolated 2- Local Community 3- Several Communities 4- Region-wide	(Intensity + Area) * Frequency
Drought	3	2.5	4	19.5
Geologic				0
Landslide	3	2	1.5	10.5
Rockfall	2	2	1	6
Karst	2	1	1	4
Earthquake	1	3	4	7
Severe Weather				0
Tornado	1	2	1	3
Freezing Temperatures	5	2	4	30
High Winds	4	2.5	3	22
Ice Storms	2	3	4	14
Snowfall	3	2	4	18
Wildfire	4	1.5	1	10
Flooding	4	2.5	3	22
Human-Caused	4	2	2	16

Comments:

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
September 28, 2010
9:00 AM – 11:30 AM

NAME	REPRESENTING	PHONE	EMAIL
Nichole Hair	Christiansburg	382-6120	nhair@christiansburg.org
PHIL HYSELL	NWS BLACKSBURG	552-1613 x 2	PHIL.HYSELL@NOAA.GOV
Pete Corrigan	" "	" 1341	peter.corrigan@noaa.gov
BOBBY CLARK	PULASKI Co.	808-3542	bclark@pulaskicounty.org
Jamie Maclean	Mont Co.	394-2148	macleanjr@montgo
Bernd Kuennecke	Radford Univ		
Karen Drake	Town of Blacksburg	951-4446	kdrake@blacksburg.gov

NEW RIVER VALLEY PLANNING DISTRICT COMMISSION
6580 Valley Center Drive, Suite 124
Radford, Virginia 24141

Phone: (540) 639-9313 Fax: (540) 831-6093 E-Mail: nrvpdc@nrvpdc.org Website: www.nrvpdc.org

Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee
October 26, 2010

1. Welcome NRVPDC
2. Plan Drafting Update
3. Project Ranking Activity
4. Next Steps NRVPDC
    a. Project Development and Ranking – Locally
    b. Plan Review – Regionally, Locally
5. Questions and answers
6. Wrap Up
    a. Next meeting date – November 30, 2010

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
October 26, 2010
9:00 AM – 11:30 AM

NAME	REPRESENTING	PHONE	EMAIL
Robbie Coates	VDEM	804-897-9976	robert.coates@vdem.virginia.gov
Nichole Hair	Christiansburg	3826120	nhair@christiansburg.org
Jamie Maclean	Montgomery Co	394-2148	macleanjr@montgomerycountyVA.gov
David H. Kuenneke	R-U.		

NEW RIVER VALLEY PLANNING DISTRICT COMMISSION
6580 Valley Center Drive, Suite 124
Radford, Virginia 24141

Phone: (540) 639-9313 Fax: (540) 831-6093 E-Mail: nrvpdc@nrvpdc.org Website: www.nrvpdc.org

Kevin R. Byrd, AICP
Executive Director

Regional Hazard Mitigation Plan
2010 Revision
Steering Committee
November 30, 2010

1. Welcome — NRVPDC
2. Plan Drafting Update — NRVPDC
    a. Plan Review — Steering Committee
3. Questions and answers
4. Wrap Up
    a. Next meeting date – December 28, 2010 CANCELLED

New River Valley Planning District Commission
Hazard Mitigation Steering Committee

Sign In Sheet
November 30, 2010
9:00 AM – 11:30 AM

NAME	REPRESENTING	PHONE	EMAIL
Brad Wright	Pulaski County	540-616-6156	brad.wright@dof.virginia.gov
Pete Corrigan	NWS Blacksburg	540-552-1341	peter.corrigan@noaa.gov
Terry Dulaney	CHRISTIANSBURG	540 257 1556	tdulaney@christiansburg.org
Jamie MacLean	Montgomery Co	540 394 2148	macleanjr@montgomerycountyva.gov
CRAIG WHITTAKER	GILES COUNTY	540 921 2527	CWHITTAKER@GILESCOUNTY.ORG
[illegible]	RU		[illegible]@radford.edu
Robbie Coates	VDEM	804-837-5576	robert.coates@vdem.virginia.gov
Karen Drake	Blacksburg	540.951.4446	kdrake@blacksburg.gov
Lydeana Martin	Floyd Co.	540 745-9300	lmartin@floyd[illegible]

Appendix 2: Adoption Resolutions

City of Radford
Resolution of Adoption
of the New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the City of Radford participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, the City of Radford is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, the City of Radford has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by Radford City Council that the City of Radford adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

Dr. Bruce Brown, Mayor

ATTEST:
Melissa A. Skelton, Deputy City Council

Adopted: January 9, 2012

Floyd County Board of Supervisors
P.O. Box 218
Floyd, Virginia
24091

AT A REGULAR MEETING OF THE BOARD OF SUPERVISORS OF FLOYD COUNTY, VIRGINIA, HELD ON TUESDAY, JANUARY 10, 2012 at 8:00 a.m. IN THE FLOYD COUNTY ADMINISTRATIVE BUILDING, THEREOF:

PRESENT: Case C. Clinger, Chairman; Virgel H. Allen, Vice Chairman; J. Fred Gerald, Joe D. Turman, Lauren D. Yoder, Board Members; Daniel J. Campbell, County Administrator; Terri W. Morris, Assistant County Administrator.

The following action was taken:

On a motion of Supervisor Allen, seconded by Supervisor Turman, and carried, it was resolved to adopt the New River Valley Hazard Mitigation Plan as presented.

Daniel J. Campbell

Daniel J. Campbell
County Administrator

540-745-9300 FAX 540-745-9305 www.floydcova.org

AT AN ADJOURNED MEETING OF THE BOARD OF SUPERVISORS OF THE COUNTY OF MONTGOMERY, VIRGINIA HELD ON THE 23rd DAY OF, 2012 AT 6:00 P.M. IN THE BOARD ROOM, MONTGOMERY COUNTY GOVERNMENT CENTER, 755 ROANOKE STREET, CHRISTIANSBURG, VIRGINIA:

R-FY-12-81
NEW RIVER VALLEY
HAZARD MITIGATION PLAN

On a motion by Mary W. Biggs, seconded by Matthew R. Gabriele and carried unanimously,

WHEREAS, The New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Montgomery County, participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and

WHEREAS, Montgomery County is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, The Plan advances the goals identified in the Montgomery County Comprehensive Plan; and

WHEREAS, Montgomery County has reviewed the Plan and affirms that the Plan will be updated no less than every five years; and

WHEREAS, The Planning Commission endorsed the Plan on December 7, 2011.

NOW, THEREFORE, BE IT RESOLVED, That the Board of Supervisors of the County of Montgomery, Virginia, hereby adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 23rd day of January 2012 at the meeting of the Montgomery County Board of Supervisors.

The vote on the forgoing resolution was as follows:

AYE	NAY
Annette S. Perkins	None
William H. Brown	
Mary W. Biggs	
Christopher A. Tuck	
Matthew R. Gabriele	
Gary D. Creed	
James D. Politis	

ATTEST: F. Craig Meadows

F. Craig Meadows
County Administrator

TOWN OF
Blacksburg
a special place

RESOLUTION 12-C-11

A RESOLUTION ADOPTING THE NEW RIVER VALLEY
HAZARD MITIGATION PLAN, 2011 UPDATE

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update, has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6, and a copy is on file in the Town Clerk's office;

WHEREAS, the Town of Blacksburg participated in the preparation of the Plan;

WHEREAS, the Town of Blacksburg is a local unit of government that has afforded citizens an opportunity to comment and provide input regarding the Plan and the actions in it; and

WHEREAS, the Town Council has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by the Council of the Town of Blacksburg that the Town of Blacksburg hereby adopts the New River Valley Hazard Mitigation Plan, 2011 Update, as the Town's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

Mayor

ATTEST:

Donna Boone-Caldwell
Town Clerk

Date of Adoption: December 13, 2011

TOWN OF CHRISTIANSBURG

Established November 10, 1792 *Incorporated January 7, 1833*

Resolution of the
Town Council of Christiansburg, Virginia

New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the Town of Christiansburg, participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, the Town of Christiansburg is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, the Town of Christiansburg has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by the Christiansburg Town Council that the Town of Christiansburg adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

Upon a call for an aye and nay vote on the foregoing resolution on a motion by Councilman Stipes seconded by Councilman Vanhoozier at a regular meeting of the Council of the Town of Christiansburg, Virginia held January 3, 2012, the members of the Council of the Town of Christiansburg, Virginia present throughout all deliberations on the foregoing and voting or abstaining, stood as indicated opposite their names as follows:

	Aye	Nay	Abstain	Absent
Mayor Richard G. Ballengee*				
D. Michael Barber	X			
Cord Hall	X			
Steve Huppert	X			
Henry Showalter	X			
Bradford J. Stipes	X			
James W. "Jim" Vanhoozier	X			

* Votes only in the event of a tie vote by Council.

A True Copy Test:

Richard G. Ballengee, Mayor

Michele M. Stipes, Clerk of Council

Giles County, Virginia
Giles County Board of Supervisors
315 North Main Street
Pearisburg, VA 241324

Resolution of Adoption Of the New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Giles County participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, Giles County is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, Giles County has reviewed the Plan and affirms that the Plan will be updated no than every five years.

NOW THEREFORE, BE IT RESOLVED by the Giles County Board of Supervisors that Giles County adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 15th day of December, 2011 at the meeting of the Giles County Board of Supervisors.

Eric Gentry, Chair, Giles County Board of Supervisors

Town Of Narrows
P.O. Box 440
Narrows, Virginia 24124
Tel. 540-726-2423
FAX 540-726-7566

Town of Narrows
Narrows Town Council
131 Center Street
P.O. Box 131
Narrows, VA 24124

Resolution of Adoption
of the New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the Town of Narrows, participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, the Town of Narrows is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, the Town of Narrows has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by Narrows Town Council that the Town of Narrows adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 14th day of January, 2012 at the meeting of the Narrows Town Council.

H. Clayton Davis

Mayor, H. Clayton Davis

Linda M. McGlothlin

Clerk, Linda M. McGlothlin

Resolution of Adoption
of the New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, the Town of Pearisburg, participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, the Town of Pearisburg is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, the Town of Pearisburg has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by Pearisburg Town Council that the Town of Pearisburg adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 13th day of December, 2011 at the meeting of the Pearisburg Town Council.

APPROVED:

Robert L. Dickerson

Robert L. Dickerson, Mayor

ATTEST:

Regina H. Harless

Regina H. Harless, Town Clerk

Town of Pembroke
Gateway to the Cascades

Post Office Box 5
Pembroke, VA 24136

Phone: 540-626-7191
Fax: 540-626-5523

Town of Pembroke

Pembroke Town Council

500 Snidow Street, Pembroke, VA 24136

Resolution of Adoption of the New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Town of Pembroke, participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, Town of Pembroke is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, Town of Pembroke has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by Pembroke Town Council that Town of Pembroke adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 5 day of December, 2011, at the meeting of the Pembroke Town Council.

Dana D. Munsey (Mayor)

Resolution of Adoption
of the New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Town of Rich Creek participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, Town of Rich Creek is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, Town of Rich Creek has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by the Rich Creek Town Council that the Town of Rich Creek adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 9th day of January, 2012 at the meeting of the Rich Creek Town Council.

Gary L. Eaton

Gary L. Eaton, Mayor

ATTEST:

Pamela J. Kantsios

Pamela J. Kantsios, Town Clerk

Resolution of Adoption of the New River Valley Hazard Mitigation Plan, 2011 Update

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and,

WHEREAS, Pulaski County, participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, Pulaski County is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, Pulaski County has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by the Board of Supervisors that Pulaski County adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

ADOPTED this 28th day of November, 2011 at the meeting of the Board of Supervisors.

Joseph L. Sheffey

Joseph L. Sheffey, Chairman
Pulaski County Board of Supervisors

RESOLUTION 2011-22

RESOLUTION OF ADOPTION OF THE NEW RIVER VALLEY HAZARD MITIGATION PLAN, 2011 UPDATE

WHEREAS, the New River Valley Hazard Mitigation Plan, 2011 Update has been prepared in accordance with FEMA requirements at 44 C.F.R. 201.6; and

WHEREAS, the Town of Pulaski, participated in the preparation of a multi-jurisdictional plan, New River Valley Hazard Mitigation Plan, 2011 Update; and,

WHEREAS, the Town of Pulaski, is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and

WHEREAS, the Town of Pulaski has reviewed the Plan and affirms that the Plan will be updated no less than every five years.

NOW THEREFORE, BE IT RESOLVED by the Town Council that the Town of Pulaski adopts the New River Valley Hazard Mitigation Plan, 2011 Update as this jurisdiction's Multi-Hazard Mitigation Plan, and resolved to execute the actions in the Plan.

This Resolution is effective upon adoption and is hereby adopted this 6th day of December, 2011 by the duly recorded vote of the Town Council of the Town of Pulaski, Virginia as follows:

Morgan P. Welker	- Aye	Robert A. Bopp	- Aye
H.M. Kidd	- Aye	Joseph K. Goodman	- Aye
David L. Clark	- Aye	Gregory C. East	- Aye

THE TOWN OF PULASKI, VIRGINIA

BY: ______________________
Jeffrey S. Worrell, Mayor

ATTEST:

Patricia Cruise

Patricia Cruise, Clerk of Council

Appendix 3: Public Involvement Documentation

NRV Hazard Mitigation Plan

Regional Hazard Mitigation Plan Mapping Available for Public Comment

Radford, VA – The draft New River Valley Hazard Mitigation Plan is available for public comment. A series of open houses will be held throughout the New River Valley to encourage citizen involvement in the plan.

