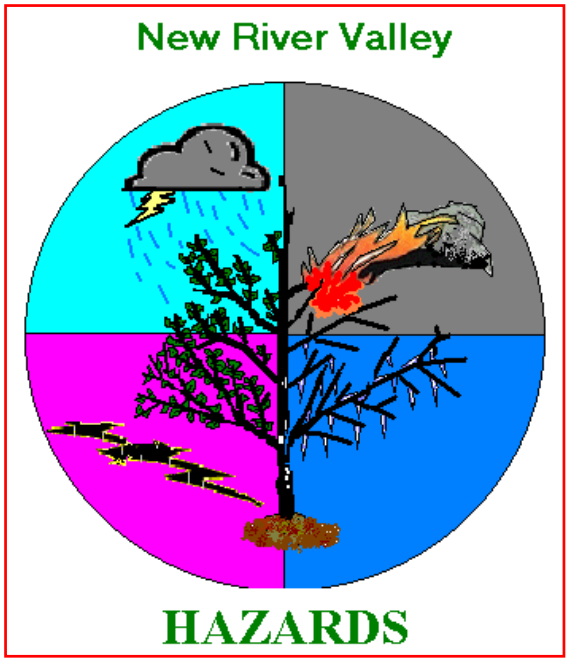


NEW RIVER VALLEY HAZARDS, RISKS AND MITIGATION OPTIONS

Introduction

The New River Valley is susceptible to a wide range of natural hazards. The region's history of hazards and effects is documented below to the full extent available. As is evident in Figure 11, about 25% of disasters are very localized to one jurisdiction; another 10% affect 3 to 5 localities. The majority of disasters affect a much broader area. Consequently, this analysis is done for the region as a whole, though distinctions are made as needed for smaller areas. First, mitigation terminology will be discussed.

FIGURE 11
Number of Localities Affected by Declared Disasters in Virginia

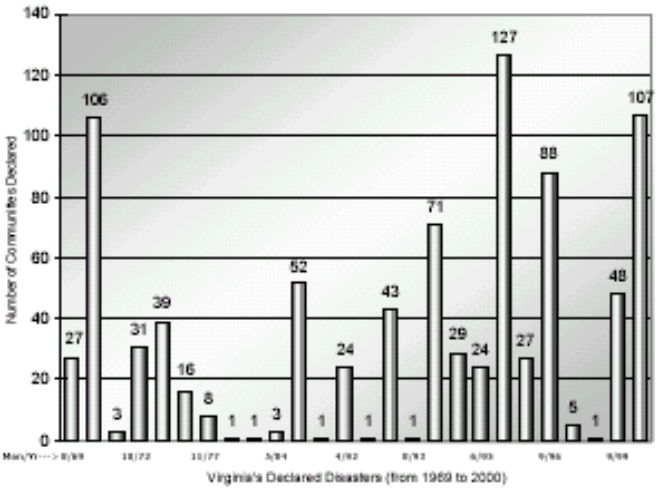


Figure 2-2. Number of Virginia Cities and Counties Declared, by Disaster.

Hazard Identification

Although hazards are classified in various ways, this Plan uses the FEMA classification system (Multi-Hazard Identification and Risk Assessment publication, 1997.) FEMA generally classifies natural hazards based on the conditions that cause the events:

- ✓ **Atmospheric**: including hurricanes, nor'easters, thunderstorms and lightning, windstorms, severe winter storms, and extreme summer heat;
- ✓ **Hydrologic**: including floods, erosion, and drought;
- ✓ **Geologic**: including landslides and earthquakes; and
- ✓ **Other**: including wildfires often triggered by unintentional human activities.

Risk Assessment

Risk assessment seeks to define the probability of events and the likely consequences of events. Currently, risk assessment is based primarily on the historical events of communities, with the assumption that hazards are straight-line occurrences. Unfortunately, in the New River Valley, there is no central repository of past hazard events for individual areas or the region. Consequently, "pieces of the puzzle" have been gathered from a wide range of sources, including personal accounts, files in local planning and engineering departments, newspaper accounts, previous studies and plans, federal and state agencies' documents, and Internet resources. On occasion, pertinent hazard histories of nearby areas are included here.

In addition to basic review of historic events, scientific research, such as seismology, seek to aid our understanding of the risk and vulnerability. High risk factors, both natural and human, which increase vulnerability to natural hazards are presented herein. It is these risk factors which mitigation seeks to reduce. In some instances, such as flooding, geologic hazards and wildfire, risk and vulnerability are closely associated with geographic areas. In other instances, such as drought, wind and winter storms, risk and vulnerability are more closely linked to human activities. Mitigation seeks to minimize losses associated with hazards by identifying and reducing risk factors.

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. Note that this 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.

Adapted from *Planning for Post-Disaster Recovery and Reconstruction*, FEMA and APA, 1998.

Mitigation

Mitigation is, in a word, "prevention." Like "sustainability," the goal of mitigation is learning to live safely and respectfully within the natural eco-system. This Plan reviews past mitigation efforts in the New River Valley. Moreover, it previews the range of possibilities for future mitigation efforts (see the box below). Finally, it recommends mitigation priorities for the New River Valley.

Mitigation Options

Prevention: activities that keep hazard problems from getting worse through planning

- ✓ Comprehensive planning
- ✓ Land-use ordinances and regulations, such as zoning and subdivision
- ✓ Building codes
- ✓ Open space preservation
- ✓ Storm water management
- ✓ Drainage system maintenance
- ✓ Water conservation programs
- ✓ Requirements to bury utility lines (and/or tree maintenance)
- ✓ Road clearing, snow fencing
- ✓ Activity policies (such as strict sports policies regarding lightning)
- ✓ Planning, studies, and systems analysis, such as securing multiple sources for water

Property Protection: activities usually undertaken by property owners on a building-to-building or parcel basis.

- ✓ Relocation
- ✓ Acquisition of private structures
- ✓ Building elevation
- ✓ Retrofitting and flood-proofing
- ✓ Strengthening or adding "flexibility" (as for earthquakes or snow loads)
- ✓ Rain catchment systems (green roofs and rain-barrels)
- ✓ Flame-resistant roof and siding
- ✓ Eliminate fuel ladders to house
- ✓ Insurance

Natural Resource Protection: activities 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.

- ✓ Wetlands protection
- ✓ Erosion and sediment control
- ✓ Best management practices for (development, agricultural, and forestry)

Mitigation Options
continued

Emergency Services: measures taken during a flood to minimize its impact. These measures are the responsibility of localities' emergency management staff and owners/operators of critical facilities.

- ✓ Emergency response planning
- ✓ Regional coordination and collaboration
- ✓ Dam condition monitoring
- ✓ Flood warnings
- ✓ Flood response, evacuation and rescue
- ✓ Critical facilities protection
- ✓ Health and safety maintenance

Structural Projects: mostly associated with efforts to keep floodwaters away from an area. Often designed by engineers and maintained by public works staff.

- ✓ Reservoirs
- ✓ Levees/floodwalls
- ✓ Diversions
- ✓ Channel modifications
- ✓ Storm sewers
- ✓ Burying utility lines (minimize ice disruption; should not do in floodplain!)
- ✓ Interconnect utility to improve redundancy and security

Public Information: activities to advise residents and visitors about hazards, ways to protect themselves and their property, and the natural and beneficial functions of natural systems. They are usually implemented by a public information office.

- ✓ Map information
- ✓ Past hazard event information
- ✓ Outreach projects
- ✓ Real estate disclosure
- ✓ Library
- ✓ Technical assistance
- ✓ Environmental education

Adapted from Association of State Floodplain Managers , September, 2000 and the National Flood Insurance Program, Community Rating System Example Plans, January, 1999, and NRV Hazard Mitigation Meetings, 2002-03.

This analysis uses the following basic outline for each hazard:

- ⇒ Identify Natural **Hazard,** including past events
- ⇒ List existing or past **Mitigation** efforts
- ⇒ Potential future Impacts: What's at high **Risk and Vulnerable** (including trends)
- ⇒ **Mitigation** Options: What else could be done to prevent or minimize destruction during hazard event

Overview of Assessments

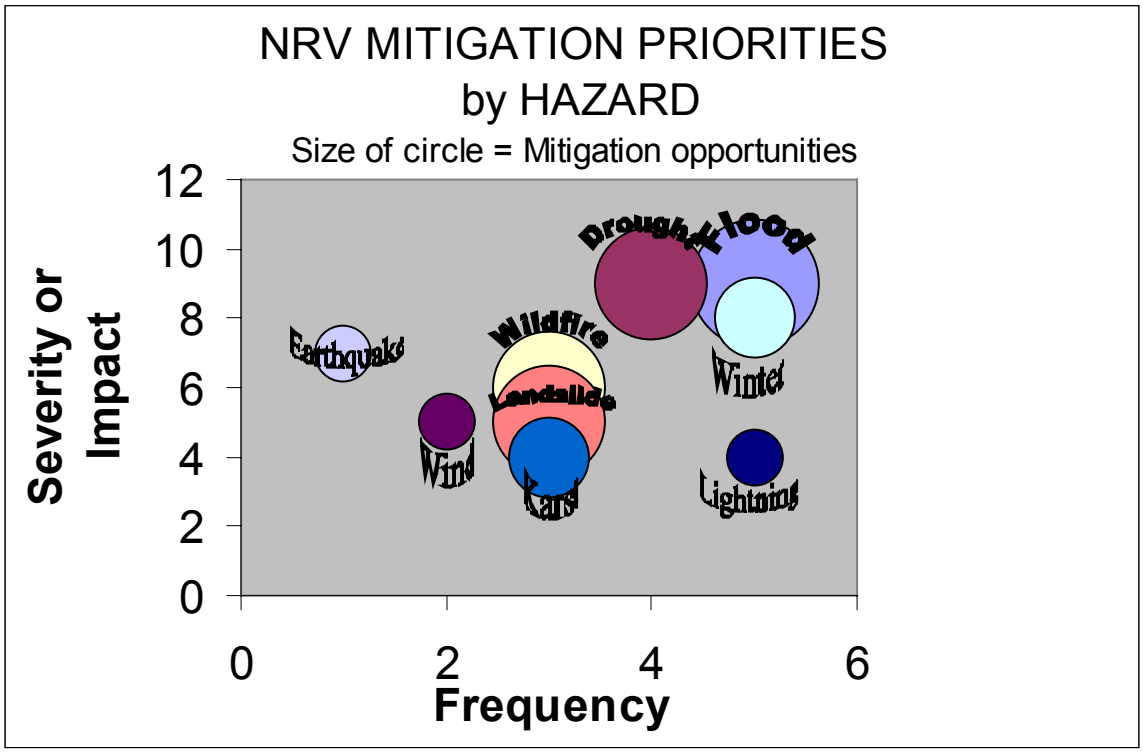
NRVPDC staff prioritized hazards for risk, based on a 125-year history of frequency and impact (Table 10; sources listed under Table 13). The highest risk hazards are flooding, drought, and severe winter storms. For planning purposes, hazards were then ranked based on frequency, impact and on the potential to mitigate in the future. Overall, flooding, drought, wildfire and landslides were deemed the top hazards for mitigation (Figure 12.)

TABLE 10
Priority Hazards in the NRV

	Additional Mitigation Opportunities	
	Limited	Many
High Risks	***Severe Winter Storms***	***Flooding*** ***Drought****
Moderate Risks	***Lightning***	***Wildfire***
Low Risks	***Sinkhole*** ***Wind***	***Landslide**** ***Earthquake***

Note: Unlike the remainder of the NRV, Floyd County has limited vulnerability to flooding, but exceptional vulnerability to drought, and moderate risk of landslide.

FIGURE 12



The analysis that produced Table 10 and Figure 12 are included in Tables 11 and 12 below. Note that the 125-year history is based on local government files, newspaper accounts, and other sources listed under Table 13. Older data is spotty at-best, but the best available information was used.

TABLE 11

NRV Vulnerability Analysis and Mitigation Prioritization									
	Flooding*	Drought*	Wildfire	Severe Winter Storm	Severe Wind	Landslide	Karst*	Earthquake	Lightning
IMPACT									
degree of impact	4	4	3	3	3	3	3	3	3
size of area impacted	5	5	3	5	2	2	1	4	1
IMPACT Total	9	9	6	8	5	5	4	7	4
LIKELIHOOD	5	4	3	5	2	3	3	1	5
TOTAL VULNERABILITY	14	13	9	13	7	8	7	8	9
MITIGATION OPPORTUNITIES	5	4	4	2	1	4	2	1	1
TOTAL SCORE	**225**	**144**	**72**	**80**	**10**	**60**	**24**	**7**	**20**
	based on # of times in 125 years, though record is spotty								
NOTE: This assessment is based on available records for the past 125 years. Detailed information is only available for about the past 10 years, though even that is not rigorous and lacks consistent damage information.									
*Floyd County is the lone county in a different physiographic area; it is less prone to flooding and does not have karst, but it is more vulnerable to drought impacts.									

TABLE 12
Explanation of Hazard Assessment Numbers

Degree of Impact

1 Temporary, nuisance damage; no lasting effect
2 Clean-up; inexpensive
3 Signficant expenditure for clean-up recovery/repair
4 Loss of life; major structural damage
5 Complete devastastion; everything in path unusuable--permanent

Likelihood: Significant impact+ occurences since 1878

1 1 time
2 2 times
3 3 times
4 4 times
5 5 times or MORE

Size of area Impacted

1 neighborhood
2 community
3 most of a jurisdiction
4 more than 1 jurisdiction
5 entire region

Mitigation opportunities

1 Mitigation is difficult and highly impractical
2 Loss reduction is possible, but highly costly.
3 Loss reduction: emergency management or public outreach only
4 Multiple opportunities, including land use
5 Major land use planning mitigation opportunities

Table 13: NRV Major Regional Natural Hazard Events By Decade

Giles County, 1916

Town of Pulaski

Flood June 6, 1992
6" of rain in Giles.

Snow 1993
Lowes & Dedmon Ctr roofs collapsed.