The New River Valley Planning District Commission (NRVPDC) will hold five open houses where draft maps of the NRV's identified hazards will be on display. Citizens are encouraged to review them, ask questions and add their comments to review process.

The meetings will be held on the following dates and locations. All meetings are 7 to 9pm. A short overview presentation will be made at 7pm and again at 8pm.

- **September 15, Giles County: Town Hall, 112 Tazewell St., Pearisburg**
- **September 16, Montgomery County: Government Center, 755 Roanoke St., Christiansburg**
- **September 20, Pulaski County: New River Community College, Edwards 206, Dublin**
- **September 21, City of Radford: Recreation Center, 200 George St., Radford**
- **September 22, Floyd County: Jessie Peterman Memorial Library, 321 W Main St., Floyd**

The plan addresses natural hazards affecting the region, including flooding, severe weather, and geological hazards such as rockfall. The region includes four counties – Floyd, Giles, Montgomery, and Pulaski – and the City of Radford. A regional plan was first developed in 2005 under the guidance of the Federal Emergency management Agency and the Virginia Department of Emergency Management and as required by federal legislation. The plan is now being updated.

The NRVPDC is partnering with Radford University's Geography Department to prepare a revised plan that will maintain the region's eligibility for FEMA's disaster mitigation program funds. The regional hazard mitigation workgroup is updating the plan by further identifying known hazards, assessing potential risks, and developing mitigation strategies to protect lives and property and to prepare the region for disasters that may strike.

More information about the planning process is available at http://www.nrvpdc.org/HazardMitigation /HazardMitigationPlanning.html or call 540.639.9313.

Back to Calendar

REGIONAL HAZARD MITIGATION PLAN MAPPING AVAILABLE FOR PUBLIC COMMENT

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The meetings will be held on the following dates and locations. All meetings are 7:00 p.m. to 9:00 p.m. A short overview presentation will be made at 7:00 p.m. and again at 8:00 p.m.

* September 15, Giles County: Town Hall, 112 Tazewell Street, Pearisburg

* September 16, Montgomery County: Government Center, 755 Roanoke Street, Christiansburg

* September 20, Pulaski County: New River Community College, Edwards 206, Dublin

* September 21, City of Radford: Recreation Center, 200 George Street, Radford

* September 22, Floyd County: Jessie Peterman Memorial Library, 321 West Main Street, Floyd

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More information about the planning process is available at: http://www.nrvpdc.org/HazardMitigation/HazardMitigationPlanning.html or call 540-639-9313.

The March 2010 newsletter is now available!

Download the August 2009 Newsletter

Download the March 2010 Newsletter

Regional Hazard Mitigation Plan Mapping Available for Public Comment

Radford, VA – The draft New River Valley Hazard Mitigation Plan is available for public comment. A series of open houses will be held throughout the New River Valley to encourage citizen involvement in the plan.

The New River Valley Planning District Commission (NRVPDC) will hold five open houses where draft maps of the NRV's identified hazards will be on display. Citizens are encouraged to review them, ask questions and add their comments to review process.

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More information about the planning process is available at http://www.nrvpdc.org/HazardMitigation/HazardMitigationPlanning.html or call 540.639.9313.

Comments are closed.

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Regional Hazard Mitigation Plan will be holding meetings

The draft New River Valley Hazard Mitigation Plan is available for public comment. A series of open houses will be held throughout the New River Valley to encourage citizen involvement in the plan.

The New River Valley Planning District Commission (NRVPDC) will hold five open houses where draft maps of the NRV's identified hazards will be on display. Citizens are encouraged to review them, ask questions and add their comments to review process.

The Giles County meeting will be held on September 15 at the Pearisburg Town Hall located at 112 Tazewell Street, Pearisburg. The meeting will be from 7 to 9pm. A short overview presentation will be made at 7pm and again at 8pm.

The plan addresses natural hazards affecting the region, including flooding, severe weather, and geological hazards such as rockfall. The region includes four counties – Floyd, Giles, Montgomery, and Pulaski – and the City of Radford. A regional plan was first developed in 2005 under the guidance of the Federal Emergency management Agency and the Virginia Department of Emergency Management and as required by federal legislation. The plan is now being updated.

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More information about the planning process is available at http://www.nrvpdc.org/HazardMitigation/HazardMitigationPlanning.html or call 540.639.9313.

Spotlight

on events in Giles-Monroe counties

10[th] Annual Veterans Memorial Park Poker Run will be held on September 19, 2010 (Sept 26, rain date). Meet at the VFW Post #6000, 206 Hare St., Narrows, VA. There is a fee per hand. Best/Worst Hand prizes awarded. Food provided by VFW Post #6000 Auxiliary. Registration from 11:30a.m. – 1:00p.m. First bike out at 1:00p.m. and last bike out at 1:30. Show your support for our veterans. Call Randall Fletcher at 540-726-3274 for more information.

*****

Fall Festival sale on Saturday, September 18[th] from 8:00a.m. to 1:00p.m. at Ingram Village Methodist Church. Breakfast items, hot dogs, baked goods. Flea market items and crafts. Everyone welcome. Proceeds go toward building fund.

*****

The Giles TRIAD cookout will be held on Tuesday, September 21[st] at 2:00p.m. at the Giles Senior Center. All Giles County senior citizens are invited to attend and bring a side dish. The event is sponsored by partners of TRIAD – Giles Senior Center, Giles RSVP and Gils Sheriff's Office. The Giles Sheriff's Office will be grilling. Come and enjoy the new Senior Outdoor Pavilion. Please call Gail Vaught at the Giles Senior Center to sign up and with any questions 921-3924.

*****

There will be a Lord's Acre Sale meeting on September 20[th]. This is a potluck dinner with dinner at 6;30 and meting at 7:00p.m. Pleasant Hill Methodist Church in Bane. All churches welcome to attend.

Rock Camp Baptist Church, in Rock Camp, West Virginia, will hold revival September 20[th] through September 23[rd] at 7:00p.m. nightly. Guest speaker Will Ramsey. Everyone welcome, Pastor Paul Broyles.

*****

Homecoming – Pathway to Heaven Worship Center on Rt. 100, outside of Pearisburg, will have Homecoming on September 18[th] at 7:00p.m. and September 19[th] at 11:00a.m. with Bishop Broadnax. Following Sunday morning worship we will have a dinner. Please come out and join us. For more information call pastor George Meredith at 922-6022.

*****

The White Gate Ruritan Club will host a country-bluegrass music jamboree on Saturday, September 18 from 7:00 – 10:00p.m. at the White Gate Community Center. No charge for admission with concessions sold by the club. Please join us for an evening of entertainment for the entire family.

financially. Donors offering $100 or more will be identi-

Cougar Trail Road in Dublin.

Courtesy Photo

or in Dublin, became
w's stars, Austin Scar-

County

Jenna Nichols/SWT

anor in Dublin hosted
the Road with Austin
become home base,
d, sewed and relaxed

Hazard Mitigation Plan available for comment

By VALERIE BEELMAN
valerie@southwesttimes.com

The New River Valley Planning District Commission (NRVPDC) has made a draft of the NRV Hazard Mitigation Plan available for public comment. The NRVPDC members include the Counties of Floyd, Giles, Montgomery, and Pulaski; the City of Radford; the Towns of Blacksburg, Christiansburg, Floyd, Narrows, Pearisburg, Pulaski, and Rich Creek; and Radford University and Virginia Tech.

The plan addresses natural hazards impacting the area, including flooding, severe weather, and geological hazards such as rock falls. A regional plan was introduced in 2005 with the assistance of the Federal Emergency Management Agency (FEMA) and the Virginia Department of Emergency Management as required by law. The plan is currently being updated.

NRVPDC has partnered with Radford University's geography department to prepare the revised plan to maintain the region's eligibility for FEMA assistance. The plan is being further updated by identifying known hazards, identifying potential risks, and developing mitigation strategies to protect lives and properties and prepare the region for potential disasters.

Five open houses will be held with draft maps of hazards in the NRV on display. Citizens are encouraged to review the maps and ask questions during the review process.

A meeting will be held on Sept. 15 in Pearisburg, on Sept. 16 in Christiansburg, on Sept. 20 in Dublin, on Sept. 21 in Radford, and Sept. 22 in Floyd. All meetings will run from 7 to 9 p.m., with brief overview presentations at 7 and 8 p.m.

See PLAN, page 2

Melinda Williams/SWT

rogram

**K of the 60th Virginia Infantry discuss the Civil War with members of Dublin
day. Rain prevented a re-inactment from being held.**

The Roanoke Times
Roanoke, Virginia
Affidavit of Publication

New River Current

NEW RIVER VALLEY PLANNING DIST
6580 VALLEY CENTER DR SUITE 124
RADFORD VA 24141

REFERENCE: 80148362
12315916 New River Valley Haz

State of Virginia
City of Roanoke

I, (the undersigned) an authorized representative of the Times-World Corporation, which corporation is publisher of the Roanoke Times, a daily newspaper published in Roanoke, in the State of Virginia, do certify that the annexed notice was published in said newspapers on the following dates:

New River Valley Hazard Mitigation Plan

The New River Valley Planning District Commission will hold open houses for the regional hazard mitigation plan. The plan addresses natural hazards affecting the region. Citizen input is requested. All meetings are from 7 to 9pm.

- September 15, Giles County: Town Hall, 112 Tazewell St., Pearisburg
- September 16, Montgomery County: Government Center, 755 Roanoke St., Christiansburg
- September 20, Pulaski County: New River Community College, Edwards 206, Dublin
- September 21, City of Radford: Recreation Center, 200 George St., Radford
- September 22, Floyd County: Jessie Peterman Memorial Library, 321 W Main St., Floyd

An overview presentation will be made at 7pm and 8pm. Draft maps of the NRV's identified hazards will be on display. Comments are welcome. PDC staff will be available to answer questions.

Information is available at http://www.nrvpdc.org/HazardMitigation/HazardMitigationPlanning.html or call 540.639.9313.

12315916

City/County of Roanoke, Commonwealth/State of Virginia. Sworn and subscribed before me this 17th day of SEPT 2010. Witness my hand and official seal.

Judith F. Bennett Notary Public

JUDITH F. BENNETT
NOTARY PUBLIC
REG. #228622
MY COMMISSION EXPIRES 12-2011
COMMONWEALTH OF VIRGINIA

PUBLISHED ON: 08/29 09/12

TOTAL COST: 174.24
FILED ON: 09/15/10

Authorized
Signature: ________, Billing Services Representative

New River Valley Planning District Commission
2010 Hazard Mitigation Plan Update

Sign In Sheet
September 20, 2010
7:00 – 9:00 PM
Dublin, VA

NAME	LIVE IN…	EMAIL (OPTIONAL)
Kitty Doolittle	Pulaski	

New River Valley Planning District Commission
2010 Hazard Mitigation Plan Update

Sign In Sheet
September 16, 2010
7:00 – 9:00 PM
Christiansburg, VA

interested in Cert

NAME	LIVE IN...	EMAIL (OPTIONAL)
Jeff Ames	Harding Rd	jeffreyames@hotmail.com

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PETS, SUPPLIES

YARD SALES

notices

NOTICES

Legals

NEW RIVER VALLEY HAZARD MITIGATION PLAN

The final draft New River Valley Hazard Mitigation Plan is available for public comment. The New River Valley Planning District Commission will hold two open houses to encourage citizen comment on the plan.

Legals

The open houses will be on February 23 and February 24, from 5 to 7 pm at the New River Valley Competitiveness Center in Fairlawn, VA.

Directions to the center and more information are available at http://www.nrvpdc.org/HazardMitigation/HazardMitigationPlanning.html or call 540.639.9313.

(12539287)

PUBLIC NOTICE

Peppers Ferry Regional Wastewater Treatment Authority located at 7797 Mason Street, Radford, VA, herein provides notice as required by the Code of Federal Regulations, Part 403.8(f)(2)(vii), that Electroplate-Rite Corporation of Dublin, VA was cited for significant noncompliance (SNC) with their pretreatment program permit during calendar year 2010. The SNC finding was based solely on a reporting deficiency. The company has taken the necessary steps to return to program compliance.

(12526586)

SURPLUS EQUIPMENT SALE

Montgomery County Public Schools is holding a yard sale for surplus equipment on Friday, February 25, 2011 from 8AM to 3PM at Elliston Lafayette Elementary School, 5201 Tango Lane, Elliston, VA. Items include school and office supplies and equipment. For more information, please call (540) 382-5113.

(12537106)

Lost & Found

Looking for A Lost Pet? Please check with the local animal shelter.

Special Notices

New River Valley Hazard Mitigation Plan
The final draft New River Valley Hazard Mitigation Plan is available for public comment. The New River Valley Planning District Commission will hold two open houses to encourage citizen comment on the plan. The open houses will be on February 23 and February 24, from 5 to 7 pm at the New River Valley Competitiveness Center in Fairlawn, VA.
Directions to the center and more information are available at http://www.nrvpdc.org/HazardMitigation/HazardMitigationPlanning.html or call 540.639.9313.

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IN BRIEF

BLACKSBURG

First Fridays return to downtown March 4

First Fridays will return to downtown Blacksburg next week.

The town partnered with The Women's Center at Virginia Tech, International Women in Need, Eco Cell and Recycle First for the March 4 event, in which patrons can participate in a wide variety of activities.

Some activities include chair massages, free wine-and-cheese tasting and information booths.

The Faraday Cage Benefit Concert for the NRV Food Pantry will take place that night. Attendees can give a suggested donation of $5 or 3 cans of nonperishable food.

Also next month, International Women in Need will hold an electronic recycling drive on Tech's campus to raise awareness for its Peace Corps support project. The group is accepting items such as GPS units, cell phones and accessories, digital music players and cameras, calculators and hard drives at a variety of locations.

For more information on First Fridays or Downtown Blacksburg Events, contact 951-0454 or events @downtownblacksburg.com.

— Lerone Graham

PULASKI

Draft hazard plans open for review

Two open houses are scheduled for New River Valley residents to review the Regional Draft Hazard Mitigation Plans from the New River Valley Planning District Commission.

The events are scheduled for 5 to 7 p.m. today and Thursday at the New River Valley Competitiveness Center, 6580 Valley Center Drive, Fairlawn.

The plan addresses natural hazards including flooding, severe weather, and geological hazards in Floyd, Giles, Montgomery and Pulaski counties and Radford, according to a news release from the NRVPDC.

The plan is available at www.nrvpdc.org/hazardmitigationplanning.html

For more information, call 639-9313.

—Amy Matzke-Fawcett

3 THINGS

you should do today

1 Be thankful for your health On this date in 1954, the fi mass inoculation of children ag polio with the Salk vaccine beg Pittsburgh.

2 Remember a countercultu Peter Fonda, best known role starring, writing and produ "Easy Rider," turns 71 today.

3 Hear about the Virginia Te Hokie coaching changes. Cavanaugh, who recently mov an administrative position to m room for two new coaches on is scheduled to speak today at Blacksburg Sports Club.

Where: Custom Catering, 902 Patrick Drive, Blacksburg **Cost:** $8
Contact: Sandy Schlaudecker, 951-13 spspas@aol.com

CHECK OUT MORE EVENTS ONLINE For the most-complet events in the New River Valley, visit www.newrivervalley.co "Events Calendar."

Welcome...

Montgomery County Virginia

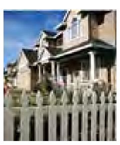
Montgomery County is located in Southwest Virginia in the New River Valley... Read More

SPOTLIGHT
on MONTGOMERY

Winter/Spring Parks & Rec brochure!

Click here to see the Winter/Spring 2011 Parks & Rec brochure!

2011 Real Estate Reassessment



Learn more about the 2011 Real Estate Reassessment.

Click here for more.

Upcoming Meetings

2/22/2011: NRV Emergency Communications Regional Authority Board Meeting

2/28/2011: Board of Supervisors

3/1/2011: Board of Zoning Appeals Meeting

3/3/2011: Parks & Recreation Commission Meeting

3/7/2011: Public Service Authority

MORE

Notices & Announcements

Regional Hazard Mitigation draft plan available for public comment
NRV Health District offers free flu shots
EPA recognizes Montgomery Regional Solid Waste Authority
Montgomery County announces February meetings

ARCHIVES

Upcoming Events

2/22/2011: Storytime at the Blacksburg Library

2/23/2011: Storytime at the Jessie Peterman Library

2/24/2011: Storytime at the Christiansburg Library

2/25/2011: Storytime at the Christiansburg Library

MORE

<< *February 2011* >>

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

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Appendix 4: Mitigation Projects

NRV Hazard Mitigation Projects
Floyd County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Water Resource Study	2005	Drought, Wildfire, Flooding	Identify critical run-off, recharge areas and potential public well and reserves to meet demand; initial implementation; agricultural losses in recent drought = $4,000,000	$1,000,000	4.0	High	USDA, USGS, FEMA, VDEM	County administration	As funding becomes available	In progress (2008)	In Progress (2010) via Regional Water Supply Plan (PDC), Source Water Protection Plan (with Virginia Rural Water.) Related to Wildfire threats during drought, one of the most vulnerable communities in the County (Slatemont) has completed the Firewise program.
2	Communication equipment interoperability with surrounding areas	2005	All natural and human-caused	Improved coordination within and among jurisdictions; increased communication reliability; quicker response times and improved access to total services; multiple lives = $8,000,000	$500,000	16.0	High	FEMA, Homeland Security	County administration	As funding becomes available	On-going	Emergency Services have established interoperability for federal agencies should the need arise; also have interoperability with some adjacent localities and will extend that when funds are available.
3	Develop Drought Contigency Plan	2005	Drought, Wildfire	Given that 95% of the County lacks public water, a drought contingency plan is particulary important. In the recent drought, 500 private wells had to be replaced at an estimate cost of $2,500,000	$50,000	50.0	High	USDA, FEMA, VDEM	County administration	As funding becomes available	In progress (2008)	Some drought planning has occurred via the Regional Water Supply Planning (PDC) and the Source Water Protection Plan;
4	Additional water sources and reserves	2005	Drought, Wildfire	Given that 95% of the County lacks public water, a drought contingency plan is particularly important. In the recent drought, 500 private wells had to be replaced at an estimate cost of $2,500,000; agricultural losses at $4,000,000 annually; threat of loss of 60 jobs in agri-tourism industry at $600,000 = total = $7,100,000	$2,500,000	2.8	High	CDBG, ARC, Tobacco Comm., USDA, FEMA, VDEM		As funding becomes available	Cancelled	Replaced by project identifying specific need to expand water and wastewater capacity and service area.

NRV Hazard Mitigation Projects
Floyd County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
5	Expanding Public Water and Wastewater Capacity and Service Area	2010	Drought	Being at the top of the watershed and with a recent history of residences having to do 500 replacement wells in 3.5 years of severe drought, we must develop additional water resources and expand the service area of public water and sewer.	$5,000,000		High	USDA, DHCD	Floyd-Floyd County PSA	As funding becomes available; ideally in next 2 to 5 years		Replaces "Additional water sources and reserves"
6	Work with RC&D for Firewise training at more woodland home locations.	2010	Wildfire	Protecting woodland homes and residents from wildfire danger.	$10,000		High	VA Dept of Forestry	VA Department of Forestry	2011-2012		
7	Hazard related GIS layers	2005	All natural and human-caused	More accurate flood maps to enable more effective development regulation; protect homes and lives; ground and surface water resource data; water-resource useage by area; future water need; estimate = $10,000,000	$200,000	50.0	Medium	USGS, FEMA, VDOF, VMME, VDEM	County administration	As funding becomes available	On-going	FEMA provided a flood map update in 2008; it did not provide additional studies, but we do now have the layers electronically. Further, we now have electronic soil layers, mineral layers, and historic mine/claim layers. Also, the PDC and Radford University have developed some important private well-related layers.
8	Additional dry hydrants	2005	Wildfire	Give the lack of a central water system in 95% of the County, additional dry hydrants are needed to supply firefighting efforts. Based on 100 home at high risk * $100,000; estimate = $10,000,000	$50,000	200.0	Medium	VDOF	VDOF	As funding becomes available	4 new hydrants in place (2007)	The addition of new dry hydrants is depend on funding and a private source of funding has ended so no new hydrants have been added recently.
9	Table-top exercise to identify needs related to private gas and oil tanks in/near Town of Floyd.	2010	Human-caused	Minimize damages should a gas leak or fire occur.	$5,000		Medium	VDEM	County and VDEM	2011-2013		

NRV Hazard Mitigation Projects
Floyd County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
10	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County administration	As needed		

NRV Hazard Mitigation Projects
Giles County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Identify culvert replacement needs to reduce flooding	2005	Flooding	Engineering studies to determine appropriate size for problem culvert areas. Reduce future flooding; estimate = $2,000,000+	$200,000	10.0	High	VDOT, USACOE	USACOE, VDOT, County administration	July 2005	Completed, Deferred	Completed inventory by County Staff and VDOT of several problem culverts. Entire drainage study deferred due to lack of funding.
2	Replace culverts to reduce flooding	2005	Flooding	Reduce "damming" effect; reduce future flooding; estimate = $2,000,000+	25 culverts at $30,000 = $750,000	2.7	High	USACOE, VDOT, FEMA, VDEM	VDOT, County administration, USACOE	Ongoing	Still progressing (2010)	Several problem culverts have been upgraded (Bowens Rd, McCall Motors, Kow Kamp, Lucas Street), will proceed as additional funding becomes available.
3	Structure Acquisition	2005	Flooding		$100,000	8.0	High	FEMA, VDEM	County administration, engineering	As funding becomes available	Completed	
4	A full-time state forester for Giles County	2005	Wildfire	Person to coordinate wildfire education, mitigation, and response; estimate (life saved) = $2,000,000	$75,000	26.7	High	VDOF	VDOF, County Administration	As funding becomes available	Deferred	Lack of funding
5	Emergency Services Coordinator Position	2005	All natural and human-caused	Person to align and integrate emergency services; estimate (life saved) = $2,000,000	$60,000	20.0	Medium	FEMA, VDEM, County	County administration	January 2006	Deferred	Lack of funding to establish new position
6	Pursue additional water sources	2005	Drought, Wildfire	Reducing dependence on sole water supply well for public system through planning; improve long-term security; estimate = $6,900,000	$50,000 (PER)	40.0	Medium	USDA, FEMA, VDEM	County administration, Giles County PSA	Ongoing	Ongoing planning (2010)	River withdrawal planning/design underway. Funding application to USDA/Rural Development has been submitted.
7	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County planning	As needed		

NRV Hazard Mitigation Projects
Town of Narrows

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Stormwater facilities	2005	Flooding	Currently stormwater largely flows in open ditches on private property, resulting in frequent flooding; facilities would reduce frequency and impact of flooding to at least 97 structures; estimate value = $970,000 per event; overall estimates = $9,700,000	$2,500,000	3.9	High	CDBG, FEMA, VDEM	Town manager's office	As funding becomes available	In progress (2008)	
2	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plan is currently in the floodway, and is subject to flooding. Estimate value = $2,000,000+	$1,500,000	1.3	High	USDA, FEMA, VDEM	Town manager's office, PSA	As funding becomes available	Cancelled	Lack of funding
3	Debris containment	2010	Flooding	The Town is subject to recurring flooding during periods of heavy precipitation. Much of the flooding is due to debris being carried downstream into Town and blocks normal drainage causing most of the flooding in Town.	unknown		High	VDEM, FEMA	Town staff	As funding becomes available		
4	Replacement for Critical Facilities Buildings in High-Hazard areas	2005	Flooding, Earthquake	The Town municipal building is located in the floodplain and is prone to frequent damage; the neighboring firehouse is also near a stream, plus it's a block/brick structure prone to Quake damage; either could be rendered totally ineffective by hazard events; estimate value = $2,000,000+	1000000	2	Medium	USDA, FEMA, VDEM	Town manager's office, local squad	As funding becomes available	Cancelled	Lack of funding
5	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town manager's office	As needed		

NRV Hazard Mitigation Projects
Town of Pearisburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plan is currently in the floodway, and is subject to flooding. Estimate value = $2,000,000+	$1,500,000	1.3	High	USDA, FEMA, VDEM	Town management, PSA	As funding becomes available	Cancelled	No longer needed; plant was upgraded and has 20 years useful life
2	Upgrade Stormwater System	2005	Flooding	Improvements needed in 3 watersheds: Grand Avenue, Midtown, and Orchard Avenue to fix drainage system impacting 60+ structures. Estimate value = $3,000,000	$1,500,000	2.0	High	USDA, FEMA, VDEM	Town management	As funding becomes available	Deferred	Lack of funding
3	Business 460 stormwater mitigation	2008	Flooding	Study to mitigate stormwater flooding on Business 460 on west side of town	$50,000		High		Town management	As funding becomes available	Deferred	Lack of funding
4	Monitor and update the Town’s zoning ordinance as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town management	As needed		

NRV Hazard Mitigation Projects
Town of Pembroke

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Engineering study of structural needs	2005	Flooding	Corps of Engineers Study to assess structural remedies to flooding; most recent damage exceeded $400,000; overall estimate = $4,000,000	$100,000	40.0	High	USACOE, FEMA, VDEM, VDOT	USACOE, VDOT, County administration	As funding becomes available	Not started	Lack of manpower
2	Replace culverts/drainage	2005	Flooding	Reduce "damming" effect causing; overall estimate = $4,000,000	10 culverts at $30,000 = $300,000	13.3	High	USACOE, FEMA, VDEM, VDOT	VDOT, County administration, USACOE	As funding becomes available	Completed	
3	Early warning system	2005	Flooding	Automated communication system for emergency notification; life save, estimated = $2,000,000	$50,000	40.0	High	FEMA, VDEM	Town manager's office, County coodinator	As funding becomes available	Not started	Lack of manpower
4	Streambank clearance	2005	Flooding	Clearing debris and maintaining banks to prevent erosion and flooding. Estimated value = $1,000,000	$100,000	10.0	Medium	NRCS	Town manager's office, County administration	As funding becomes available	Completed	
5	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town manager's office	As needed		