Flood June 27, 1995
5" of rain in 2 hours in Giles. **Fed. Disaster** declared.

Snow January 13, 1996
Lowes' roof collapsed for 2nd time. **Fed. Disaster** declared.

Flood Jan 18-19, 1996
Rain, snowmelt caused mudslides, flooding.

Flood Jan 27, 1996
High winds and driven rain. **Fed Disaster** declared.

Hurricane Fran
September 6, 1996
Wind gusts to 40 mph. 9.35" of rain at Poor Mtn. **Fed. Disaster** declared.

Montgomery Co , 2003

Flood
1878
New River 30' above normal level.

Earthquake
1897
Strong tremors rocked Pearisburg.

Flood
July 17, 1916
New River 30' above normal level.

Hurricane Agnes
June 21-22, 1972
Many homes, especially "trailers" damaged in flood plains.

1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000

Flood
August 14, 1940
New River at Radford at 34.5' above flood.

Snow
1960
6 major snowfalls in 6 weeks.

Hurricane Hugo
September 21, 1989
Local gusts 60-80 mph. 4 deaths. Damaged many trees. **4 deaths.**

Winter Storm Jan 2000
Severe winter storm. **Fed. Disaster** declared.

Winter Storm Feb 2000
Severe winter storm. **Fed. Disaster** declared.

Drought 1999-2002
Severe drought. **USDA Disaster** declared.

Flood/Ice Feb 2003
1 death. Fed Disaster declared in Mont. Co.

Note: Data collection and information networks began to rapidly improve in the 1990's so it gives the appearance of more frequent major events.

Source: National Climatic Data Center, National Weather Service, local files, The Roanoke Times, the Virginia Leader, NRVPDC photos.

Floyd County, 1960

Drought 2002

Natural Hazard Assessments

Every Virginia locality has suffered at least one major disaster in the last 35 years, and all New River Valley jurisdictions have suffered at least 4 or 5. Some areas in the New River Valley have had 10 or more federally-declared disasters including flooding, drought and severe winter storms.

The following pages provide detailed assessments of hazards, risks and vulnerabilities and mitigation opportunities. The pages also provide a snapshot of past or present mitigation activities. The assessment covers all significant natural hazards in the NRV, which, of course, has no volcanoes or beach-related threats. Where localities differ, these distinctions are included.

Note:
1. For hopefully obvious reasons, most effort was expended on gathering data and creating information on flood hazards. Most other hazards have no determined geographic basis, so therefore it is impossible to assess risk to any certain structures or people. For example, there is no tornado alley in the NRV, nor is there a place more likely to get major snowstorms. Even for those that do appear to have greater vulnerability, such as the earthquake circle, there was no ready mechanism for assess structure at risk. In the case of drought, a proxy effort was used assuming that households reliant only on private water sources are at-risk.

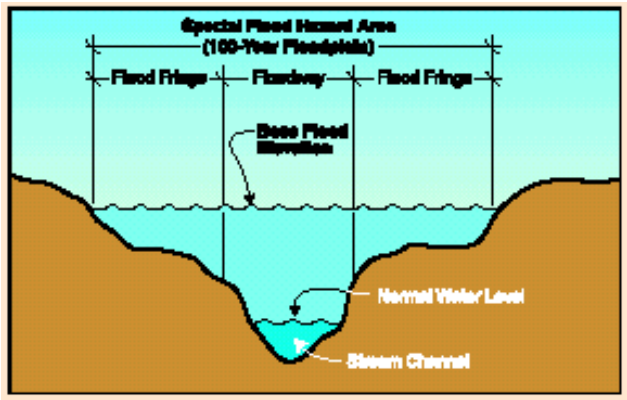
2. Dam failure is not assessed in any detail, due to the lack of public information on inundation areas (perhaps due to security concerns.) It is briefly mentioned, though, as a secondary hazard (due to flooding.) The Virginia Department of Conservation and Recreation dam safety specialist for the region, will be pursuing this, most likely in the State Mitigation Plan.

Similarly, there are shrink-swell soils in the New River Valley, but no information regarding past damage or calibrated current risk is available. It is, therefore, presumed that this is not a high-risk hazard at this time. A generalized Soil Survey Geographic database (SSURGO) has been completed for Montgomery County and is included in Appendix E. Note that the areas have a significant margin of error, but Montgomery County will be working to get better information. Due to "having 20% and greater moderate and high shrink/swell potential," the Counties of Montgomery, Giles and Pulaski must implement an "expansive soil test policy," according to the new Virginia/International Building Code. Montgomery County is creating a "pre-development process" to help insure adequate information is given to and received from prospective developers. It is recommended that future major revisions to this Hazard Mitigation Plan look closely at the shrink-swell soil data available at that time.

FLOODS

Flooding is perhaps the most common and widespread hazard within the New River Valley, as it is across the nation. In fact, during the course of the planning process, at least two significant floods occurred in the New River Valley. These floods, and others which have affected the NRV, are documented below. Unfortunately, as is the case with all hazard events in the NRV, very little information was documented concerning damage amounts.

Figure 13
100-Year Floodplain



There are National Flood Insurance Rate Maps (FIRM's) available for all NRV localities except the Towns of Dublin, Floyd, and Pearisburg. Most of the maps date back to the 1970's and the origination of the program. These FIRM's locate the 100-year floodplain, or that area that has a 1% chance of flooding in any given year. Owners inside and outside the floodplain may purchase flood insurance, but the rates increase dramatically with risk. Figure 13 portrays a generalized floodplain, which is composed of both the floodway and flood-fringe (see definitions below).

Definitions:

Base Flood: Flood that has a 1 percent probability of being equaled or exceeded in any given year. Also known as the 100-year flood.

Floodplain: Any land area, including watercourse and floodway, susceptible to partial or complete inundation by water from any source.

Floodway: The central channel and that portion of the adjacent floodplain, which must remain open to permit passage of the base flood. The greatest intensity of floodwaters generally is in the floodway, and anything in this area is in the greatest danger 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.

Frequency: A statistical measure of how often events of a particular magnitude are expected to occur, on average. For example, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance—its probability—of happening in any given year. Events may occur more or less often in reality, however.

Repetitive Loss Properties: A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1,000 each have been paid within any 10-year period since 1978. These properties are important to the National Flood Insurance program and its Community Rating System because they account for one-third of the country's flood insurance claim payments.

Source of Diagram and Definitions: FEMA How-To Guides, 2002.

It is important to note that on the FIRM's and in the supporting National 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.

Nonetheless, the Flood Insurance Rate Maps and flood histories and are the best availability tools for risk assessment. (Note: the Towns of Dublin and Floyd do not currently participate in the National Flood Insurance Program.) Next flood history is explored.

History

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

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," or an event with only 1% likelihood in any given year. (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.

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, 1973, Tropical Storm Agnes wreaked havoc on western Virginia. Next, the two most recent flash-floods are examined.

February 2003 Flooding

On February 22, 2003 heavy rains fell upon accumulated ice and snow around the NRV. Flash-flooding impacted every jurisdiction to some degree. Montgomery County and other western Virginia counties were later declared **Presidential-disaster areas.**

Montgomery County

In a highly-publicized event, two men were rescued from the North Fork of the Roanoke River in Montgomery County. They were swept away while trying to get back to a flooded vehicle, but both caught hold of trees. Local crews were unequipped to reach them, but finally the Salem Swift Water Rescue Team (after completing calls in Salem) pulled both from the river alive. Unfortunately, one man died a short time later of hypothermia.

Several homes also flooded in eastern Montgomery County, including this photo in the Allegheny Springs community. Local crews rescued several residents who were trapped in their homes.

Town of Pulaski

The Town of Pulaski, historically plagued by flooding, again experienced flooding in its high-hazard areas.

Other Areas

The Counties of Giles and Floyd as well as the City of Radford were also impacted by the February 2003 flood. Several private bridges were damaged or destroyed. Hundreds of thousands of dollars in damages also occurred to state roads around the region, including Floyd County which is not often affected by flooding. At the Dedmon Center in Radford, the waters breached the berm but the only damage was a layer of mud.

Floyd County (left)

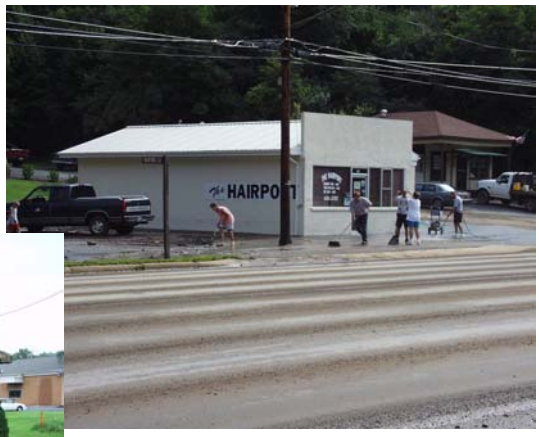
"Greater Pembroke" Flood

A more localized flash flood occurred on July 25, 2002 in and around the Town of Pembroke in Giles County. Approximately 4-5" of rain fell in four hours. At least $367,000 in damage was documented in Pembroke and the immediate vicinity, especially along Doe Creek, east and north of the Town limits. Route 460 was temporarily closed due to flooding. The rear portion of McCall Motors was torn off by floodwaters and the nearby church had major damage. Several other homes and businesses were damaged as well, as were several secondary roads. (Photos were taken the day after the damage.)

Large debris, including storage buildings and large hay bales, blocked culverts and drainage-ways, significantly exacerbating flood damage. The middle-of-the-night timing of the storm also delayed response and revealed the need for additional warning mechanisms.

Photos Made Just East of Town along 460 the "Day After"

Photos Made in Town "the Day After"



Additional Flood History, Hazard and Risk Information

Though the local flooding in 2002 and 2003 are fresh in memory, the New River Valley has a significant long-term history of flooding. Unfortunately, the documentation on previous events is spotty. General flooding history is discussed next by geographic area. The information was compiled from FEMA reports, National Flood Insurance Studies, Army Corps of Engineer studies, Natural Resource Conservation Service reports, newspaper accounts and local records, so level of detail and mapping varies significantly by jurisdiction. For large special hazard areas, additional analysis is provided. The empirical analysis primarily includes parcels in those communities that are 100% in the floodplain and 80-99% in the floodplain, since structures would almost certainly be impacted by flooding. However, it does not include the many additional parcels that are 10-79% in the floodplain. Dataset and mapping methodology for this analysis is provided in Appendix F. Full-size risk assessment maps for flood-prone areas are located in the Large Map Supplement.

NRV Dams

Dam breaks are a special risk, particularly as a secondary effect of flooding (or terrorist attack.) There are 16 dams listed with the Department of Conservation and Recreation for the New River Valley region. The high hazard dams, where dam failure would result in loss of many lives, include Claytor Lake Dam, Gatewood and Hogan's Dams above the Town of Pulaski. Downstream of these dams is an area called the Inundation Zone, which is the area that would be submerged in rapidly moving floodwaters in the event of a dam failure. More often than not residents, builders, zoning officials, and planners are unaware of these Inundation Zones and the possible hazards to locating new facilities within these zones. Localities should, where possible, incorporate information on these inundation zones in locality GIS data, Five Year Comprehensive Plans, and Zoning maps so that future facilities can be planned out of harms way.

Source: Virginia Department of Conservation and Recreation.

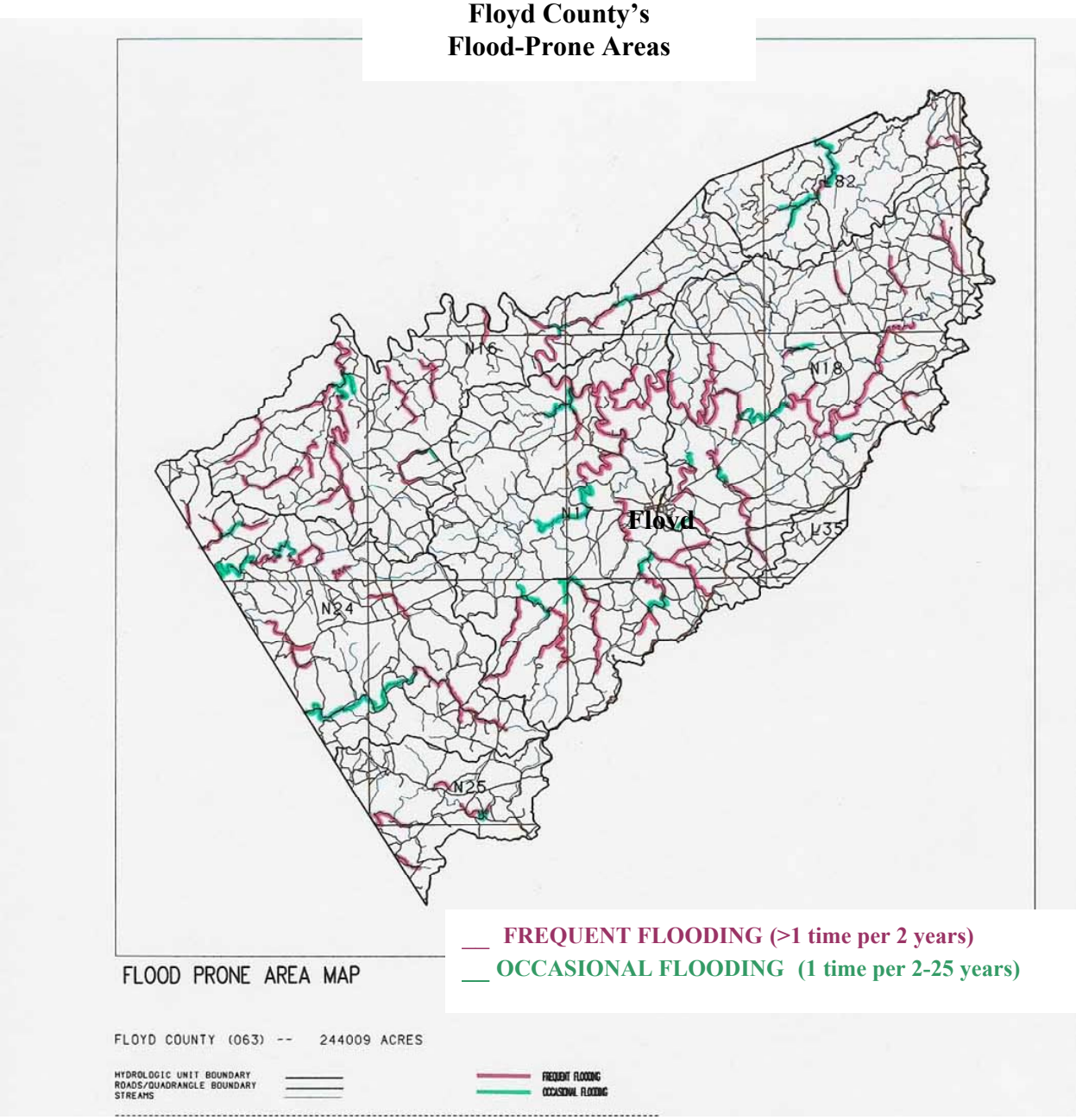
Floyd County

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, and 1985, and again in 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. Table 15 below details the drainage area and peak-discharges of Little River. Figure 14 shows the locations of frequent and occasional flooding in Floyd County, according to research by the United States Department of Agriculture's Natural Resource Conservation Service and Virginia Tech, 1994-95.