NRV Hazard Mitigation Projects
Town of Rich Creek

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plan is currently in the floodway, and is subject to flooding. Estimated value=$10,000,000+	$7,000,000	1.3	High	USDA and Towns of Glen Lyn & Rich Creek	Towns of Glen Lyn and Rich Creek	As funding becomes available	Started	USDA Grant Awarded
2	Storm Water Drain Replacement	2010	Flooding	The storm drains in the downtown area are deteriated and under sized.	$450,000	1.3	Medium	VDOT Tea-21 & Town of Rich Creek	Town of Rich Creek	5 Years as funding is available	Started	Tea-21 Grant Awarded
3	Adoption and enforcement of floodplain management requirements, including regulating all and substantially improved construction in the Special Flood Hazard Area	2010	Flooding		not applicable		Medium		Town of Rich Creek	As needed		
4	Floodplain identification and mapping, including any local requests for map updates, if needed	2010	Flooding		not applicable		Medium		Town of Rich Creek	As needed		

NRV Hazard Mitigation Projects
Montgomery County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Equalization basin	2005	Flooding	Will enable protection of wastewater treatment plan in 100-year events; protecting thousands of public water drinkers downstream; estimate = $100,000/day; $1,000,000+	Desiagn, excavation, tank, & installation = $250,000	4.0	High	FEMA, VDEM, County	PSA	2006	Not started	Lack of funding & manpower
2	Develop swift-water rescue capacity (regional)	2005	Flooding	At least 5 lives have been lost in swift water in the NRV this year; estimate (life saved) = $2,000,000	$100,000	20.0	High	FEMA, VDEM, County	County ESC	2004-2005	Completed	
3	Identification and study of Village floodplains; including GIS	2005	Flooding	Already at least $14,000,000 in development in floodplain; more accurate maps would enable more effective regulation = est. $1,000,000 in future development	$50,000	33.3	High	FEMA, VDEM, County	County Planning	2005-2007	Completed	All new floodplain maps, effective 9.25.2009, have been mapped in GIS. A new study done in Plum Creek during 2009.
4	Flood map modernization	2005	Flooding	More accurate flood maps to enable more effective development regulation; protect homes and lives; estimate (10 homes @$150,000) = $1,500,000	$150,000	10.0	High	FEMA	VT, County Planning	2005-2008	Completed	Completed with the adoption of a revised floodplain ordiance and revised maps in September 2009.
5	Property acquisition in floodprone area	2005	Flooding	Residential property acquisition in high risk areas of Roanoke River watershed, whereever there is citizen willingness	$1,000,000		High	FEMA, VDEM, County	County ESC, Planning	2005-2010	Not started	Lack of funding & manpower
6	Reverse 911 as emergency warning tool	2005	All natural and human-caused	Will enable automated calling of 900 households per hour vs the current slow, dangerou, door-to-door notification by Sheriff's Dept; estimate = $2,000,000+	$51,000	39.92	High	FEMA, VDEM, County	County ESC, Sheriff	HMGP grant approved 2004; Implementation in 2005	Completed	
7	Pre-development database	2005	Flooding, Geologic, Wildfire, Drought	Full integration of zoning, permitting, building, 911, & real property info	$100,000		High	VDCR, FEMA, VDEM, VMME, VT	County ESC & Planning	Implementation 2005	Partially Completed	Shrink swell soils and flood zone designation are reviewed during the process of obtaining a zoning and building permit. Wildfire risk is not assessed at this time.
8	Develop and promote pipeline safety	2010	Human-caused	We have one underground gas transmission line that runs through Montgomery County and into Pulaski Co. Staff will work with NaCo to create report that is due out very soon called Pipelines and Informed Planning Alliance (PIPA).	$25,000	30	High	NaCo , County	County Planning	2010		
9	Montgomery County Certified as Storm Ready Community	2010	Flood, Snowfall, Ice Storms	To be better prepared to save lives from the onslaught of severe weather through advanced planning, education and awareness.	unknown	10	High	NOAA, NWS, County	ESC/County Planning	2010	Completed	

NRV Hazard Mitigation Projects
Montgomery County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
10	Expand current karst mapping	2005	Geologic	A karst feature inventory to enable, inform better development regulations & ordinance to limit future risks; value of one home lost to sink hole, estimate = $150,000+	$50,000	3	Low	VDCR, FEMA, VDEM, VT	County Planning	2007	Not started	Lack of manpower
11	Streambed/streambank restoration	2005	Flooding, Drought	Recuding peak-flows and increasing recharge	$50,000		Low	USACOE, VDOT, FEMA, VDEM	County Planning	2007-2010	Partially Completed	Montgomery County does not have a program; however they have supported many conservation easmenets wherein landowners participate in VDOT and USDA streambank restoration/mitigation programs.
12	Acquistion of Plum Creek area businesses	2005	Flooding	Reducing repetitive loss structures and threats to life; estimate = $2,000,000	At least 13 structures = $600,000	3.3	Low	FEMA, VDEM	County Planning	2010-2015	Not started	Lack of funding
13	Residential acquisition (landslide) on Elliot Creek	2005	Flooding, Geologic	Reducing repetitive loss structure (flooding and landslide) and threats to life; estimate = $2,000,000	Acquisition & demolition of 2 structures = $153,000	13.1	Low	FEMA, VDEM, County	County Planning	2010-2015	Not started	Lack of funding; HMGP funding denied 2004
14	Shrink-swell soil mapping	2005	Geologic	More accurate shrink-swell soil maps to enable more effective development regulation; protect homes and businesses; past damage unknown; potential home values in high hazard areas estimated to exceed $5,000,000	$50,000		Medium	VDCR, FEMA, VDEM, VT	County Planning	2005	Completed	Shrink swell soils are reviewed at the time a zoning permit is issued and logged into a database.
15	More hazard related GIS data	2005	Flooding, Geologic, Wildfire, Drought	Capturing damage data, more detailed risk data, critical infrastructure data, etc.	$100,000		Medium	VDCR, FEMA, VDEM, VMME, VT	County ESC & Planning	2004-2010	Completed	A elevation certificate database has been created, and locations of pipelines have been mapped.

NRV Hazard Mitigation Projects
Montgomery County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
16	Public education: flooding, wildfire, karst	2005	All natural and human-caused	Educating the public about hazards and threats to life and property and ways to minimize those threats; estimate = $2,000,000	$100,000	20.0	Medium	FEMA, VDEM, County	County ESC	2005-2010	Completed	A series of meetings discussing floodplains were held in 2009 with the adoption of new maps, all property owners with land in the floodplain were notified by mail. FP property owners are also made aware when they come in for zoning permits. There is literature available at the office as well.
17	Additional I-FLOWS gauges	2005	Flooding	Enhance prediction and warning abilities; better protection of lives; estimate + $2,000,000+	$50,000	40.0	Medium	NOAA, NWS	NOAA/NWS, County ESC	2010-2015	Not started	Lack of funding
18	Utilize zoning ordinances to further restrict undeveloped floodplains	2010	Flooding		not applicable		Medium		County planning dept.	As needed		
19	Encourage standards above NFIP standards when considering floodplain development	2010	Flooding		not applicable		Medium		County planning dept.	As needed		

NRV Hazard Mitigation Projects
Town of Blacksburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Series of stormwater detention ponds	2005	Flooding	Create a series of stormwater detention ponds to reduce peak-flow especially during 100-year event; last significant flood caused $4,000,000 in damage at VT	$1,000,000	4.0	High	USACOE, FEMA, VDEM	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	Stormwater Task Force Committee formed to review funding options. Completed work in 2010, but Town Council has made no final decision.
2	Hazard related GIS layers	2005	All natural and human-caused	More accurate flood, groundwater, geologic maps to enable more effective development regulation; protecting lives, natural resources, & homes; estimate $1,000,000 in future development redirected	$100,000	10.0	High	USGS, FEMA, VDOF, VMME, VDEM	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	Floodmap, geology, soils, aerials of forest cover, open streams are complete. Stormwater and subsurface mapping in progress
3	New Rescue Station	2010	All natural and human-caused	Provide emergency shelter for citizens, provide training areas for regional rescue members and enhance response times; $10,000,000	$5,000,000	2	High		Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In progress	
4	Development of water supply plan which includes a drought ordinance	2010	All natural and human-caused	Provides continuous water supply to all homes, business and Virginia Tech. The drought ordinance provides guidance of water saving measures in times of drought; $5,000,000 as water is essential to all residents, businesses and Virginia Tech.	$25,000	200	High		Town of Blacksburg & Town of Christiansburg, Virginia Tech, BCVPIWA	Fall, 2011	In progress	
5	Creation of development guidelines for wildfire prevention	2005	Wildfire	Improving ability and means to prevent future wildfire damage through development guidance; 10 homes saved at $250,000 = $2,500,000	$25,000	100.0	Low	FEMA, VDEM, VDOF	NRVPDC	As funding becomes available	Deferred	No funding available
6	Undergrounding utilities	2005	Wildfire, wind, winter weather	Burying major utility lines to prevent outages and accidents related to natural hazards; estimate = $10,000,000 (safety and business not lost)	$7,500,000	1.3	Low	FEMA, VDEM, CDBG, TEA-21	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	note that existing Town Zoning Ordinance regulations require new utilities to be placed underground.
7	Implement remote monitoring system for utility operation	2005	All natural and human-caused	Allow monitoring of wastewater pump stations operations and water system pressures during power outages; estimate = $500,000	$70,000	7.1	Medium	BCVPIWA, BVPISA	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress (2010)	
8	Provision of back-up power for critical infrastructures	2005	All natural and human-caused	Allow water and wastewater systems to continue operations during major power outages; estimate = $2,000,000 (safety and business not lost)	$200,000	10.0	Medium	FEMA, VDEM	BCVPIWA	As funding becomes available	In Progress (2010)	with generators in place at critical facilities and utilities.

NRV Hazard Mitigation Projects
Town of Blacksburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
9	Increase water storage	2005	All natural and human-caused	Increasing water storage capacity to serve both the Town and VT; estimate = $5,000,000 (security)	$2,000,000	2.5	Medium	FEMA, VDEM, CDBG	PSA	As funding becomes available	Completed	The new tanks that have been constructed are the Highland Park Tanks. There were originally 2 tanks on the site, 1- one million gallon tank and 1- 0.5 million gallon tank. We constructed 3 new tanks; 1- 2.0 million gallon tank, and 2-1.0 million gallon tanks. So we have added an additional 2.5 million gallons worth of storage.
10	Increase fireflow for Town's High System	2010	All natural and human-caused	Increase fireflow available to the Town's High Water system in the Southeast Quadrant; estimate=10 Homes saved at $500,000 each, $5,000,000	$700,000	7.14	Medium		Town of Blacksburg, Engineering & GIS depts	As funding becomes available	Proposed in Town CIP for 2013	
11	Emergency water interconnection between High System and Low System	2010	All natural and human-caused	Serve users on either system in case of interruption on either system; home saved and health and safety, minimum disruption to homes, business and Virginia Tech, $5,000,000	$500,000	10	Medium	Town of Blacksburg, Virginia Tech	Town of Blacksburg, Engineering & GIS depts	As funding becomes available		
12	Provision of back up power at critcal intersections	2010	All natural and human-caused	Through natural gas backup generator at major signalized intersections, traffic will be able to flow as normal without the addition of emergency personnel who may be needed elsewhere. Allows businesses and residents to continue operations at $1,000,000 per event	$220,000	4.55	Medium		Town of Blacksburg, Engineering & GIS depts	As funding becomes available for existing signages, but as other signals are replaced or proposed, all new signals to be constructed with backup systems in case of power outages.	Proposed in Town CIP 2012 to retrofit 4 signals per year, for 5 years	Existing and proposed roundabouts are not signalized and provide for normal traffic flow routinely and in case of power outages.
13	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town of Blacksburg planning dept.	As needed		

NRV Hazard Mitigation Projects
Town of Christiansburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Floodplain GIS layer	2005	Flooding	More accurate flood maps to enable more effective development regulation; protect homes and lives; estimate (5 homes @ $150,000) = $750,000	$50,000	15.0	High	FEMA, VDEM	Town planners & GIS	FY 2007 (pending FEMA coordination)	completed	
2	Study of series of stormwater ponds	2005	Flooding	Reduce flooding on College St.	$100,000		Medium	USACOE, FEMA, VDEM	Town management	As funding becomes available	Cancelled	Lack of support
3	Home acquisition	2005	Flooding	Purchase 8 homes (@ $150,000); no information availabe on exact damage, but recurrent flooding and damage estimage at 15% of value + life saved; estimate = ~$2,000,000	$1,200,000	1.7	Low	FEMA, VDEM	Town management	As funding becomes available	Deferred	Lack of funding
4	Undergrounding utilities	2005	Wildfire, wind, winter weather	Burying utility lines to prevent outages and accidents; estimate = $4,000,000 (accidents & lost revenue)	$2,000,000	2	Low	FEMA, VDEM	Town management	As development occurs	In progress	
5	Monitor and update the Town’s zoning ordinance as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town planning dept.	As needed		