FIGURE 14
Floyd County's
Flood-Prone Areas



Source: United States Department of Agriculture's Natural Resources Conservation Service; Research by Agricultural Engineering Department, Virginia Tech, 1994/1995.

Risk Assessment and Vulnerability

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 (all NRV data will be summarized later in Tables). The repetitive loss property is in the Sowers Mill/Little River Area. Floyd County is experiencing substantial housing and population growth, but it is not currently believed to be occurring in the flood hazard area.

Giles County

The unincorporated areas of Giles County can be affected by flooding from nineteen 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. Those studied in detail were done so due to known history of flood hazard and the projected growth in area.

Studied in Detail

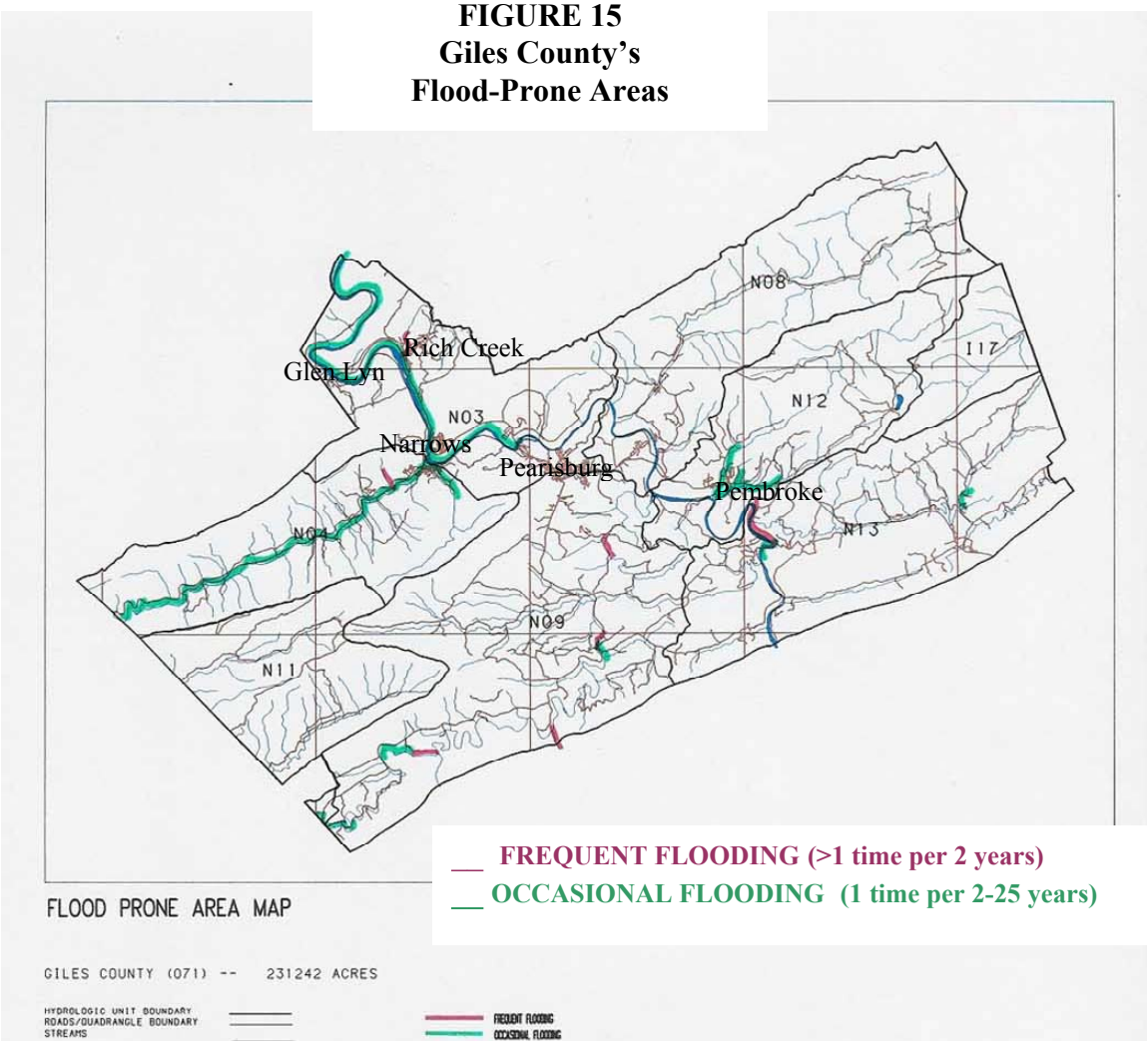
New River (in or near Towns)	Spruce Run
Wolf Creek	Doe Creek
Sinking Creek	Laurel Branch
Stony Creek	Piney Creek
Little Stony Creek	Greenbrier Branch

Studied using approximate methods

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

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.

FIGURE 15
Giles County's
Flood-Prone Areas



Source: United States Department of Agriculture's Natural Resources Conservation Service; Research by Agricultural Engineering Department, Virginia Tech, 1994/1995.

Risk Assessment and Vulnerability

Low-lying areas of the county in the proximity of the above streams are the most subject to flooding (see Figure 15). 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 (see map on page 42), 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. Of these, only Pembroke is experiencing population growth.

SPECIAL FLOOD HAZARD AREAS in Giles County

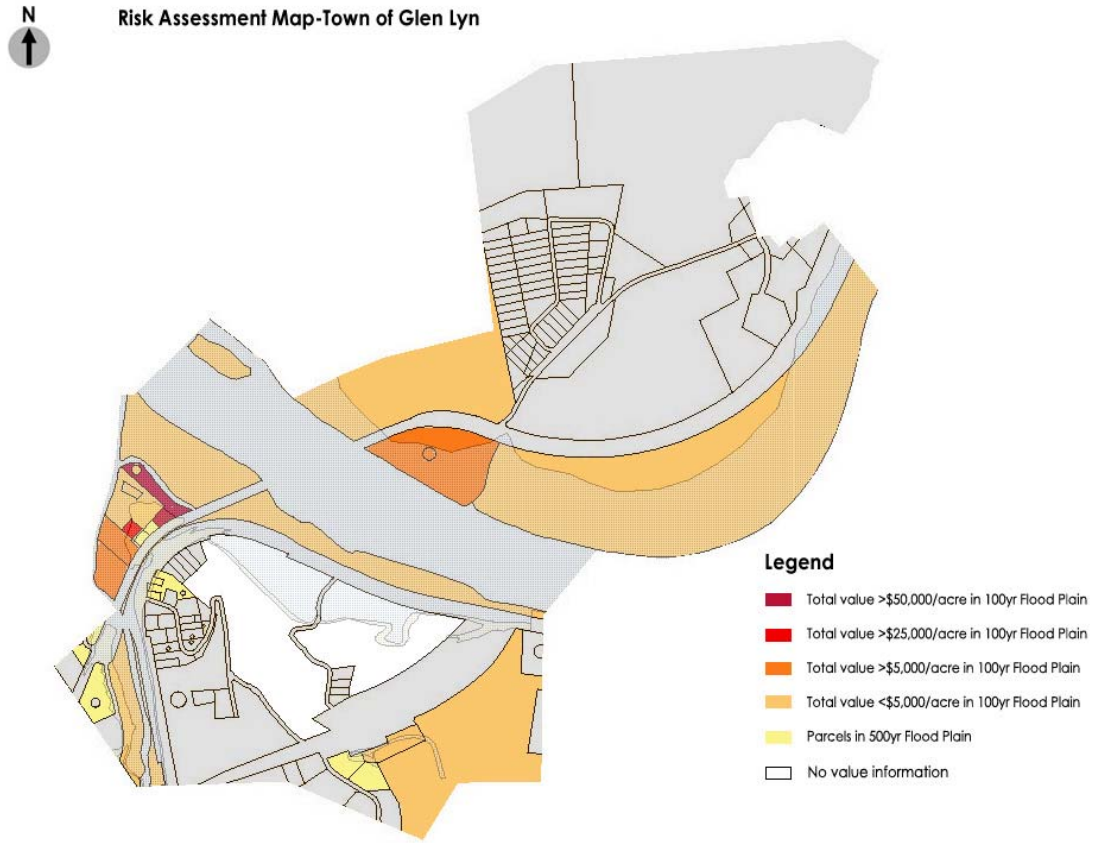
Town of Glen Lyn

The Town of Glen Lyn lies alongside the New River as it flows north into West Virginia.

Risk Assessment and Vulnerability

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 couple of structures are at risk in the event of a flood. Figure 16 shows the Parcels in the 100-year floodplain by total value (land and improvement) at-risk per acre. 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.

Figure 16
Glen Lyn: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



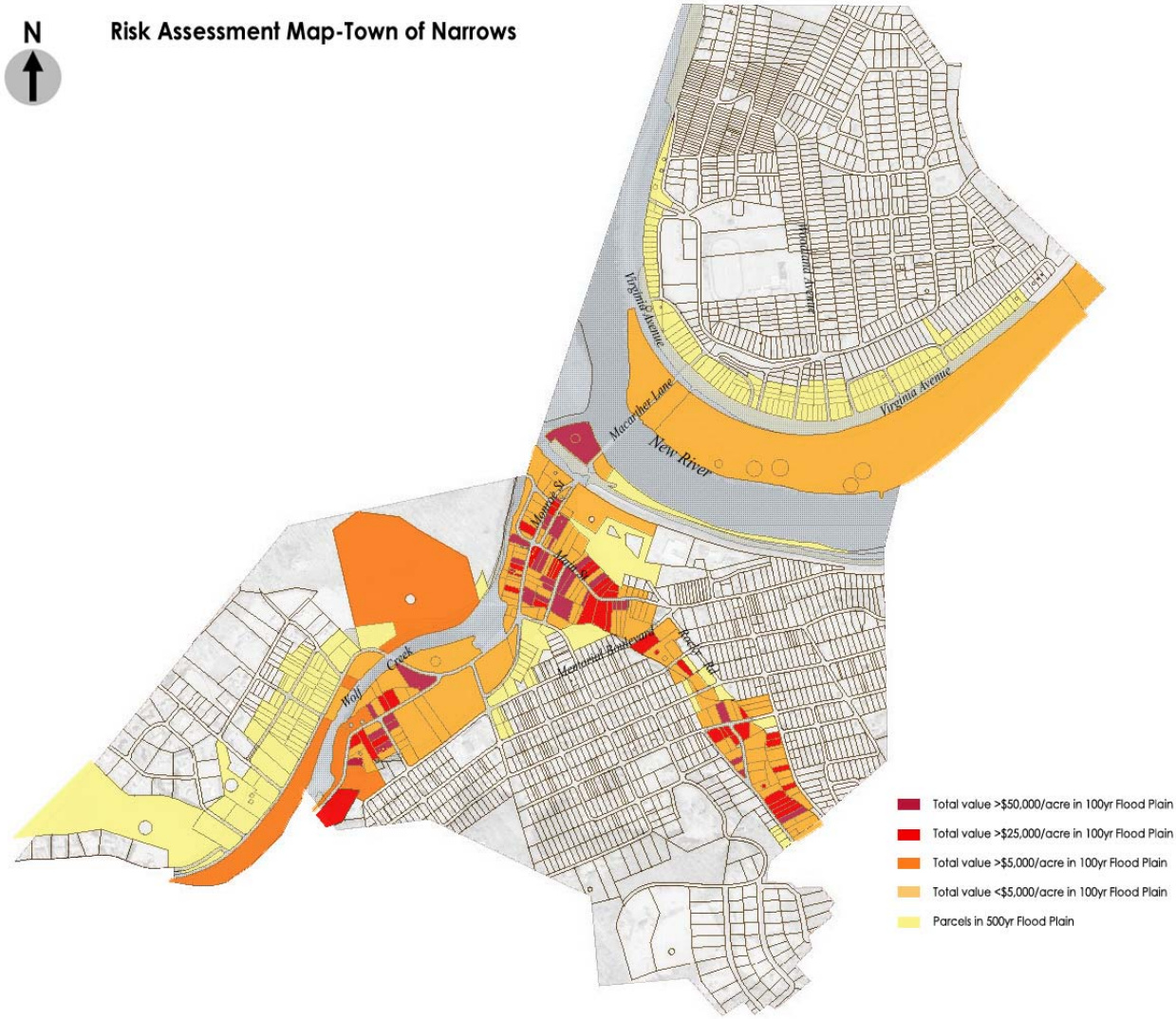
Town of Narrows

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 affects 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, businesses and the peaked at a height of four feet in a local power substation.