NRV Hazard Mitigation Projects
Pulaski County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Reverse 911/Early warning system	2005	All natural and human-caused	Will enable automated calleing of 900 households per hour vs the current slow, dangerous, door-to-door notification by the Sheriff's Dept.; estimate = $2,000,000+	Includes new system plus upgrading GIS records for integration = $75,000	26.7	High	FEMA, VDEM, USDA	County administration	June 2007	Completed	
2	Updgraded rescue and utility communication equipment	2005	All natural and human-caused	Improved coordination within and among jurisdictions; increased communication reliability' quicker response times & improved access to total services; multiple lives saved; estimate = $5,000,000	Includes broadband and wireless technology for emergency operations & utilities = $2,000,000	2.5	High	FEMA, VDEM, USDA	County administration	June 2005	On going	Mostly completed, finished as funding allows
3	Elevating homes	2005	Flooding	Elevating homes in high-hazard areas; willing participants not yet identified	unknown		High	FEMA, VDEM	Planning	Ongoing	Not started	Lack of participants
4	Upgrading New River Trail	2005	Flooding	Upgrading the New River Trail for use during floods as a means of emergency transportation for residents in Allisonia; estimate = $2,000,000	$500,000	4.0	High	FEMA, VDEM, TEA-21	Planning	May 2008	Completed	
5	Relocate ECC/Sheriff's Office	2008	All natural and human-caused		$2,000,000		High	Local budget	Sheriff/County Admin	Dec 2012 (proposed)	In planning	To be completed by 2012 (goal)
6	Additional I-FLOWS rain and stream gauges	2005	Flooding	Enhance prediction and warning abilities; better protection of lives; estimate = $2,000,000+	$50,000	40.0	Low	NOAA, NWS	NOAA/NWS, Emergency Coordinator	April 2005	Completed	
7	Dredging of upper Claytor Lake	2005	Flooding	Dredging the upper end of Claytor Lake to enable additional storage capacity in flood events; help downstream areas including Radford and Giles County; estimate = $5,000,000	$1,500,000	3.3	Low	USACOE, FEMA, AEP	Planning	January 2010	Planning in progress (2008)	Still planning, pending funding from USACOE
8	Wildfire Mitigation -- Creating Defensible Space for High Risk Communities	2008	Wildfire		$455,000		medium	VDOF	Emergency services Coordinator	Planning started 2010	Not started	Applied for VDEM funding
9	Ready Pulaski!	2008	All natural and human-caused	Education/Survival Kit program	$25,000		medium	NWS	Emergency services Coordinator	As funding becomes available	Deferred	Lack of funding/staffing
10	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County planning dept.	As needed		

NRV Hazard Mitigation Projects
Town of Pulaski

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Integrated Early Warning system or Reverse 911	2005	All natural and human-caused	Automate communication system for emergency notification; live saved = $2,000,000	$50,000	40.0	High	FEMA, VDEM	Town and County emergency coordinator	not applicable	Completed	
2	Channel dredging, straightening	2005	Flooding	Very old channel through Town does not hold major rain events; peak flow could be reduced by more rapid discharge of flood waters; channel contains questionable sediment washed to downstream water supplies in flood; estimate = $6,000,000	2 miles by 40' width by 5' depth = $5,000,000	1.2	High	USACOE, FEMA, VDEM, VDOT, EPA, DEQ	Town management, engineering	As funding becomes available	Deferred	Lack of Funding.
3	Replace or rehabilitate railroad bridge (acting as dam)	2005	Flooding	Reduce elevation of flood waters by opening flow impeded by railroad structure; probably the difference between downtown damage or not in 100-year event; estimate = $10,000,000 at risk	$1,000,000	10.0	High	USACOE, FEMA, VDEM, VDOT, N&S	Town management, engineering	As funding becomes available	Deferred	Lack of Funding.
4	Acquisition of other Repetitive Loss properties	2005	Flooding	Reduce repetitive loss and decrease danger to lives; estimate = $2,000,000+	$250,000	8.0	High	FEMA, VDEM	Town management, engineering	As funding becomes available	Deferred	Lack of Funds to Purchase Repetitive Loss Properties.
5	Flood education/ outreach	2005	Flooding	Educating the public about hazards and threats to life and property and ways to minimize those threats; estimate = $2,000,000+	$50,000	40.0	Medium	FEMA, VDEM	Town and County emergency coordinator	Ongoing	Deferred.	Personnel reductions; lack of funding.
6	Acquisition of other Repetitive Loss properties for Lottier Bottom	2005	Flooding	Reduce repetitive loss in Lottier Bottom area; decrease danger to lives.	unknown			FEMA, VDEM	Town and County emergency coordinator	As funding becomes available	Completed.	Three homes removed from Lottier Bottom area.
7	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town planning dept.	As needed		

NRV Hazard Mitigation Projects
City of Radford

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Detention pond at Sunset Park	2005	Flooding	Reduce periodic flooding	$1,000,000		High	CIP	Engineering Dept	2004-2005	Completed	
2	Swift water rescue equipment & training (regional)	2005	Flooding	At least 5 lives have been lost in swift water in the NRV this year; estimate (life saved) = $2,000,000	$500,000	4.0	High	FEMA, VDEM	Fire Chief	2005-2006	Completed	
3	Tie-pile removal along New River	2005	Flooding, Wildfire	Reduce flooding and wildfire risk of 1,000,000+ old railroad ties, piled along New River; also possible burning toxins putting lives at risk; estimate = $10,000,000	$2,000,000	5.0	High	EPA, DEQ, FEMA, VDEM	City Mangers Office	2008-2009	Deferred, seeking funds for 2011	
4	Code Red	2009	All natural and human-caused	Emergency notification system	unknown		High	General Fund	GIS Dept and City Managers Office	2009	Complete	
5	Flood Insurance Relief Map Update	2009	Flooding	Community planning resource, meet new federal insurance requirements.	unknown		High		Engineering Dept, GIS Dept, FEMA	2009	Complete	
6	Improvements to Dispatch Software and Equipment	2009	All natural and human-caused	Upgraded the GIS software and servers for E911 to improve response times and access to information	$30,000		High	GRANT?	Police Dept, GIS, Dept and ?	2009	Complete	
7	Little River Dam Study	2009	Flooding	Evaluated working components, structural integrity and assessed other general metrics related to the function and safety of the dam	$100,000		High	Electric Dept	Electric Dept	2008-2010	Complete	
8	Intermediate Water System Improvement Project	2009	Flooding, Drought	Public Health	$1.8 M		High	CIP, ARRA	City Engineer, Water Department	2009-2010	In progress	
9	Regional stormwater detention project: Connelly's Run	2005	Flooding	Reducing peak flows from 5.45AC drainage area to reduce flooding in lower reaches	$2,500,000		Low	FEMA, VDEM, USACOE	Engineering Dept	2008-2009	Seeking funds for 2011	Need regional cooperation 177 Corridor plan
10	Inventory of City Trees	2007	Flooding	Evaluate existing city owned tree canopy, determine benefit to neighborhoods, community development, costs to maintain.	none, received Departme of Forest grant to perform study.		Low		City Engineer, Commission on Forestry and Civic Beautification	2008-2010	Completed 2010	
11	New stormwater drainage structures	2008	Flooding		$15,000/year		Medium	General fund	Public Works	Ongoing	Complete (annual project)	
12	Improvements to Impervious Surface Maps	2009	Flooding	improve quality of runoff quality and quanitity.	unknown		Medium	none	City Engineer	2009-2010	In progress	
13	Little River Dam Improvements	2010	Flooding	Maintenance and improvements to the flood gates	$30,000-50,000		Medium	Electric Dept	Electric Department	2011	Planning Stages	
14	Storm Drainage Basin Map Improvements	2009-2010	Flooding	community development, quality of life, sustainability	unknown		Medium	City Engineer, Virginia Department of Forestry	City Engineer	2009-2011	Phase I completed 2010	
15	Gibsondale Sanitary Sewer Project	2006	Flooding		unknown			CIP	City Engineer	not applicable	Completed 2008	
16	Mutual Aid Agreements for Emergency Response	2009	All natural and human-caused	improve respone time for emergencies	unknown		Low			2012-2015		
17	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		City planning dept.	As needed		

NRV Hazard Mitigation Projects
Region-wide

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Updated flood maps	2005	Flooding	More accurate flood maps to enable more effective development regulation; protective homes and lives; estimate (33 homes @ $150,000) = $5,000,000	$50,000 per jurisdiction = $750,000	6.7	High	FEMA	NRVPDC and/or local govt.	3-5 years	Completed by FEMA	
2	Additional hazard, risk, damage and scientific data points	2005	Flooding, Geologic, Wildfire, Dro	Capturing damage data, more detailed risk data, critical infrastructure data, etc.; estimate = $2,000,000+ (guiding development away from risk areas)	$200,000	10.0	High	FEMA, VDEM	NRVPDC and/or local govt.	Ongoing	Ongoing as part of hazard mitigation planning	
3	Regional Swift Water Rescue Team	2005	Flooding	Atleast 5 lives have been lost in swift water in the NRV this year; estimate = $2,000,000	Training and Equipment for 7 fire and rescue squad rep's = $500,000	4.0	High	FEMA, VDEM	Local Fire and Rescue Teams	Ongoing	Completed	
4	Regional Reverse-911	2005	All natural and human-caused	Rapid dispatch to protect many lives; estimate = $10,000,000	17 entities (including VT & RU) @ $75,000 = $1,275,000	7.8	High	FEMA, VDEM	NRVPDC and local govt's.	2-3 years	Completed	
5	Regional Water Supply Planning	2005	Drought, Wildfire	Research, coordination and planning to secure safe and adequate water supplies for drinking water, household, agricultural, commercial and industrial uses; agricultural losses alone in most recent drought exceeded $10,000,000; estimate = $20,000,000 +	$500,000	40.0	High	USDA, FEMA, VDEM	NRVPDC, Local govt's and PSA's	Ongoing	In progress, to be completed 2011	
6	Regional Telecommunication Capacity and Interoperatibility	2005	All natural and human-caused	Improved coordination within and among jurisdictions; increased communication reliability; quicker response times and improved access to total services; estimated 20 lives saved; estimate = $40,000,000	Broad-band and wireless services for local emergency services operations = $10,000,000	4.0	Medium	EDA, ARC, CDBG, FEMA, VDEM	NRVPDC and local govt's.	2-4 years	Ongoing by localities	
7	Regional Damage Assessment Team	2005	All natural and human-caused	Establishing a trained, equipped, and ready-to-respond group to open and speed assessment and access to fed and state help; estimate = $1,000,000	25 (5 per major juris) = $120,000	8.3	Low	VDEM	NRVPDC and/or VDEM.	1 year	Deferred	Funding unavailable
8	Regional Infrastructure and Debris Management Planning Model	2005	All natural and human-caused	Expedite removal of storm debris by identifying high-risk and neighborhood staging areas; with a goal of quick recovery and reduction of unnecessary landfill utilization; estimate (every acre saved) = $1,000,000	$50,000 for each of 5 major jurisdiction $250,000	4.0	Low	FEMA, VDEM	NRVPDC	5 years	Deferred	Funding unavailable
9	Regional inventory of emergency response equipment and personnel	2010	All natural and human-caused		unknown		Medium		Emergency responders	As funding becomes available		
10	Create all hazards educational materials	2010	All natural and human-caused		unknown		High		NRVPDC	As funding becomes available		
11	Provide weather radios to vulnerable populations	2010	All natural and human-caused		unknown		Medium		NWS/Emergency responders	As funding becomes available		
12	Develop a regional strategy for participation in "Turn Around, Don't Drown"	2010	Flooding		unknown		High		NRVPDC	As funding becomes available		
13	Create all hazards educational program & distribute preparedness kits	2010	All natural and human-caused		unknown		Medium		NRVPDC/Emergency Responders	As funding becomes available		
14	Inventory culverts & identify those that need attention	2010	Flooding		unknown		Medium		NRVPDC/Localities	As funding becomes available		
15	Create maps of inaccessible areas for emergency equipment	2010	All natural and human-caused		unknown		Low		NRVPDC/Emergency Responders	As funding becomes available		
16	Rockfall inventory for secondary roads	2010	Rockfall/Geologic		unknown		Low		NRVPDC/Radford University	As funding becomes available		

NRV Hazard Mitigation Projects
Region-wide

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
17	Improve detour signage	2010	All natural and human-caused		unknown		Low		VDOT	As funding becomes available		
18	Identify emergency shelters & coordinate their use and equipment	2010	All natural and human-caused		unknown		Medium		Emergency responders	As funding becomes available		
19	Install notification systems at likely rockfall locations	2010	Rockfall/Geologic		unknown		Low		Localities	As funding becomes available		
20	Inventory potential rockfall areas for mitigation benefits	2010	Rockfall/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
21	Identify rockfall issues on trails and walkways	2010	Rockfall/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
22	Inventory smaller and private bridges	2010	Flooding		unknown		Low		NRVPDC/Localities	As funding becomes available		
23	Coordinate with VDEM to identify companies to provide large, reliable water supplies	2010	Drought		unknown		Medium		NRVPDC/Localities	As funding becomes available		
24	Create karst program to actively map and educate landowners	2010	Karst/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
25	Wildfire prevention and mitigation such as Firewise training at more woodland home communities, creating defensible space, hazardous fuels reduction, and ignition resistant retrofitting	2010	Wildfire		unknown		High		NRVPDC/Localities	As funding becomes available		
26	Acquisition and demolition, acquisition and relocation, retrofitting, elevation, floodproofing, mitigation reconstruction of NFIP defined SRL properties, or other mitigation for properties in flood-prone areas	2010	Flooding		unknown		High		NRVPDC/Localities	As funding becomes available		
27	Minor localized flood control projects to include but not limited to stormwater management improvements	2010	Flooding		unknown		Medium		NRVPDC/Localities	As funding becomes available		
28	Upgrade and implementation of emergency response systems	2010	All		unknown		Medium		NRVPDC/Localities	As funding becomes available		
29	Hazard education and outreach	2010	All		unknown		Medium		NRVPDC/Localities	As funding becomes available		