Risk Assessment and Vulnerability

The Town of Narrows is very vulnerable to flooding. According to cursory flood map and tax assessment record reviews, 97 improved properties (27% of parcels) in the Town of Narrows are entirely in the 100-year floodplain. Most of these are homes, but a significant number are local government structures, churches, and commercial properties including banks. The value of these 97 structures alone, according to tax records, exceeds $5.5 million. Moreover, many more parcels and structures are at least partially in the 100-year floodplain. Additionally, much of the rest of the Town (13%) is entirely in the 500-year floodplain, including 48 homes and small businesses valued at $2.5 million. Yet, there are only 17 flood insurance policies in-force in Narrows, covering $2.1 million in structures (2002). There are no reported "repetitive loss properties" in Narrows. Figure 17 shows the Parcels in the 100-year floodplain by total value (land and improvement) at-risk per acre.

Figure 17
Narrows: Parcels in the 100-Year Floodplain by Total Value At-Risk/Acre



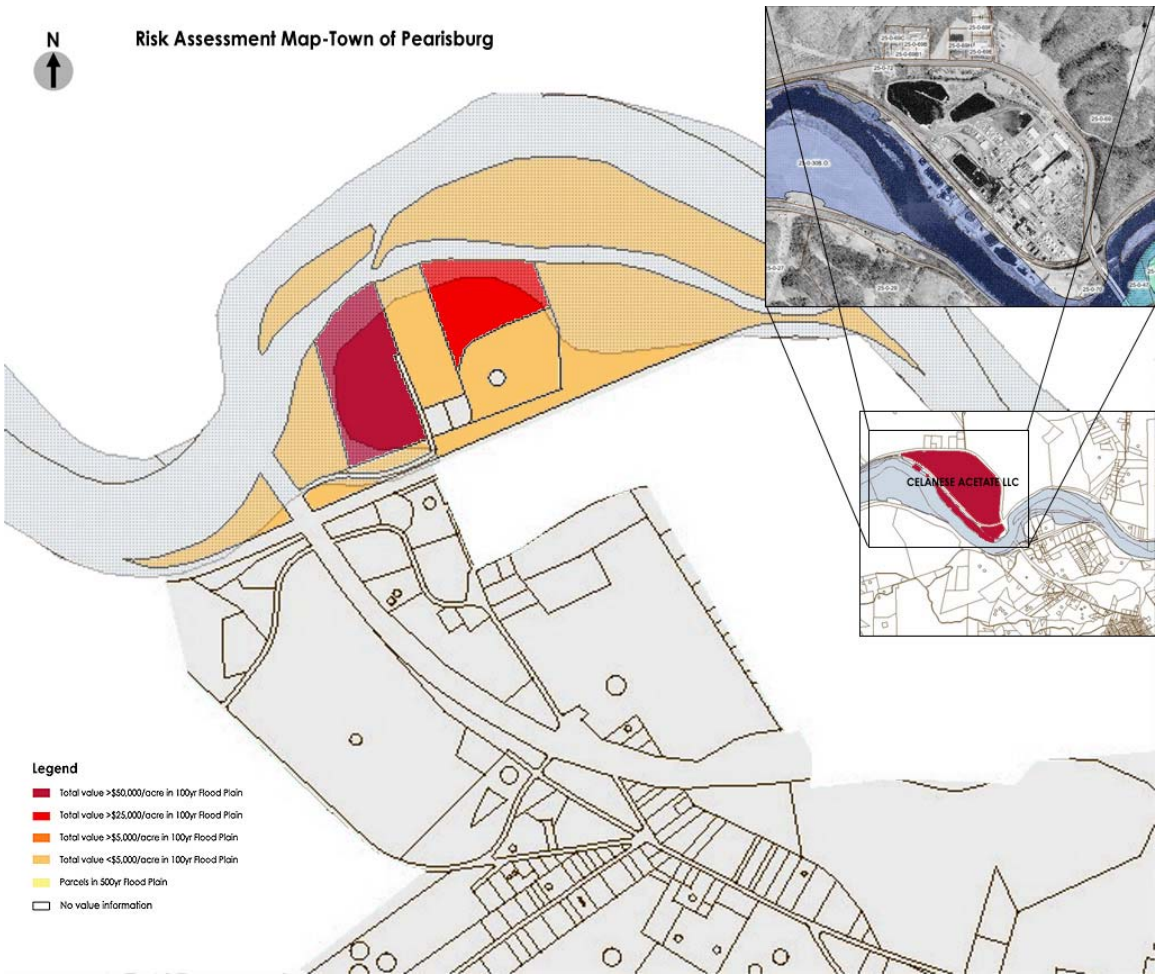
Town of Pearisburg

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 1996.

Risk Assessment and Vulnerability

Wenonah, Clifford, and Chestnut streets are affected by flooding in Pearisburg, as is the Bunker Hill area (Preliminary Engineering Report, 1998). Since no flood insurance studies or mapping have been done in the Town, the risk factors are unknown. Located just outside 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 is valued at over $1 million. As of 2002, there were 3 flood insurance policies in Pearisburg area, covering $159,000 in structures. Figure 18 shows the "Celanese" property. Pearisburg has one repetitive loss property.

Figure 18
Pearisburg Vicinity: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



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. The most recent flood event occurred in July 2002, as already discussed, after a localized storm dropped 5.5"+ 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.

Risk Assessment and Vulnerability

Many structures in Pembroke are located in the floodplain. A cursory assessment of tax sheets suggests that there are residential structures in the floodway and residential and commercial structures in the flood-fringe area. Table 14 displays estimates of the value of structures in Town, and the value of structures at high risk of flooding. It appears that, value-wise, more than 80% of structures are at high risk. Similarly, one would estimate that the majority of the population (total of 1,134 people) is also at high risk. In Pembroke, for example, the residential area along 460 can expect up to 3 feet of water in a "base flood." Altogether, there are at least 40 homes and six businesses predominantly in the floodplain, several of which are actually in the floodway. Clearly, mitigation is needed for Pembroke.

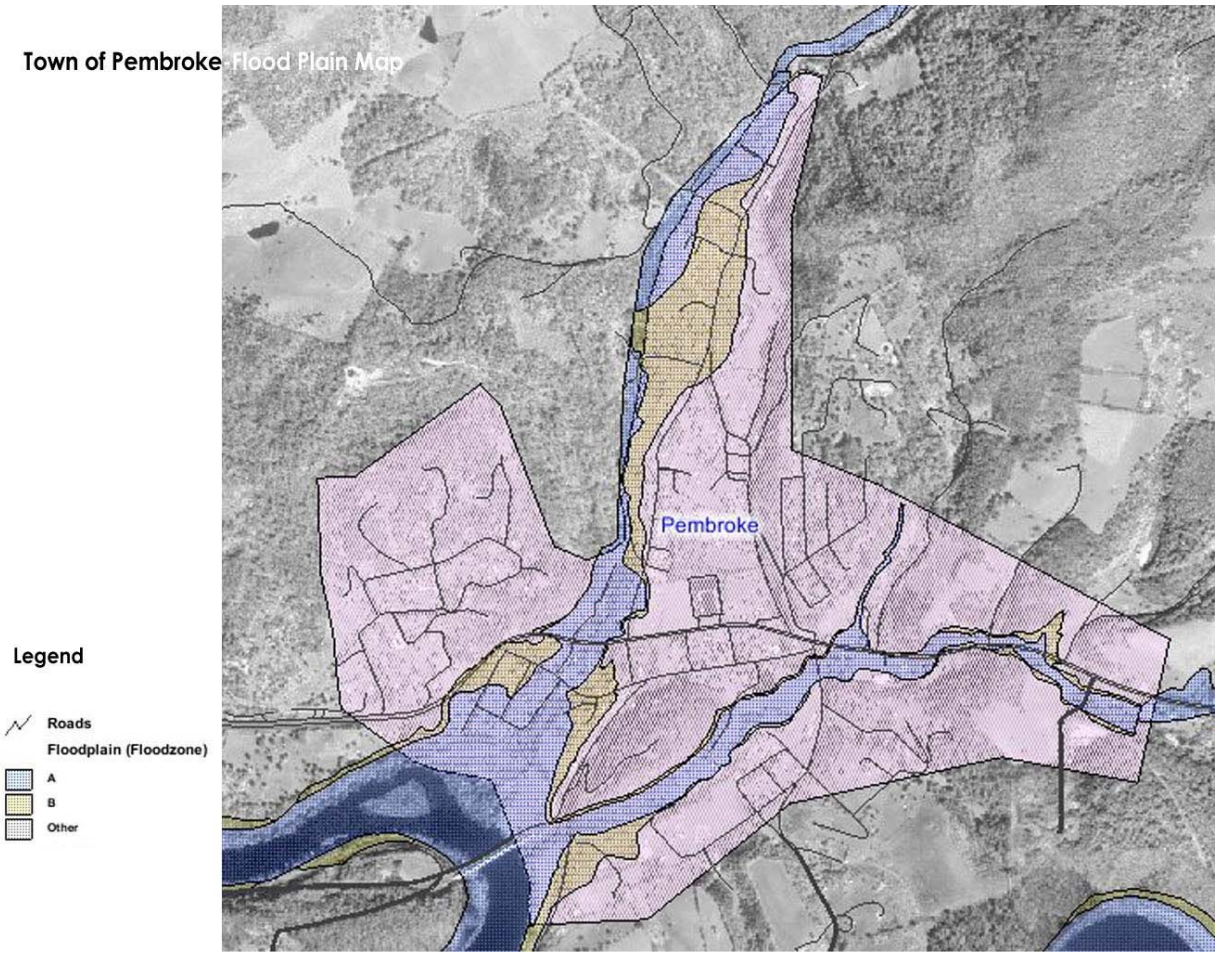
Table 14

	Value of Structures in Pembroke			
	TOTAL	In Floodway	Flood Fringe	Total at High Risk
Tax Sheet 42A:	$1,980,800	$323,615	$1,421,416	$1,745,031
Tax Sheet 42B:	$3,326,000	$1,297,730	$1,290,650	$2,588,380
Tax Sheet 42C:	$913,080	$357,375	$489,055	$846,430
	$6,219,880	$1,978,720	$3,201,121	$5,179,841

The 2002 "Doe Creek" flood revealed part of Pembroke's vulnerability to flash-flooding. As Figure 16 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

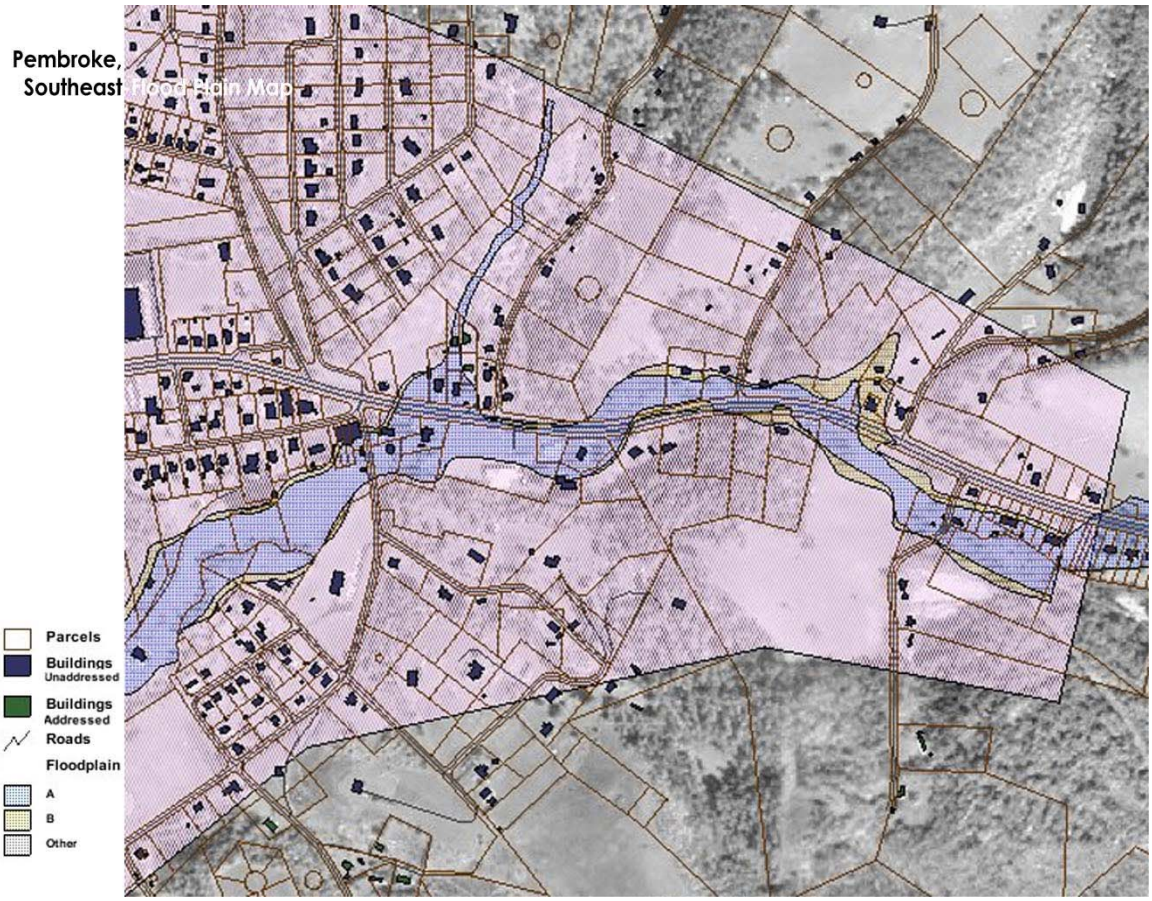
(flowing East to West). If the 2002 event had been centered just slightly north and west, much more damage would have likely occurred, as there are many more structures close to the streambed along Little Stony. See Figures 19- for a view of structures in the floodplain.

Figure 19
Town of Pembroke Floodplain
generated from Webgis.net



Note: Floodplain A is the 100-year floodplain; B is the 500-year floodplain.

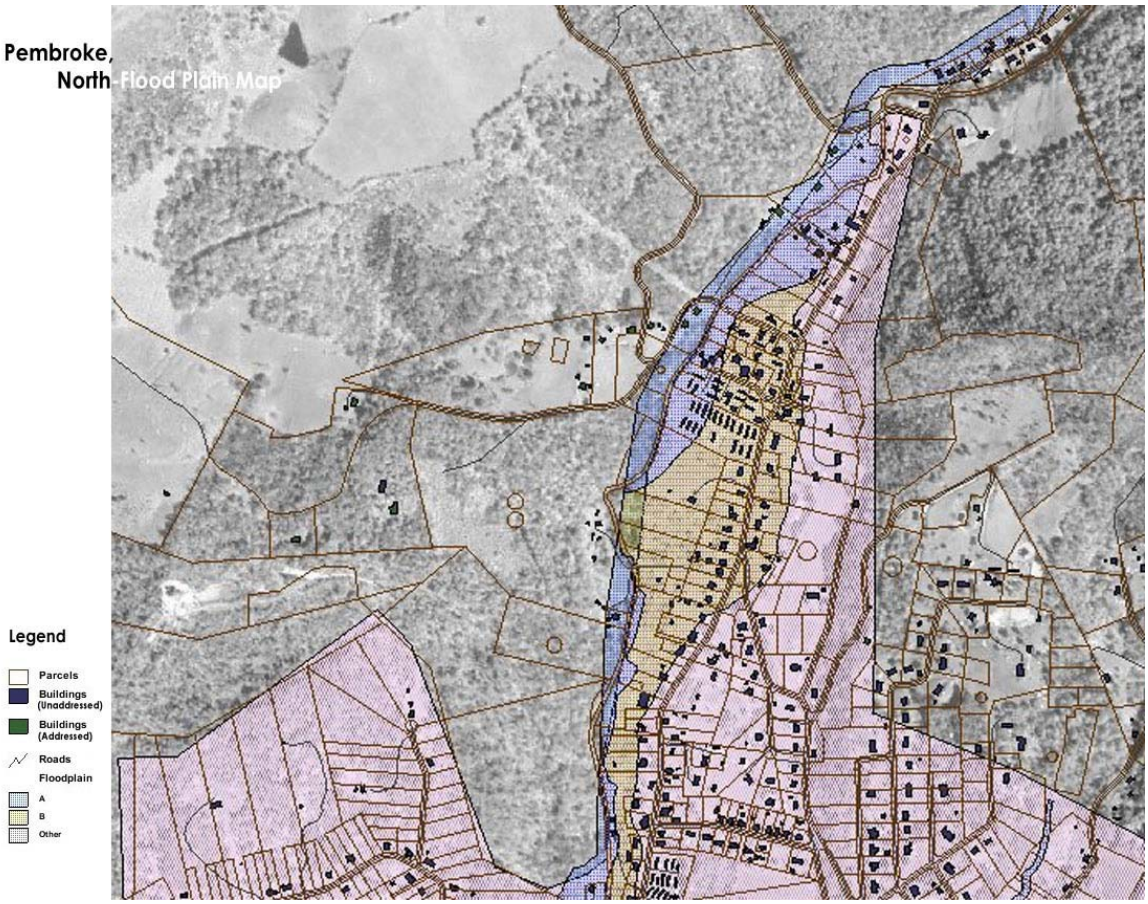
Figure 20
Doe Creek Floodplain in Eastern Pembroke
generated from Webgis.net



Note: Floodplain A is the 100-year floodplain; B is the 500-year floodplain.

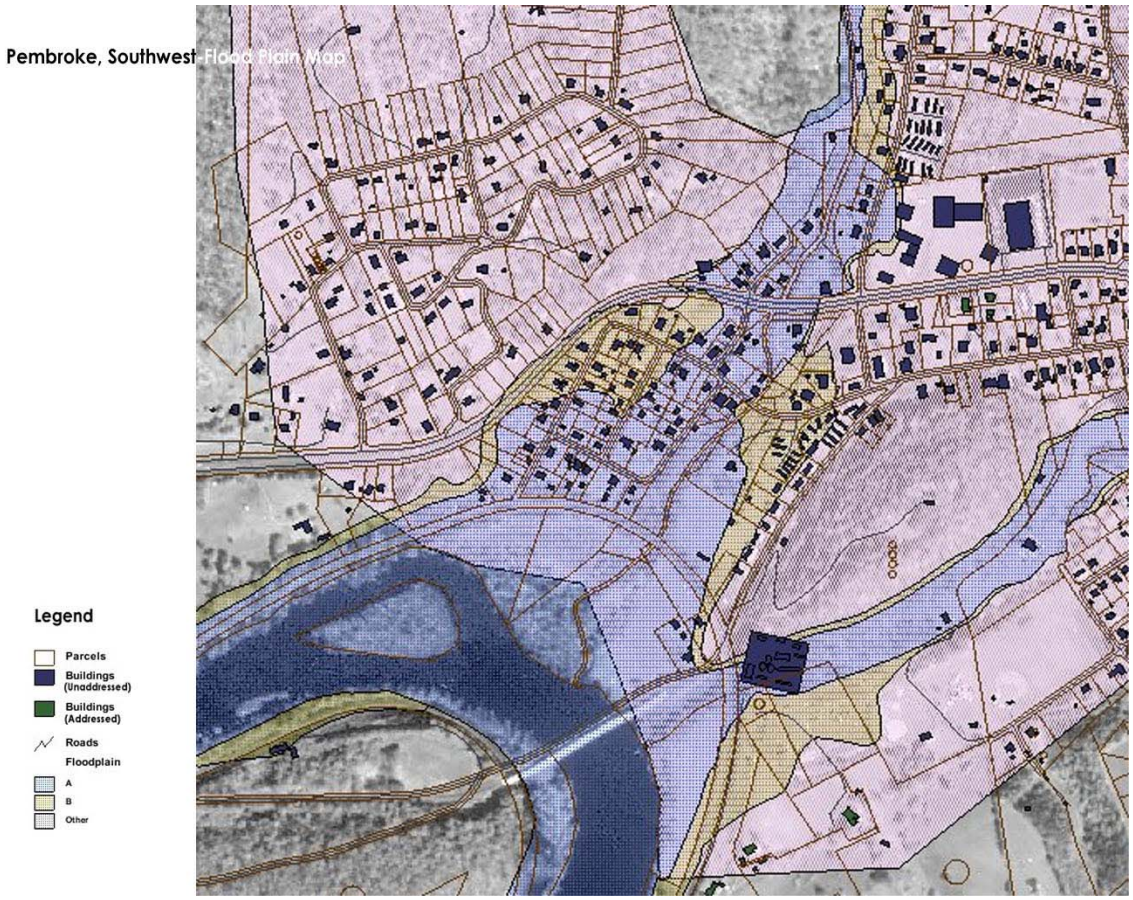
Figure 21
Little Stony Floodplain in Northern Pembroke

generated from Webgis.net



Note: Floodplain A is the 100-year floodplain; B is the 500-year floodplain.

Figure 22
Little Stony Floodplain in Southern Pembroke
generated from Webgis.net



Note: Floodplain A is the 100-year floodplain; B is the 500-year floodplain.

It is estimated that there are over $5 million in residential, commercial and public structures at high risk of flooding (in the 100-year floodplain) in Pembroke. In fact, most commercial structures are in the floodplain. A significant percentage of the remaining property is in the 500-year floodplain, though no exact figures are available on those. 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.

Town of Rich Creek

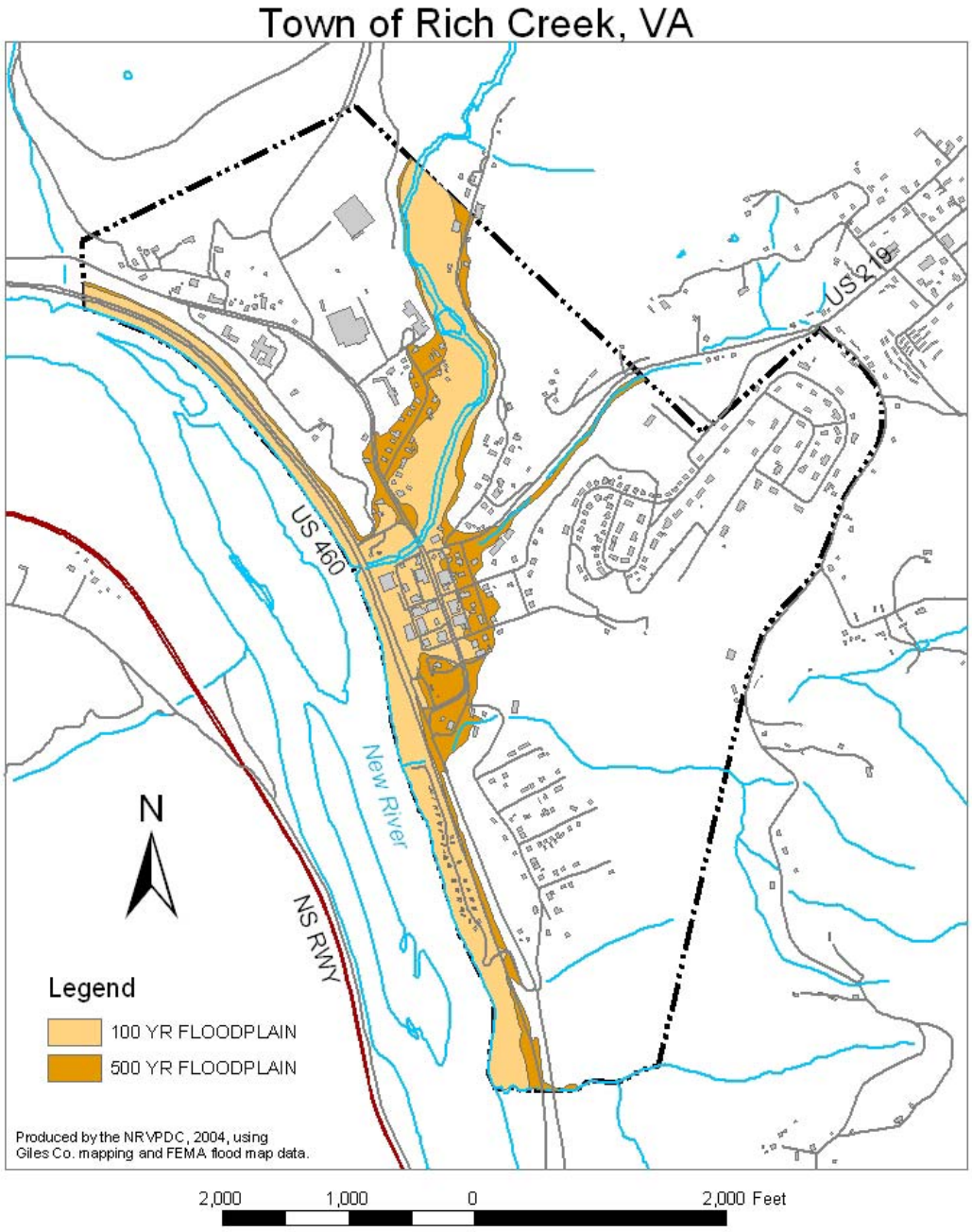
Incorporated in 1947, the Town of Rich Creek is located in Giles County, Va. only a few miles from West Virginia. The New River is the western boundary of the Town and is the primary source of periodical flooding. Another source of flooding is the Town's namesake, Rich Creek, a tributary to the New River.

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.

Risk Assessment and Vulnerability

Located on and named for a creek, much of Rich Creek is in the floodplain. Specifically, 39 properties, many of which are businesses, are in the 100-year floodplain; their estimated value is $3,085,600. See Figure 23. Another 39 properties are in the 500-year floodplain; their estimated value is $3,224,100. No repetitive loss properties are known to be located in Rich Creek.

Figure 23
Rich Creek: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



Montgomery County

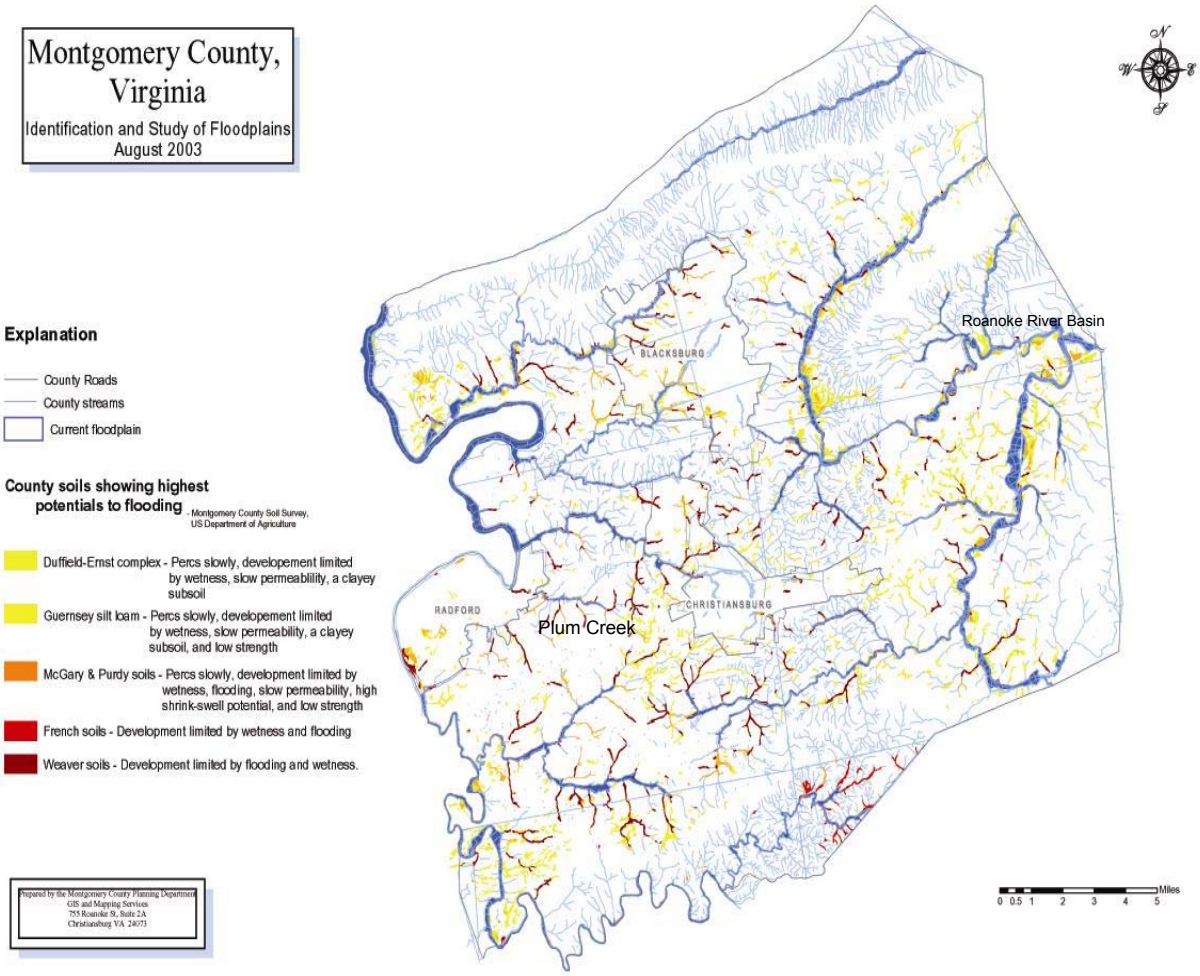
Montgomery County is bordered on the north by Giles and Craig Counties, on the south by Floyd County, on the east by Roanoke County, and on the west by Pulaski County. Urbanized areas within the County experience fairly frequent flooding. These high risk areas will be discussed in more detail later.