Appendix 5: Acronyms

American Red Cross	ARCross
average daily traffic	ADT
Certified Floodplain Managers	CFM
Community Emergency Response Team	CERT
cubic feet per second	cfs
digital elevation model	DEM
Digital Flood Insurance Rate Maps	DFIRM
Disability Services Board	DSB
Disaster Mitigation Act 2000	DMA 2000
Emergency Planning and Community Right-to-Know Act	EPCRA
Environmental Protection Agency	EPA
Extremely Hazardous Substances	EHSs
Federal Emergency Management Agency	FEMA
Flood Insurance Rate Maps	FIRMs
Flood Mitigation Assistance	FMA
Hazard Identification and Risk Assessment	HIRA
Hazard Mitigation Assistance	HMA
Hazard Mitigation Grant Program	HMGP
Integrated Stream Flows	IFLOWs
Level I Stability Analysis	LISA
level of service	LOS
Linear feet	LF
Modified Mercalli Intensity Scale	MMI
National Climatic Data Center	NCDC
National Flood Insurance Program	NFIP
National Flood Insurance Program	NFIP
National Oceanic and Atmospheric Administration	NOAA
National Oceanic and Atmospheric Administration	NOAA
National Weather Service	NWS
New River Valley	NRV
New River Valley Planning District Commission	NRVPDC
Northeast Snowfall Impact Scale	NESIS
Pipeline and Hazardous Materials Safety Administration	PHMSA

Pipelines and Informed Planning Alliance	PIPA
Pre-Disaster Mitigation Program	PDM
Quarterly Census of Employment and Wages	QCEW
Repetitive Flood Claims	RFC
Severe Repetitive Loss	SRL
Specific Area Message Encoder	SAME
Threshold Planning Quantity	TPQ
Transportation Research Board	TRB
Underground Storage Tank	UST
US Department of Agriculture	USDA
US Geological Survey	USGS
Virginia Department of Conservation and Recreation	DCR
Virginia Department of Emergency Management	VDEM
Virginia Department of Forestry	DOF
Virginia Department of Transportation	VDOT

NRV Hazard Mitigation Projects
Floyd County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Water Resource Study	2005	Drought, Wildfire, Flooding	Identify critical run-off, recharge areas and potential public well and reserves to meet demand; initial implementation; agricultural losses in recent drought = $4,000,000	$1,000,000	4.0	High	USDA, USGS, FEMA, VDEM	County administration	As funding becomes available	In progress (2008)	In Progress (2010) via Regional Water Supply Plan (PDC), Source Water Protection Plan (with Virginia Rural Water.) Related to Wildfire threats during drought, one of the most vulnerable communities in the County (Slatemont) has completed the Firewise program.
2	Communication equipment interoperability with surrounding areas	2005	All natural and human-caused	Improved coordination within and among jurisdictions; increased communication reliability; quicker response times and improved access to total services; multiple lives = $8,000,000	$500,000	16.0	High	FEMA, Homeland Security	County administration	As funding becomes available	On-going	Emergency Services have established interoperability for federal agencies should the need arise; also have interoperability with some adjacent localities and will extend that when funds are available.
3	Develop Drought Contigency Plan	2005	Drought, Wildfire	Given that 95% of the County lacks public water, a drought contingency plan is particulary important. In the recent drought, 500 private wells had to be replaced at an estimate cost of $2,500,000	$50,000	50.0	High	USDA, FEMA, VDEM	County administration	As funding becomes available	In progress (2008)	Some drought planning has occurred via the Regional Water Supply Planning (PDC) and the Source Water Protection Plan;
4	Additional water sources and reserves	2005	Drought, Wildfire	Given that 95% of the County lacks public water, a drought contingency plan is particularly important. In the recent drought, 500 private wells had to be replaced at an estimate cost of $2,500,000; agricultural losses at $4,000,000 annually; threat of loss of 60 jobs in agri-tourism industry at $600,000 = total = $7,100,000	$2,500,000	2.8	High	CDBG, ARC, Tobacco Comm., USDA, FEMA, VDEM		As funding becomes available	Cancelled	Replaced by project identifying specific need to expand water and wastewater capacity and service area.

NRV Hazard Mitigation Projects
Floyd County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
5	Expanding Public Water and Wastewater Capacity and Service Area	2010	Drought	Being at the top of the watershed and with a recent history of residences having to do 500 replacement wells in 3.5 years of severe drought, we must develop additional water resources and expand the service area of public water and sewer.	$5,000,000		High	USDA, DHCD	Floyd-Floyd County PSA	As funding becomes available; ideally in next 2 to 5 years		Replaces "Additional water sources and reserves"
6	Work with RC&D for Firewise training at more woodland home locations.	2010	Wildfire	Protecting woodland homes and residents from wildfire danger.	$10,000		High	VA Dept of Forestry	VA Department of Forestry	2011-2012		
7	Hazard related GIS layers	2005	All natural and human-caused	More accurate flood maps to enable more effective development regulation; protect homes and lives; ground and surface water resource data; water-resource useage by area; future water need; estimate = $10,000,000	$200,000	50.0	Medium	USGS, FEMA, VDOF, VMME, VDEM	County administration	As funding becomes available	On-going	FEMA provided a flood map update in 2008; it did not provide additional studies, but we do now have the layers electronically. Further, we now have electronic soil layers, mineral layers, and historic mine/claim layers. Also, the PDC and Radford University have developed some important private well-related layers.
8	Additional dry hydrants	2005	Wildfire	Give the lack of a central water system in 95% of the County, additional dry hydrants are needed to supply firefighting efforts. Based on 100 home at high risk * $100,000; estimate = $10,000,000	$50,000	200.0	Medium	VDOF	VDOF	As funding becomes available	4 new hydrants in place (2007)	The addition of new dry hydrants is depend on funding and a private source of funding has ended so no new hydrants have been added recently.
9	Table-top exercise to identify needs related to private gas and oil tanks in/near Town of Floyd.	2010	Human-caused	Minimize damages should a gas leak or fire occur.	$5,000		Medium	VDEM	County and VDEM	2011-2013		

NRV Hazard Mitigation Projects
Floyd County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
10	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County administration	As needed		

NRV Hazard Mitigation Projects
Giles County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Identify culvert replacement needs to reduce flooding	2005	Flooding	Engineering studies to determine appropriate size for problem culvert areas. Reduce future flooding; estimate = $2,000,000+	$200,000	10.0	High	VDOT, USACOE	USACOE, VDOT, County administration	July 2005	Completed, Deferred	Completed inventory by County Staff and VDOT of several problem culverts. Entire drainage study deferred due to lack of funding.
2	Replace culverts to reduce flooding	2005	Flooding	Reduce "damming" effect; reduce future flooding; estimate = $2,000,000+	25 culverts at $30,000 = $750,000	2.7	High	USACOE, VDOT, FEMA, VDEM	VDOT, County administration, USACOE	Ongoing	Still progressing (2010)	Several problem culverts have been upgraded (Bowens Rd, McCall Motors, Kow Kamp, Lucas Street), will proceed as additional funding becomes available.
3	Structure Acquisition	2005	Flooding		$100,000	8.0	High	FEMA, VDEM	County administration, engineering	As funding becomes available	Completed	
4	A full-time state forester for Giles County	2005	Wildfire	Person to coordinate wildfire education, mitigation, and response; estimate (life saved) = $2,000,000	$75,000	26.7	High	VDOF	VDOF, County Administration	As funding becomes available	Deferred	Lack of funding
5	Emergency Services Coordinator Position	2005	All natural and human-caused	Person to align and integrate emergency services; estimate (life saved) = $2,000,000	$60,000	20.0	Medium	FEMA, VDEM, County	County administration	January 2006	Deferred	Lack of funding to establish new position
6	Pursue additional water sources	2005	Drought, Wildfire	Reducing dependence on sole water supply well for public system through planning; improve long-term security; estimate = $6,900,000	$50,000 (PER)	40.0	Medium	USDA, FEMA, VDEM	County administration, Giles County PSA	Ongoing	Ongoing planning (2010)	River withdrawal planning/design underway. Funding application to USDA/Rural Development has been submitted.
7	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County planning	As needed		

NRV Hazard Mitigation Projects
Town of Narrows

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Stormwater facilities	2005	Flooding	Currently stormwater largely flows in open ditches on private property, resulting in frequent flooding; facilities would reduce frequency and impact of flooding to at least 97 structures; estimate value = $970,000 per event; overall estimates = $9,700,000	$2,500,000	3.9	High	CDBG, FEMA, VDEM	Town manager's office	As funding becomes available	In progress (2008)	
2	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plan is currently in the floodway, and is subject to flooding. Estimate value = $2,000,000+	$1,500,000	1.3	High	USDA, FEMA, VDEM	Town manager's office, PSA	As funding becomes available	Cancelled	Lack of funding
3	Debris containment	2010	Flooding	The Town is subject to recurring flooding during periods of heavy precipitation. Much of the flooding is due to debris being carried downstream into Town and blocks normal drainage causing most of the flooding in Town.	unknown		High	VDEM, FEMA	Town staff	As funding becomes available		
4	Replacement for Critical Facilities Buildings in High-Hazard areas	2005	Flooding, Earthquake	The Town municipal building is located in the floodplain and is prone to frequent damage; the neighboring firehouse is also near a stream, plus it's a block/brick structure prone to Quake damage; either could be rendered totally ineffective by hazard events; estimate value = $2,000,000+	1000000	2	Medium	USDA, FEMA, VDEM	Town manager's office, local squad	As funding becomes available	Cancelled	Lack of funding
5	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town manager's office	As needed		

NRV Hazard Mitigation Projects
Town of Pearisburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plan is currently in the floodway, and is subject to flooding. Estimate value = $2,000,000+	$1,500,000	1.3	High	USDA, FEMA, VDEM	Town management, PSA	As funding becomes available	Cancelled	No longer needed; plant was upgraded and has 20 years useful life
2	Upgrade Stormwater System	2005	Flooding	Improvements needed in 3 watersheds: Grand Avenue, Midtown, and Orchard Avenue to fix drainage system impacting 60+ structures. Estimate value = $3,000,000	$1,500,000	2.0	High	USDA, FEMA, VDEM	Town management	As funding becomes available	Deferred	Lack of funding
3	Business 460 stormwater mitigation	2008	Flooding	Study to mitigate stormwater flooding on Business 460 on west side of town	$50,000		High		Town management	As funding becomes available	Deferred	Lack of funding
4	Monitor and update the Town's zoning ordinance as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town management	As needed		

NRV Hazard Mitigation Projects
Town of Pembroke

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Engineering study of structural needs	2005	Flooding	Corps of Engineers Study to assess structural remedies to flooding; most recent damage exceeded $400,000; overall estimate = $4,000,000	$100,000	40.0	High	USACOE, FEMA, VDEM, VDOT	USACOE, VDOT, County administration	As funding becomes available	Not started	Lack of manpower
2	Replace culverts/drainage	2005	Flooding	Reduce "damming" effect causing; overall estimate = $4,000,000	10 culverts at $30,000 = $300,000	13.3	High	USACOE, FEMA, VDEM, VDOT	VDOT, County administration, USACOE	As funding becomes available	Completed	
3	Early warning system	2005	Flooding	Automated communication system for emergency notification; life save, estimated = $2,000,000	$50,000	40.0	High	FEMA, VDEM	Town manager's office, County coodinator	As funding becomes available	Not started	Lack of manpower
4	Streambank clearance	2005	Flooding	Clearing debris and maintaining banks to prevent erosion and flooding. Estimated value = $1,000,000	$100,000	10.0	Medium	NRCS	Town manager's office, County administration	As funding becomes available	Completed	
5	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town manager's office	As needed		

NRV Hazard Mitigation Projects
Town of Rich Creek

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Replacement of Wastewater Treatment Plant	2005	Flooding	The Wastewater Treatment plan is currently in the floodway, and is subject to flooding. Estimated value=$10,000,000+	$7,000,000	1.3	High	USDA and Towns of Glen Lyn & Rich Creek	Towns of Glen Lyn and Rich Creek	As funding becomes available	Started	USDA Grant Awarded
2	Storm Water Drain Replacement	2010	Flooding	The storm drains in the downtown area are deteriated and under sized.	$450,000	1.3	Medium	VDOT Tea-21 & Town of Rich Creek	Town of Rich Creek	5 Years as funding is available	Started	Tea-21 Grant Awarded
3	Adoption and enforcement of floodplain management requirements, including regulating all and substantially improved construction in the Special Flood Hazard Area	2010	Flooding		not applicable		Medium		Town of Rich Creek	As needed		
4	Floodplain identification and mapping, including any local requests for map updates, if needed	2010	Flooding		not applicable		Medium		Town of Rich Creek	As needed		