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 in the Unincorporated Areas of Montgomery County

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

FIGURE 24
Montgomery County's
Flood-Prone Areas
Map Courtesy of Montgomery County Planning



Source: Montgomery County Planning, 2004.

Risk Assessment and Vulnerability

The communities of Shawsville, Elliston, Lafayette, and 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. This caused extensive damage to the adjacent communities in excess of one million dollars. This area also experienced flooding during the 1980's and 1990's and as recently as the 2003 event referenced earlier. More detailed risk assessment follows. 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 (see Appendix D.)

As of December 2002, there were 151 National Flood Insurance Policies in-force in the unincorporated areas of Montgomery County, covering $15,289,700 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.

SPECIAL FLOOD HAZARD AREAS in Montgomery County

Roanoke River Basin in Eastern Montgomery:
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.

Risk Assessment and Vulnerability

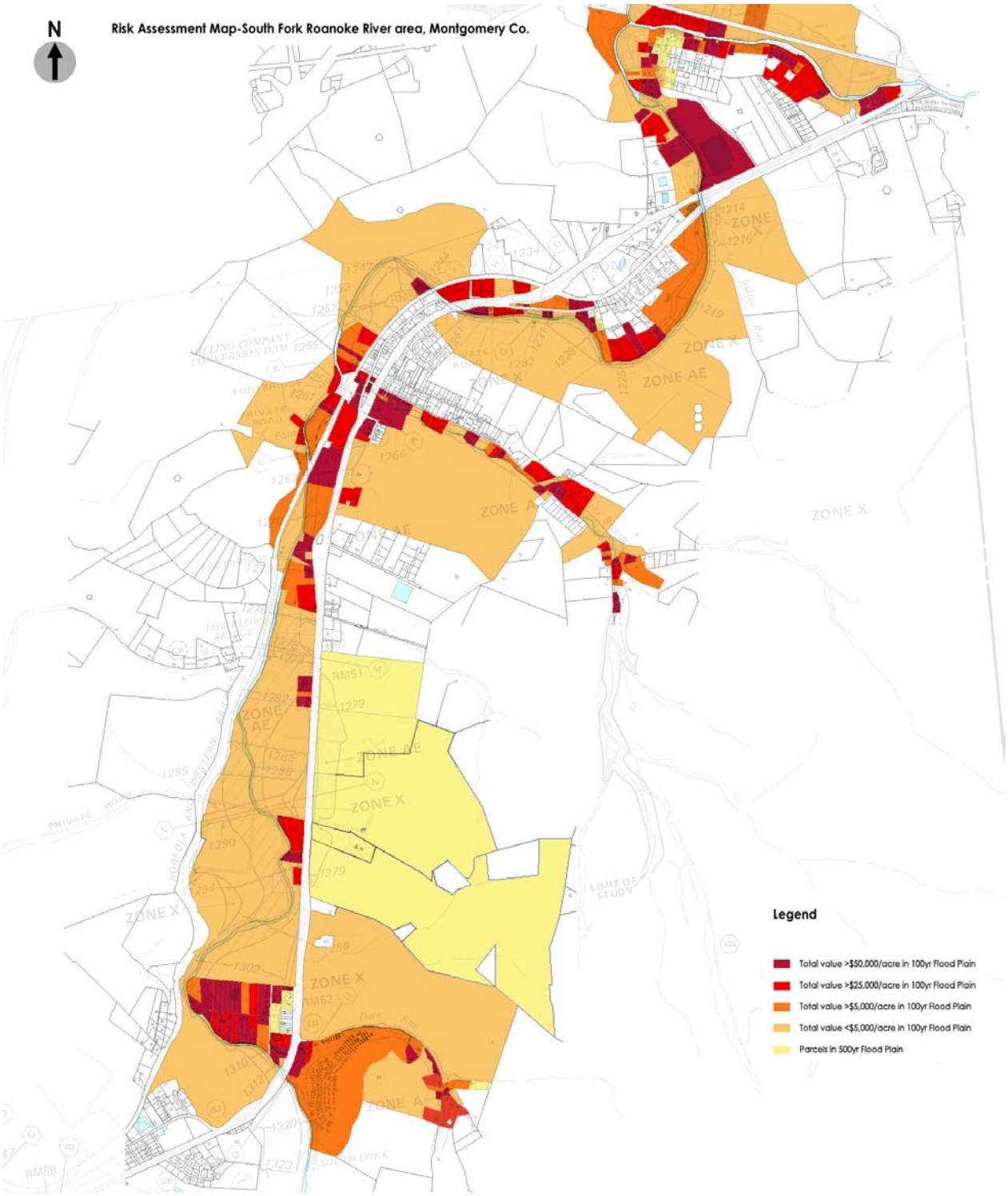
In relatively mild downpours, communities in eastern Montgomery County experience flooded roads and hampered mobility. When serious rainfall occurs, as seen in the February 2003 event, substantial threats to life exist. Roads and bridges flood, as do homes, resulting in substantial damage. As can be seen in Table 15, at least $11 million in property is in imminent danger during substantial flood events in this area. This includes Shawsville Elementary School, a wastewater treatment plant, and 85 homes, at least 23 of which are mobile homes. Figure 25 illustrates the substantial number of parcels in the 100-year floodplain along the South Fork of the Roanoke River by values at-risk per acre.

Table 15

High-Risk Structures in Eastern Montgomery, based on Cursory Estimates

Area	Bldg Values 100% FP	Bldg values 80-90% FP	Total # Homes	# of Mobile Homes	Other Notables
Roanoke River	$4,956,300	na	25	4	Also Shawsville School at $3.1 million
South Fork of Roanoke River: North end	$1,642,600	$1,228,900	44	16	
South Fork of Roanoke River: South end	$4,634,000	na	16	3	Public Service Authority: $3.2 million
					School Board: $200,000+
Sub-totals of Structures at High-Risk	**$11,232,900**	$1,228,900			
Total of Structures at High Risk	**$12,461,800**		85	23	

Figure 25
South Fork of Roanoke River: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



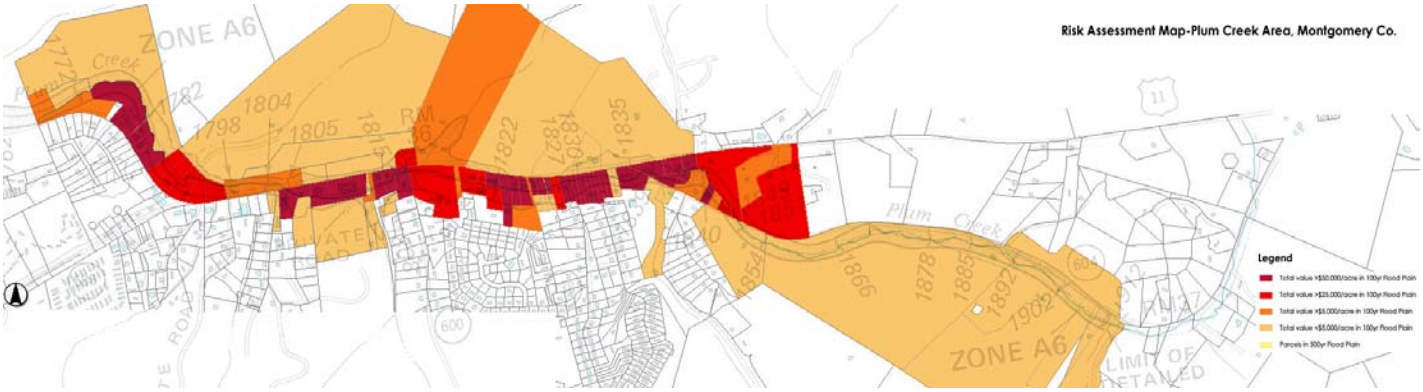
Plum Creek

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.

Risk Assessment and Vulnerability

The Plum Creek area includes at least 12 homes and 1 church that are entirely in the 100-year floodplain. These are valued at $581,700. A few more parcels with homes are 80-99% in the 100-year floodplain. Figure 26 illustrates the parcels in the 100-year floodplain in the Plum Creek area by values at-risk per acre.

Figure 26
Plum Creek: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



Town of Blacksburg

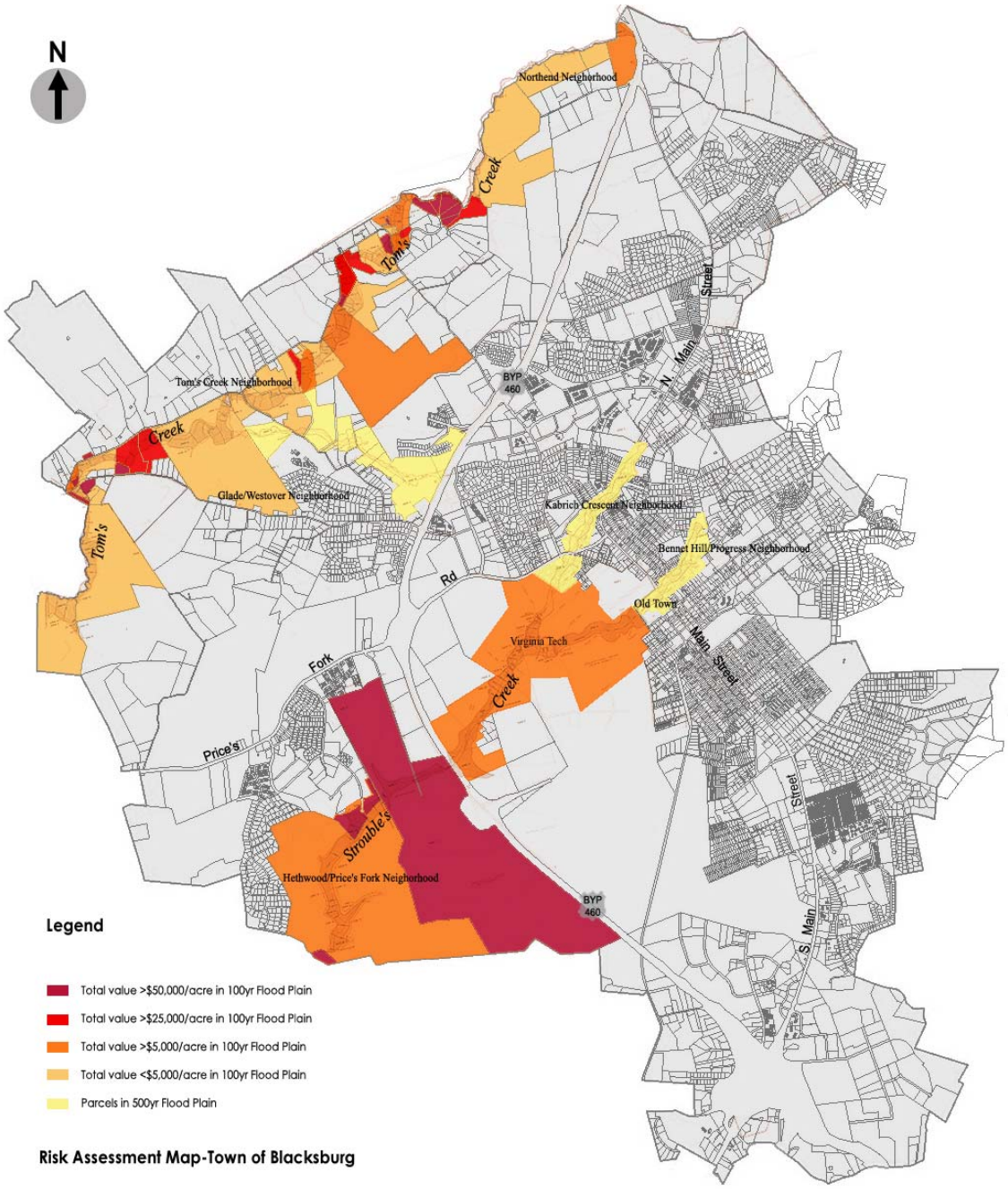
The Town of Blacksburg supports a population of 39,573 residents, the largest urban area in the New River Valley. The Town of Blacksburg was incorporated in 1871. Growth of the town has been as a result of the establishment and growth of Virginia Polytechnic Institute and State University as a land grant 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.

Risk Assessment and Vulnerability

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, include 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 Blacksburg Town Office in the form of zoning regulations, building codes and availability of Flood Insurance Rate Maps (FIRM's).