NRV Hazard Mitigation Projects
Montgomery County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Equalization basin	2005	Flooding	Will enable protection of wastewater treatment plan in 100-year events; protecting thousands of public water drinkers downstream; estimate = $100,000/day; $1,000,000+	Desiagn, excavation, tank, & installation = $250,000	4.0	High	FEMA, VDEM, County	PSA	2006	Not started	Lack of funding & manpower
2	Develop swift-water rescue capacity (regional)	2005	Flooding	At least 5 lives have been lost in swift water in the NRV this year; estimate (life saved) = $2,000,000	$100,000	20.0	High	FEMA, VDEM, County	County ESC	2004-2005	Completed	
3	Identification and study of Village floodplains; including GIS	2005	Flooding	Already at least $14,000,000 in development in floodplain; more accurate maps would enable more effective regulation = est. $1,000,000 in future development	$50,000	33.3	High	FEMA, VDEM, County	County Planning	2005-2007	Completed	All new floodplain maps, effective 9.25.2009, have been mapped in GIS. A new study done in Plum Creek during 2009.
4	Flood map modernization	2005	Flooding	More accurate flood maps to enable more effective development regulation; protect homes and lives; estimate (10 homes @$150,000) = $1,500,000	$150,000	10.0	High	FEMA	VT, County Planning	2005-2008	Completed	Completed with the adoption of a revised floodplain ordiance and revised maps in September 2009.
5	Property acquisition in floodprone area	2005	Flooding	Residential property acquisition in high risk areas of Roanoke River watershed, whereever there is citizen willingness	$1,000,000		High	FEMA, VDEM, County	County ESC, Planning	2005-2010	Not started	Lack of funding & manpower
6	Reverse 911 as emergency warning tool	2005	All natural and human-caused	Will enable automated calling of 900 households per hour vs the current slow, dangerou, door-to-door notification by Sheriff's Dept; estimate = $2,000,000+	$51,000	39.92	High	FEMA, VDEM, County	County ESC, Sheriff	HMGP grant approved 2004; Implementation in 2005	Completed	
7	Pre-development database	2005	Flooding, Geologic, Wildfire, Drought	Full integration of zoning, permitting, building, 911, & real property info	$100,000		High	VDCR, FEMA, VDEM, VMME, VT	County ESC & Planning	Implementation 2005	Partially Completed	Shrink swell soils and flood zone designation are reviewed during the process of obtaining a zoning and building permit. Wildfire risk is not assessed at this time.
8	Develop and promote pipeline safety	2010	Human-caused	We have one underground gas transmission line that runs through Montgomery County and into Pulaski Co. Staff will work with NaCo to create report that is due out very soon called Pipelines and Informed Planning Alliance (PIPA).	$25,000	30	High	NaCo , County	County Planning	2010		
9	Montgomery County Certified as Storm Ready Community	2010	Flood, Snowfall, Ice Storms	To be better prepared to save lives from the onslaught of severe weather through advanced planning, education and awareness.	unknown	10	High	NOAA, NWS, County	ESC/County Planning	2010	Completed	

NRV Hazard Mitigation Projects
Montgomery County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
10	Expand current karst mapping	2005	Geologic	A karst feature inventory to enable, inform better development regulations & ordinance to limit future risks; value of one home lost to sink hole, estimate = $150,000+	$50,000	3	Low	VDCR, FEMA, VDEM, VT	County Planning	2007	Not started	Lack of manpower
11	Streambed/streambank restoration	2005	Flooding, Drought	Recuding peak-flows and increasing recharge	$50,000		Low	USACOE, VDOT, FEMA, VDEM	County Planning	2007-2010	Partially Completed	Montgomery County does not have a program; however they have supported many conservation easmenets wherein landowners participate in VDOT and USDA streambank restoration/mitigation programs.
12	Acquistion of Plum Creek area businesses	2005	Flooding	Reducing repetitive loss structures and threats to life; estimate = $2,000,000	At least 13 structures = $600,000	3.3	Low	FEMA, VDEM	County Planning	2010-2015	Not started	Lack of funding
13	Residential acquisition (landslide) on Elliot Creek	2005	Flooding, Geologic	Reducing repetitive loss structure (flooding and landslide) and threats to life; estimate = $2,000,000	Acquisition & demolition of 2 structures = $153,000	13.1	Low	FEMA, VDEM, County	County Planning	2010-2015	Not started	Lack of funding; HMGP funding denied 2004
14	Shrink-swell soil mapping	2005	Geologic	More accurate shrink-swell soil maps to enable more effective development regulation; protect homes and businesses; past damage unknown; potential home values in high hazard areas estimated to exceed $5,000,000	$50,000		Medium	VDCR, FEMA, VDEM, VT	County Planning	2005	Completed	Shrink swell soils are reviewed at the time a zoning permit is issued and logged into a database.
15	More hazard related GIS data	2005	Flooding, Geologic, Wildfire, Drought	Capturing damage data, more detailed risk data, critical infrastructure data, etc.	$100,000		Medium	VDCR, FEMA, VDEM, VMME, VT	County ESC & Planning	2004-2010	Completed	A elevation certificate database has been created, and locations of pipelines have been mapped.

NRV Hazard Mitigation Projects
Montgomery County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
16	Public education: flooding, wildfire, karst	2005	All natural and human-caused	Educating the public about hazards and threats to life and property and ways to minimize those threats; estimate = $2,000,000	$100,000	20.0	Medium	FEMA, VDEM, County	County ESC	2005-2010	Completed	A series of meetings discussing floodplains were held in 2009 with the adoption of new maps, all property owners with land in the floodplain were notified by mail. FP property owners are also made aware when they come in for zoning permits. There is literature available at the office as well.
17	Additional I-FLOWS gauges	2005	Flooding	Enhance prediction and warning abilities; better protection of lives; estimate + $2,000,000+	$50,000	40.0	Medium	NOAA, NWS	NOAA/NWS, County ESC	2010-2015	Not started	Lack of funding
18	Utilize zoning ordinances to further restrict undeveloped floodplains	2010	Flooding		not applicable		Medium		County planning dept.	As needed		
19	Encourage standards above NFIP standards when considering floodplain development	2010	Flooding		not applicable		Medium		County planning dept.	As needed		

NRV Hazard Mitigation Projects
Town of Blacksburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Series of stormwater detention ponds	2005	Flooding	Create a series of stormwater detention ponds to reduce peak-flow especially during 100-year event; last significant flood caused $4,000,000 in damage at VT	$1,000,000	4.0	High	USACOE, FEMA, VDEM	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	Stormwater Task Force Committee formed to review funding options. Completed work in 2010, but Town Council has made no final decision.
2	Hazard related GIS layers	2005	All natural and human-caused	More accurate flood, groundwater, geologic maps to enable more effective development regulation; protecting lives, natural resources, & homes; estimate $1,000,000 in future development redirected	$100,000	10.0	High	USGS, FEMA, VDOF, VMME, VDEM	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	Floodmap, geology, soils, aerials of forest cover, open streams are complete. Stormwater and subsurface mapping in progress
3	New Rescue Station	2010	All natural and human-caused	Provide emergency shelter for citizens, provide training areas for regional rescue members and enhance response times; $10,000,000	$5,000,000	2	High		Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In progress	
4	Development of water supply plan which includes a drought ordinance	2010	All natural and human-caused	Provides continuous water supply to all homes, business and Virginia Tech. The drought ordinance provides guidance of water saving measures in times of drought; $5,000,000 as water is essential to all residents, businesses and Virginia Tech.	$25,000	200	High		Town of Blacksburg & Town of Christiansburg, Virginia Tech, BCVPIWA	Fall, 2011	In progress	
5	Creation of development guidelines for wildfire prevention	2005	Wildfire	Improving ability and means to prevent future wildfire damage through development guidance; 10 homes saved at $250,000 = $2,500,000	$25,000	100.0	Low	FEMA, VDEM, VDOF	NRVPDC	As funding becomes available	Deferred	No funding available
6	Undergrounding utilities	2005	Wildfire, wind, winter weather	Burying major utility lines to prevent outages and accidents related to natural hazards; estimate = $10,000,000 (safety and business not lost)	$7,500,000	1.3	Low	FEMA, VDEM, CDBG, TEA-21	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress	note that existing Town Zoning Ordinance regulations require new utilities to be placed underground.
7	Implement remote monitoring system for utility operation	2005	All natural and human-caused	Allow monitoring of wastewater pump stations operations and water system pressures during power outages; estimate = $500,000	$70,000	7.1	Medium	BCVPIWA, BVPISA	Town of Blacksburg, Engineering & GIS depts	As funding becomes available	In Progress (2010)	
8	Provision of back-up power for critical infrastructures	2005	All natural and human-caused	Allow water and wastewater systems to continue operations during major power outages; estimate = $2,000,000 (safety and business not lost)	$200,000	10.0	Medium	FEMA, VDEM	BCVPIWA	As funding becomes available	In Progress (2010)	with generators in place at critical facilities and utilities.

NRV Hazard Mitigation Projects
Town of Blacksburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
9	Increase water storage	2005	All natural and human-caused	Increasing water storage capacity to serve both the Town and VT; estimate = $5,000,000 (security)	$2,000,000	2.5	Medium	FEMA, VDEM, CDBG	PSA	As funding becomes available	Completed	The new tanks that have been constructed are the Highland Park Tanks. There were originally 2 tanks on the site, 1- one million gallon tank and 1- 0.5 million gallon tank. We constructed 3 new tanks; 1- 2.0 million gallon tank, and 2-1.0 million gallon tanks. So we have added an additional 2.5 million gallons worth of storage.
10	Increase fireflow for Town's High System	2010	All natural and human-caused	Increase fireflow available to the Town's High Water system in the Southeast Quadrant; estimate=10 Homes saved at $500,000 each, $5,000,000	$700,000	7.14	Medium		Town of Blacksburg, Engineering & GIS depts	As funding becomes available	Proposed in Town CIP for 2013	
11	Emergency water interconnection between High System and Low System	2010	All natural and human-caused	Serve users on either system in case of interruption on either system; home saved and health and safety, minimum disruption to homes, business and Virginia Tech, $5,000,000	$500,000	10	Medium	Town of Blacksburg, Virginia Tech	Town of Blacksburg, Engineering & GIS depts	As funding becomes available		
12	Provision of back up power at critcal intersections	2010	All natural and human-caused	Through natural gas backup generator at major signalized intersections, traffic will be able to flow as normal without the addition of emergency personnel who may be needed elsewhere. Allows businesses and residents to continue operations at $1,000,000 per event	$220,000	4.55	Medium		Town of Blacksburg, Engineering & GIS depts	As funding becomes available for existing signages, but as other signals are replaced or proposed, all new signals to be constructed with backup systems in case of power outages.	Proposed in Town CIP 2012 to retrofit 4 signals per year, for 5 years	Existing and proposed roundabouts are not signalized and provide for normal traffic flow routinely and in case of power outages.
13	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town of Blacksburg planning dept.	As needed		

NRV Hazard Mitigation Projects
Town of Christiansburg

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Floodplain GIS layer	2005	Flooding	More accurate flood maps to enable more effective development regulation; protect homes and lives; estimate (5 homes @ $150,000) = $750,000	$50,000	15.0	High	FEMA, VDEM	Town planners & GIS	FY 2007 (pending FEMA coordination)	completed	
2	Study of series of stormwater ponds	2005	Flooding	Reduce flooding on College St.	$100,000		Medium	USACOE, FEMA, VDEM	Town management	As funding becomes available	Cancelled	Lack of support
3	Home acquisition	2005	Flooding	Purchase 8 homes (@ $150,000); no information availabe on exact damage, but recurrent flooding and damage estimage at 15% of value + life saved; estimate = ~$2,000,000	$1,200,000	1.7	Low	FEMA, VDEM	Town management	As funding becomes available	Deferred	Lack of funding
4	Undergrounding utilities	2005	Wildfire, wind, winter weather	Burying utility lines to prevent outages and accidents; estimate = $4,000,000 (accidents & lost revenue)	$2,000,000	2	Low	FEMA, VDEM	Town management	As development occurs	In progress	
5	Monitor and update the Town's zoning ordinance as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town planning dept.	As needed		

NRV Hazard Mitigation Projects
Pulaski County

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Reverse 911/Early warning system	2005	All natural and human-caused	Will enable automated calleing of 900 households per hour vs the current slow, dangerous, door-to-door notification by the Sheriff's Dept.; estimate = $2,000,000+	Includes new system plus upgrading GIS records for integration = $75,000	26.7	High	FEMA, VDEM, USDA	County administration	June 2007	Completed	
2	Updgraded rescue and utility communication equipment	2005	All natural and human-caused	Improved coordination within and among jurisdictions; increased communication reliability' quicker response times & improved access to total services; multiple lives saved; estimate = $5,000,000	Includes broadband and wireless technology for emergency operations & utilities = $2,000,000	2.5	High	FEMA, VDEM, USDA	County administration	June 2005	On going	Mostly completed, finished as funding allows
3	Elevating homes	2005	Flooding	Elevating homes in high-hazard areas; willing participants not yet identified	unknown		High	FEMA, VDEM	Planning	Ongoing	Not started	Lack of participants
4	Upgrading New River Trail	2005	Flooding	Upgrading the New River Trail for use during floods as a means of emergency transportation for residents in Allisonia; estimate = $2,000,000	$500,000	4.0	High	FEMA, VDEM, TEA-21	Planning	May 2008	Completed	
5	Relocate ECC/Sheriff's Office	2008	All natural and human-caused		$2,000,000		High	Local budget	Sheriff/County Admin	Dec 2012 (proposed)	In planning	To be completed by 2012 (goal)
6	Additional I-FLOWS rain and stream gauges	2005	Flooding	Enhance prediction and warning abilities; better protection of lives; estimate = $2,000,000+	$50,000	40.0	Low	NOAA, NWS	NOAA/NWS, Emergency Coordinator	April 2005	Completed	
7	Dredging of upper Claytor Lake	2005	Flooding	Dredging the upper end of Claytor Lake to enable additional storage capacity in flood events; help downstream areas including Radford and Giles County; estimate = $5,000,000	$1,500,000	3.3	Low	USACOE, FEMA, AEP	Planning	January 2010	Planning in progress (2008)	Still planning, pending funding from USACOE
8	Wildfire Mitigation -- Creating Defensible Space for High Risk Communities	2008	Wildfire		$455,000		medium	VDOF	Emergency services Coordinator	Planning started 2010	Not started	Applied for VDEM funding
9	Ready Pulaski!	2008	All natural and human-caused	Education/Survival Kit program	$25,000		medium	NWS	Emergency services Coordinator	As funding becomes available	Deferred	Lack of funding/staffing
10	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		County planning dept.	As needed		

NRV Hazard Mitigation Projects
Town of Pulaski

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Integrated Early Warning system or Reverse 911	2005	All natural and human-caused	Automate communication system for emergency notification; live saved = $2,000,000	$50,000	40.0	High	FEMA, VDEM	Town and County emergency coordinator	not applicable	Completed	
2	Channel dredging, straightening	2005	Flooding	Very old channel through Town does not hold major rain events; peak flow could be reduced by more rapid discharge of flood waters; channel contains questionable sediment washed to downstream water supplies in flood; estimate = $6,000,000	2 miles by 40' width by 5' depth = $5,000,000	1.2	High	USACOE, FEMA, VDEM, VDOT, EPA, DEQ	Town management, engineering	As funding becomes available	Deferred	Lack of Funding.
3	Replace or rehabilitate railroad bridge (acting as dam)	2005	Flooding	Reduce elevation of flood waters by opening flow impeded by railroad structure; probably the difference between downtown damage or not in 100-year event; estimate = $10,000,000 at risk	$1,000,000	10.0	High	USACOE, FEMA, VDEM, VDOT, N&S	Town management, engineering	As funding becomes available	Deferred	Lack of Funding.
4	Acquisition of other Repetitive Loss properties	2005	Flooding	Reduce repetitive loss and decrease danger to lives; estimate = $2,000,000+	$250,000	8.0	High	FEMA, VDEM	Town management, engineering	As funding becomes available	Deferred	Lack of Funds to Purchase Repetitive Loss Properties.
5	Flood education/ outreach	2005	Flooding	Educating the public about hazards and threats to life and property and ways to minimize those threats; estimate = $2,000,000+	$50,000	40.0	Medium	FEMA, VDEM	Town and County emergency coordinator	Ongoing	Deferred.	Personnel reductions; lack of funding.
6	Acquisition of other Repetitive Loss properties for Lottier Bottom	2005	Flooding	Reduce repetitive loss in Lottier Bottom area; decrease danger to lives.	unknown			FEMA, VDEM	Town and County emergency coordinator	As funding becomes available	Completed.	Three homes removed from Lottier Bottom area.
7	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		Town planning dept.	As needed		

NRV Hazard Mitigation Projects
City of Radford

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Detention pond at Sunset Park	2005	Flooding	Reduce periodic flooding	$1,000,000		High	CIP	Engineering Dept	2004-2005	Completed	
2	Swift water rescue equipment & training (regional)	2005	Flooding	At least 5 lives have been lost in swift water in the NRV this year; estimate (life saved) = $2,000,000	$500,000	4.0	High	FEMA, VDEM	Fire Chief	2005-2006	Completed	
3	Tie-pile removal along New River	2005	Flooding, Wildfire	Reduce flooding and wildfire risk of 1,000,000+ old railroad ties, piled along New River; also possible burning toxins putting lives at risk; estimate = $10,000,000	$2,000,000	5.0	High	EPA, DEQ, FEMA, VDEM	City Mangers Office	2008-2009	Deferred, seeking funds for 2011	
4	Code Red	2009	All natural and human-caused	Emergency notification system	unknown		High	General Fund	GIS Dept and City Managers Office	2009	Complete	
5	Flood Insurance Relief Map Update	2009	Flooding	Community planning resource, meet new federal insurance requirements.	unknown		High		Engineering Dept, GIS Dept, FEMA	2009	Complete	
6	Improvements to Dispatch Software and Equipment	2009	All natural and human-caused	Upgraded the GIS software and servers for E911 to improve response times and access to information	$30,000		High	GRANT?	Police Dept, GIS, Dept and ?	2009	Complete	
7	Little River Dam Study	2009	Flooding	Evaluated working components, structural integrity and assessed other general metrics related to the function and safety of the dam	$100,000		High	Electric Dept	Electric Dept	2008-2010	Complete	
8	Intermediate Water System Improvement Project	2009	Flooding, Drought	Public Health	$1.8 M		High	CIP, ARRA	City Engineer, Water Department	2009-2010	In progress	
9	Regional stormwater detention project: Connelly's Run	2005	Flooding	Reducing peak flows from 5.45AC drainage area to reduce flooding in lower reaches	$2,500,000		Low	FEMA, VDEM, USACOE	Engineering Dept	2008-2009	Seeking funds for 2011	Need regional cooperation 177 Corridor plan
10	Inventory of City Trees	2007	Flooding	Evaluate existing city owned tree canopy, determine benefit to neighborhoods, community development, costs to maintain.	none, received Departme of Forest grant to perform study.		Low		City Engineer, Commission on Forestry and Civic Beautification	2008-2010	Completed 2010	
11	New stormwater drainage structures	2008	Flooding		$15,000/year		Medium	General fund	Public Works	Ongoing	Complete (annual project)	
12	Improvements to Impervious Surface Maps	2009	Flooding	improve quality of runoff quality and quanitity.	unknown		Medium	none	City Engineer	2009-2010	In progress	
13	Little River Dam Improvements	2010	Flooding	Maintenance and improvements to the flood gates	$30,000-50,000		Medium	Electric Dept	Electric Department	2011	Planning Stages	
14	Storm Drainage Basin Map Improvements	2009-2010	Flooding	community development, quality of life, sustainability	unknown		Medium	City Engineer, Virginia Department of Forestry	City Engineer	2009-2011	Phase I completed 2010	
15	Gibsondale Sanitary Sewer Project	2006	Flooding		unknown			CIP	City Engineer	not applicable	Completed 2008	
16	Mutual Aid Agreements for Emergency Response	2009	All natural and human-caused	improve respone time for emergencies	unknown		Low			2012-2015		
17	Monitor and update applicable ordinances as needed to reflect any change in NFIP standards	2010	Flooding		not applicable		Medium		City planning dept.	As needed		

NRV Hazard Mitigation Projects
Region-wide

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
1	Updated flood maps	2005	Flooding	More accurate flood maps to enable more effective development regulation; protective homes and lives; estimate (33 homes @ $150,000) = $5,000,000	$50,000 per jurisdiction = $750,000	6.7	High	FEMA	NRVPDC and/or local govt.	3-5 years	Completed by FEMA	
2	Additional hazard, risk, damage and scientific data points	2005	Flooding, Geologic, Wildfire, Dro	Capturing damage data, more detailed risk data, critical infrastructure data, etc.; estimate = $2,000,000+ (guiding development away from risk areas)	$200,000	10.0	High	FEMA, VDEM	NRVPDC and/or local govt.	Ongoing	Ongoing as part of hazard mitigation planning	
3	Regional Swift Water Rescue Team	2005	Flooding	Atleast 5 lives have been lost in swift water in the NRV this year; estimate = $2,000,000	Training and Equipment for 7 fire and rescue squad rep's = $500,000	4.0	High	FEMA, VDEM	Local Fire and Rescue Teams	Ongoing	Completed	
4	Regional Reverse-911	2005	All natural and human-caused	Rapid dispatch to protect many lives; estimate = $10,000,000	17 entities (including VT & RU) @ $75,000 = $1,275,000	7.8	High	FEMA, VDEM	NRVPDC and local govt's.	2-3 years	Completed	
5	Regional Water Supply Planning	2005	Drought, Wildfire	Research, coordination and planning to secure safe and adequate water supplies for drinking water, household, agricultural, commercial and industrial uses; agricultural losses alone in most recent drought exceeded $10,000,000; estimate = $20,000,000 +	$500,000	40.0	High	USDA, FEMA, VDEM	NRVPDC, Local govt's and PSA's	Ongoing	In progress, to be completed 2011	
6	Regional Telecommunication Capacity and Interoperatibility	2005	All natural and human-caused	Improved coordination within and among jurisdictions; increased communication reliability; quicker response times and improved access to total services; estimated 20 lives saved; estimate = $40,000,000	Broad-band and wireless services for local emergency services operations = $10,000,000	4.0	Medium	EDA, ARC, CDBG, FEMA, VDEM	NRVPDC and local govt's.	2-4 years	Ongoing by localities	
7	Regional Damage Assessment Team	2005	All natural and human-caused	Establishing a trained, equipped, and ready-to-respond group to open and speed assessment and access to fed and state help; estimate = $1,000,000	25 (5 per major juris) = $120,000	8.3	Low	VDEM	NRVPDC and/or VDEM.	1 year	Deferred	Funding unavailable
8	Regional Infrastructure and Debris Management Planning Model	2005	All natural and human-caused	Expedite removal of storm debris by identifying high-risk and neighborhood staging areas; with a goal of quick recovery and reduction of unnecessary landfill utilization; estimate (every acre saved) = $1,000,000	$50,000 for each of 5 major jurisdiction $250,000	4.0	Low	FEMA, VDEM	NRVPDC	5 years	Deferred	Funding unavailable
9	Regional inventory of emergency response equipment and personnel	2010	All natural and human-caused		unknown		Medium		Emergency responders	As funding becomes available		
10	Create all hazards educational materials	2010	All natural and human-caused		unknown		High		NRVPDC	As funding becomes available		
11	Provide weather radios to vulnerable populations	2010	All natural and human-caused		unknown		Medium		NWS/Emergency responders	As funding becomes available		
12	Develop a regional strategy for participation in "Turn Around, Don't Drown"	2010	Flooding		unknown		High		NRVPDC	As funding becomes available		
13	Create all hazards educational program & distribute preparedness kits	2010	All natural and human-caused		unknown		Medium		NRVPDC/Emergency Responders	As funding becomes available		
14	Inventory culverts & identify those that need attention	2010	Flooding		unknown		Medium		NRVPDC/Localities	As funding becomes available		
15	Create maps of inaccessible areas for emergency equipment	2010	All natural and human-caused		unknown		Low		NRVPDC/Emergency Responders	As funding becomes available		
16	Rockfall inventory for secondary roads	2010	Rockfall/Geologic		unknown		Low		NRVPDC/Radford University	As funding becomes available		

NRV Hazard Mitigation Projects
Region-wide

Project #	Project Name	Year Added	Hazards Mitigated; Plan Goal/Objective	Benefit	Cost	Benefit to Cost Ratio	Priority	Funding Partners	Implementation/ Lead Agency	Proposed Timeframe	Project Status	Comments
17	Improve detour signage	2010	All natural and human-caused		unknown		Low		VDOT	As funding becomes available		
18	Identify emergency shelters & coordinate their use and equipment	2010	All natural and human-caused		unknown		Medium		Emergency responders	As funding becomes available		
19	Install notification systems at likely rockfall locations	2010	Rockfall/Geologic		unknown		Low		Localities	As funding becomes available		
20	Inventory potential rockfall areas for mitigation benefits	2010	Rockfall/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
21	Identify rockfall issues on trails and walkways	2010	Rockfall/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
22	Inventory smaller and private bridges	2010	Flooding		unknown		Low		NRVPDC/Localities	As funding becomes available		
23	Coordinate with VDEM to identify companies to provide large, reliable water supplies	2010	Drought		unknown		Medium		NRVPDC/Localities	As funding becomes available		
24	Create karst program to actively map and educate landowners	2010	Karst/Geologic		unknown		Medium		NRVPDC/Localities	As funding becomes available		
25	Wildfire prevention and mitigation such as Firewise training at more woodland home communities, creating defensible space, hazardous fuels reduction, and ignition resistant retrofitting	2010	Wildfire		unknown		High		NRVPDC/Localities	As funding becomes available		
26	Acquisition and demolition, acquisition and relocation, retrofitting, elevation, floodproofing, mitigation reconstruction of NFIP defined SRL properties, or other mitigation for properties in flood-prone areas	2010	Flooding		unknown		High		NRVPDC/Localities	As funding becomes available		
27	Minor localized flood control projects to include but not limited to stormwater management improvements	2010	Flooding		unknown		Medium		NRVPDC/Localities	As funding becomes available		
28	Upgrade and implementation of emergency response systems	2010	All		unknown		Medium		NRVPDC/Localities	As funding becomes available		
29	Hazard education and outreach	2010	All		unknown		Medium		NRVPDC/Localities	As funding becomes available		