There appear to be only four or five main structures which are predominantly in the 100-year floodplain in Blacksburg. Precise estimates of structures at risk are difficult, since a few Virginia Tech structures are the principal at-risk properties, and these buildings are not valued individually in tax records. A Reconnaissance Study by the Army Corps of Engineers in October 2000 reported that "the primary cause of damages is the inability of the channelized portions of Stroubles Creek to effectively pass the increased stream discharges associated with storm events [and urbanization and development in the upper third of the subbasin.]" 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. Figure 27 illustrates the parcels in the 100-year floodplain in Blacksburg by values at-risk per acre.

Figure 27
Blacksburg: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



Town of Christiansburg

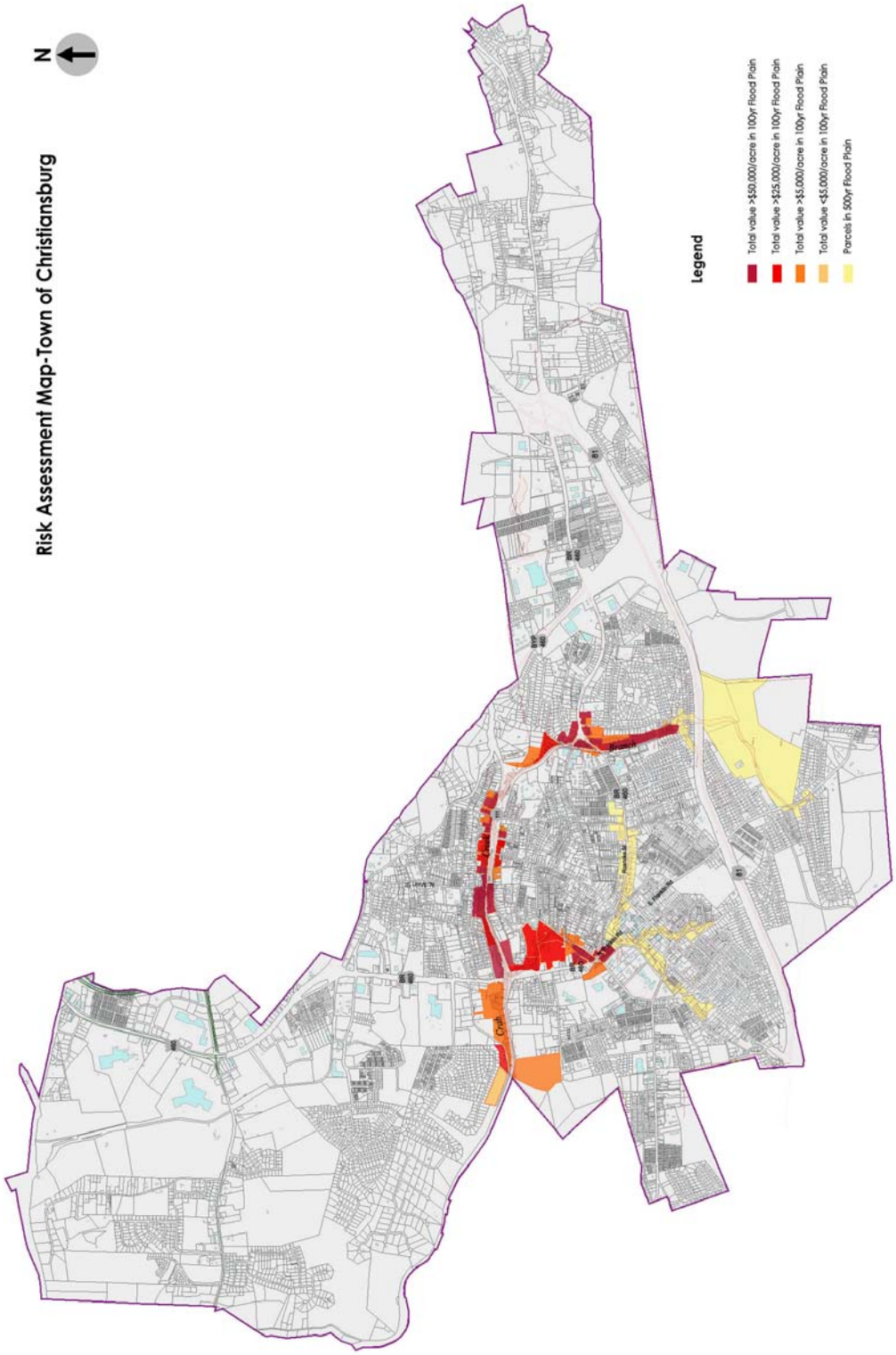
The Town of Christiansburg is located in central Montgomery County and serves as the county seat, and commercial center for the entire New River Valley. Christiansburg was incorporated in 1792 and boasts a population, in 2000, of 16,947 residents. The town, located in the Valley and Ridge Physiographic 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 flood plain 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.

Risk Assessment and Vulnerability

There are about 35 main structures in Christiansburg located in the 100-year floodplain. About half of those are residential, and the remainder are industrial and commercial. The total value of the structures in the 100-year floodplain is just under $3 million. There are 20 National Flood Insurance Policies in-force in the Town, covering about $2.5 million in structures. These 2002 policy numbers represent a 25% increase over 2001 numbers, but the cause of the increase is not known. Figure 28 illustrates the number of parcels in the official 100-year floodplain in Christiansburg, by values at-risk per acre. Additionally, there are homes in the College Avenue area that flood periodically; this is not reflected on the National Flood Insurance Rate Maps, perhaps due to development since FIRM maps were done.

Figure 28
Christiansburg: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



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 an hydroelectric reservoir on the New River (built in 1939) within the County as well. Significant tributaries of the New 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.

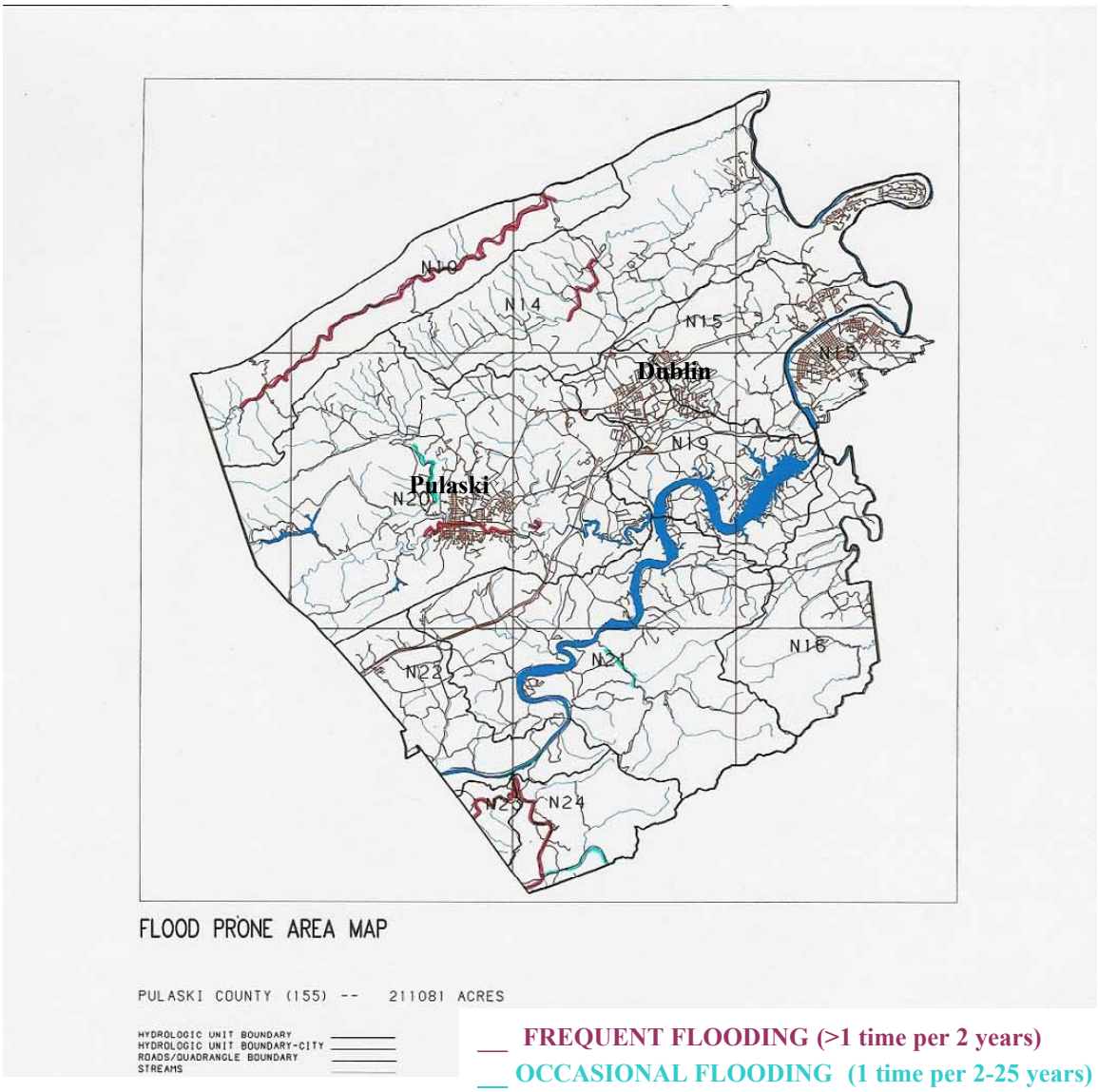
Risk Assessment and Vulnerability

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. Floods at this level appear to have a 10-13% likelihood, rather than the 1% likelihood that a 100-year flood has by definition.

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.

Each of the most significant flood prone areas are described in the following section. Both a description of the area and a risk assessment and vulnerability analysis is described.

FIGURE 29
Pulaski County's
Flood-Prone Areas



__ **FREQUENT FLOODING (>1 time per 2 years)**
__ **OCCASIONAL FLOODING (1 time per 2-25 years)**

SPECIAL FLOOD HAZARD AREAS in Pulaski County

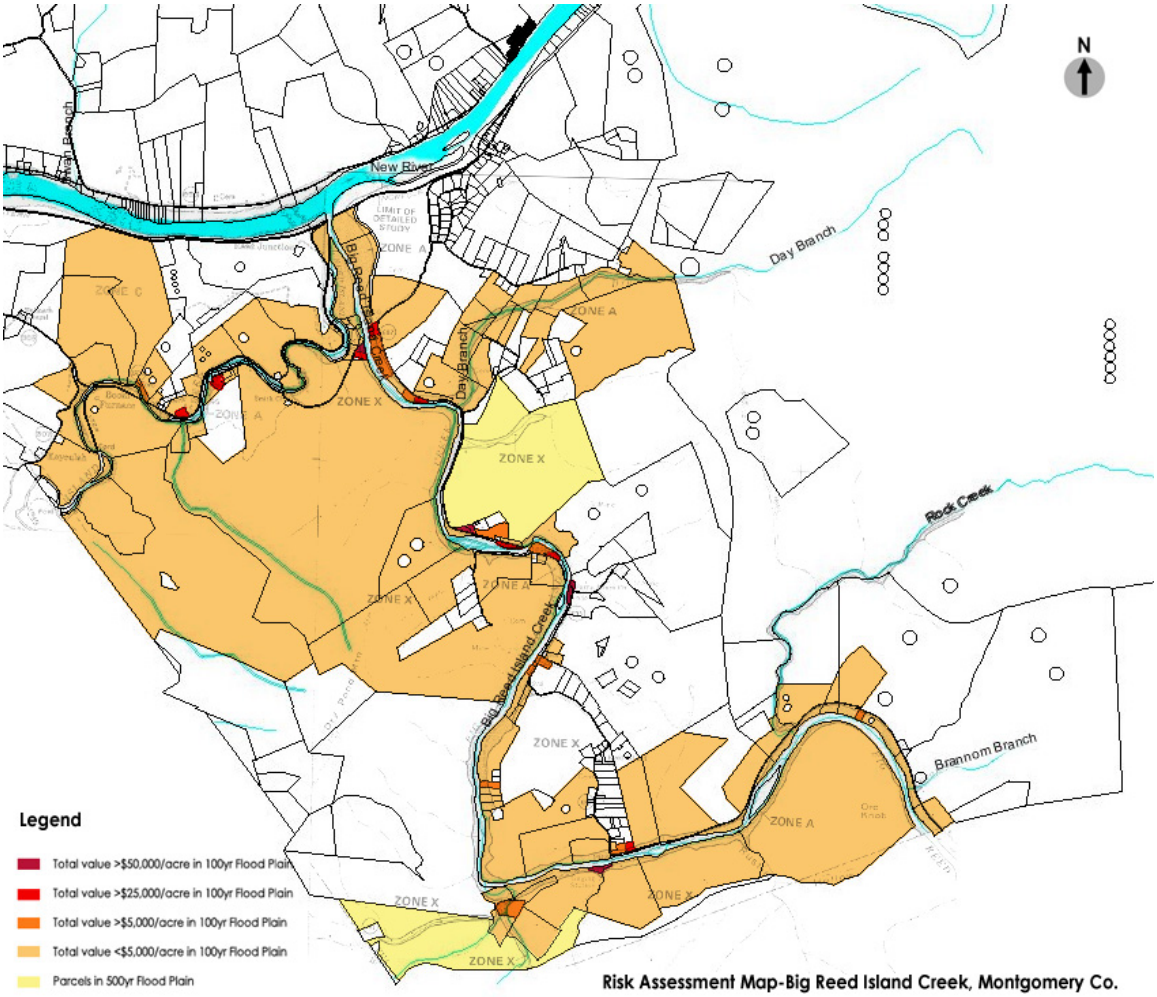
Big Reed Island Area

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.

Risk Assessment and Vulnerability

There appear to be 15 buildings located entirely in the 100-year floodplain, valued at $419,200. Three more parcels with structures are 80-99% in the floodplain. These are valued at $178,400. Figure 30 illustrates the parcels in the 100-year floodplain in the Big Reed Island Creek area by values at-risk per acre.

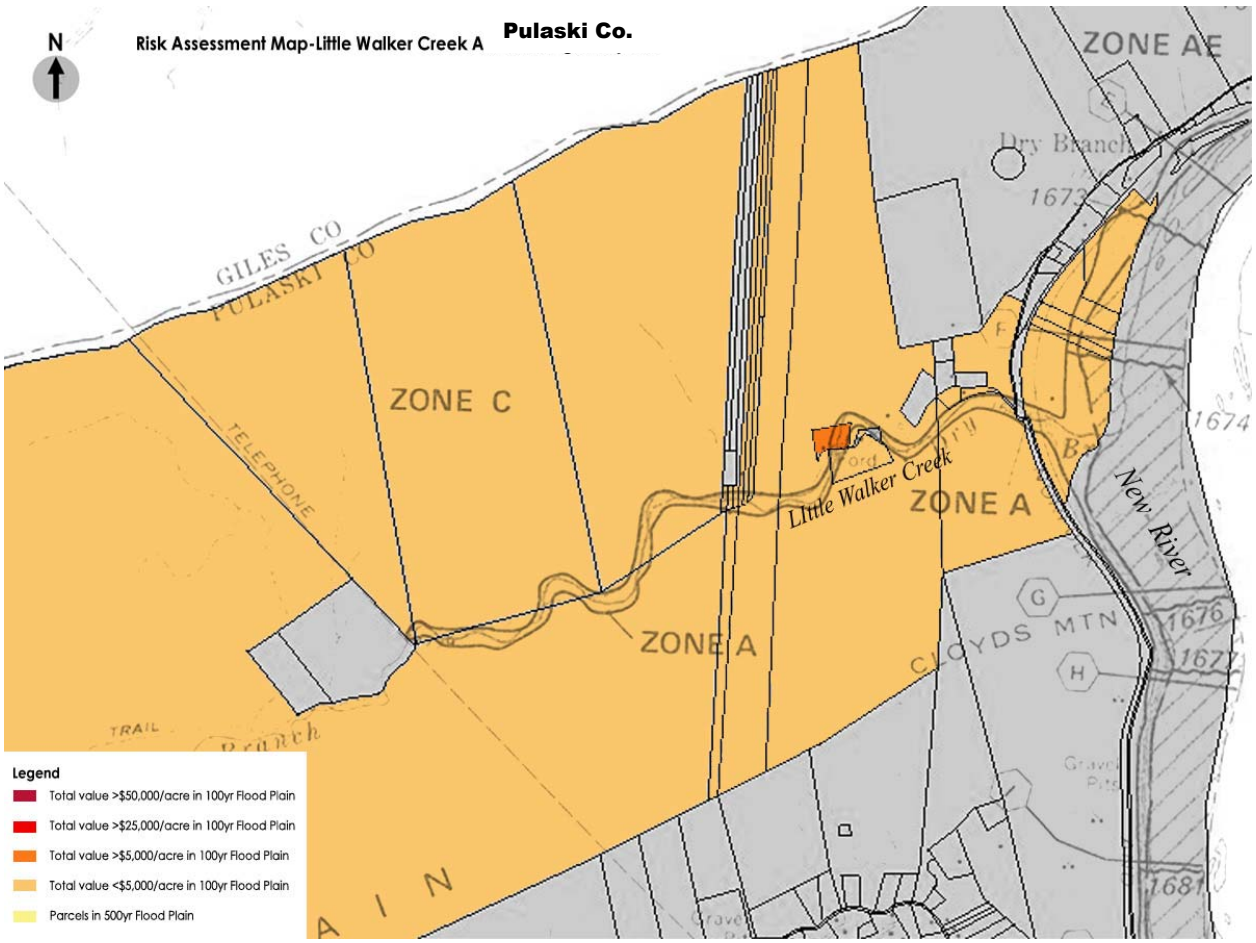
Figure 30
Big Reed Island: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre



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. There appear to be few if any structures located in the floodplain there, as most of the area is farmland (see Figure 31).

Figure 31
Little Walker Creek: Parcels in the 100-Year floodplain by Total Value At-Risk/Acre

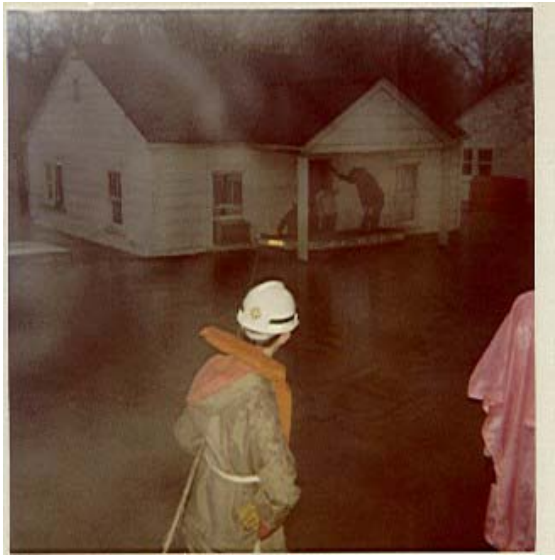


Town of Pulaski

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 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.

Risk Assessment and Vulnerability

The 100-year flood plain 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 flood plain 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 2 commercial establishments were inundated. Since that time, a few of those homes along Dora Highway have been bought out through FEMA and demolished. The Town created its own floodplain overlay map, even though the needed parcel maps are not digitized (therefore, no map here). Town staff did a visual estimate, though, which suggests that in the combined areas, $37.9 million in improvements are located in the 100-year floodplain. These include at least 200 structures. Along the downtown business area, the 100-year flood elevation reaches 1-3 feet into most structures.



During Hurricane Agnes in 1972, residents along Dora Highway in Pulaski had to be rescued by boat. Recently, the Town purchased and removed several of these repeat-loss homes through Hazard Mitigation Grant funding.

Note: 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 National Flood Insurance Map 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.

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.

Risk Assessment and Vulnerability

On that first terrace and entirely in the 100-year floodplain are at least 128 parcels. Unfortunately, the City of Radford does not have electronic data to support tax assessment analysis in relation to the floodplain, so value estimates of structures at-risk are not available. It is believed that few structures are within the New River's 100-year floodplain in Radford, as most of the area is owned by the City and used for recreation.

New River Valley Vulnerability and Risk-Assessment Summary

While the New River Valley has innumerable small areas where flooding affects property, analysis has focused on the several large, populated areas at high-risk for flooding. It is not surprising, then, that many of these high-risk areas are urban or growth areas (compare Figure 9 on page 19 to Figure 32 below.) As the preceding analysis has shown, due to a combination of topography, weather patterns, and locational choices for buildings, roads and bridges, tens of millions of dollars of structures in these areas are very vulnerable to flooding. These areas are shown in Figure 32, with the size of the circle corresponding to the value of structures at risk.

Figure 32
NRV's Large, Populated Areas at High-Risk for Flooding

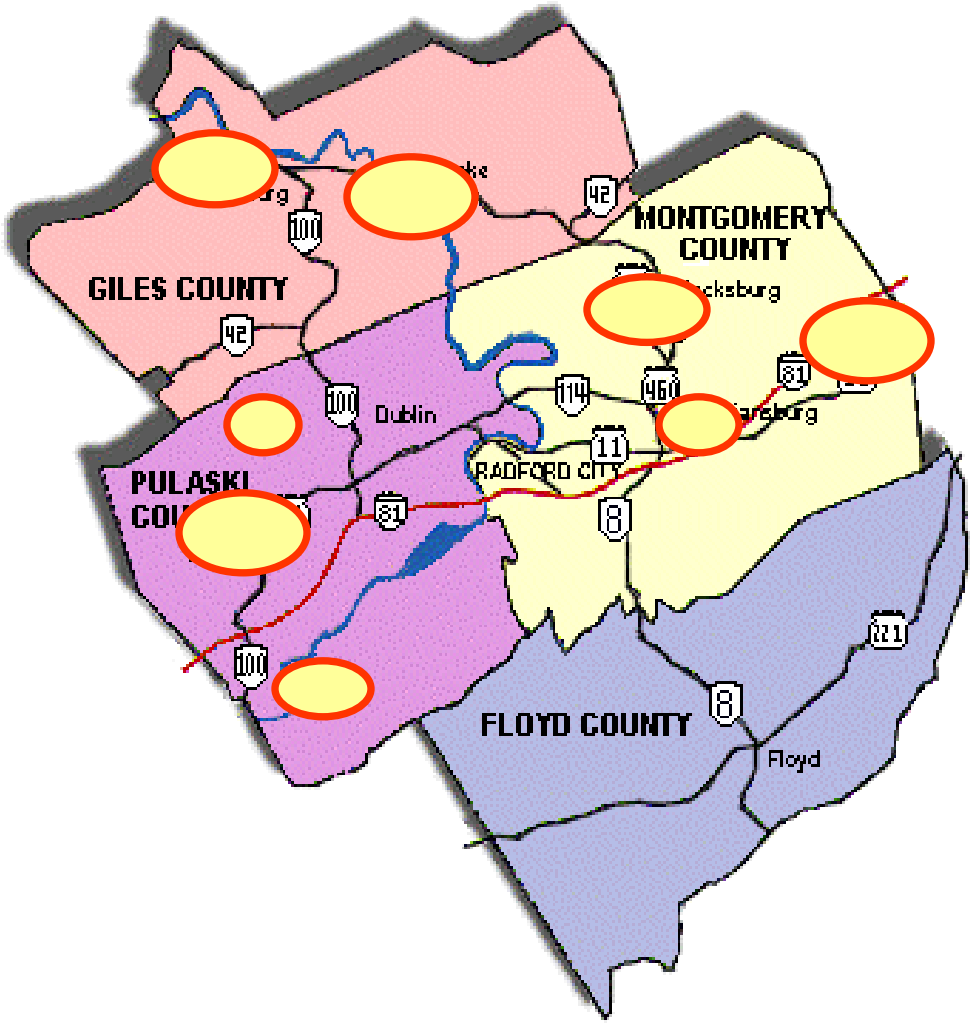


Table 16 shows a summary of high-risk data presented here. As will be discussed later in greater depth, more than $47 million worth of property in the NRV is insured through the National Flood Insurance Program. The value of structures in the large, populated high-risks areas is estimated to be more than $70 million. Unaccounted for here are the additional structures in floodplains in other portions of the Counties. Based on the Town data, which is more comprehensive, it appears 50% or fewer of properties at risk have flood insurance. Consequently, it appears that approximately $100 million in structural improvements in the NRV are at high risk of flooding.

Table 16

Summary of NRV Risk Data

	2002	2002		Structures in Large, Populated High Risk areas*		
Community Name	# NFIP Policies In-force	Insurance In-force	Number of Repetitive Loss Properties	*# Structures*	*Total Value*	
Blacksburg, Town of	13	$2,386,900	2	5	$4,500,000	**
Christiansburg, Town of	20	$2,485,200	1	35	$3,000,000	
Floyd County	12	$822,000	1	no large high hazard areas		
Giles County	50	$3,564,100	2	see Town data in this table		
Montgomery County	151	$15,289,700	7	98	$11,600,000	
Narrows, Town of	17	$2,129,100	0	97	$5,500,000	
Pearisburg, Town of	3	$159,300	1	3	$1,500,000	
Pembroke, Town of	23	$1,879,000	1	46	$5,000,000	
Pulaski County	63	$5,737,900	4	15	$400,000	
Pulaski, Town of	58	$9,186,000	3	200	$37,900,000	
Radford, City of	17	$3,689,600	0	unknown	unknown	
Rich Creek, Town of	39	$390,900	0	1	$3,085,600	
TOTALS	**466**	**$47,719,700**	**22**	**499**	**$72,335,600**	

**Based on cursory tax assessment and flood map review of sub-areas.*

County data does not include incorporated Town data.

**Based on past damage information.

Not Participating: Towns of Dublin and Floyd.

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 two feet 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 (see info below). Another risk is that people get trapped in inaccessible homes.

Above: Giles Co.
Below: Montgomery Co.

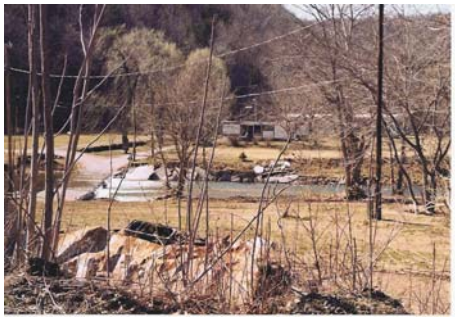


Figure 33

<u>Three dangerous assumptions</u> when you drive into water:

1) **That water isn't strong enough to sweep you away**
2) **That the road/bridge is still there**
3) **That road/bridge is still strong enough to hold your vehicle**

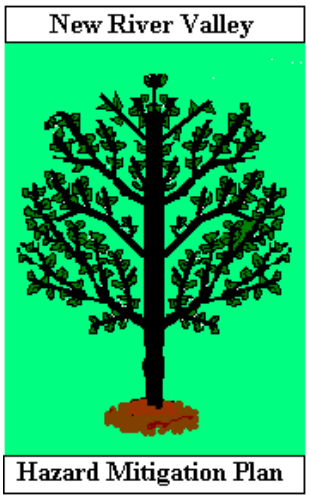
Source: National Weather Service Presentation, 2003

Figure 34
Effects of Shallow Water on Autos

Water weighs 62.4 lbs./cubic foot and typically flows downstream at 6 to 12 miles/hour. When a vehicle stalls in the water, the water momentum is transferred to the car. For every foot the water rises, 500 lbs. Of lateral force are applied to the car. But the biggest factor is buoyancy. For each foot the water rises up the side of the car, the car displaces 1,500 lbs. of water. In effect, the car weighs 1,500 lbs. less for each foot the water rises. TWO FEET OF WATER WILL CARRY AWAY MOST VEHICLES.

Source: Flash Floods and Floods. . . the Awesome Power. National Weather Service.

Flood Mitigation



While the risk to lives and property from flooding are 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. Past and present mitigation activities are discussed next, followed by additional mitigation opportunities.

Past and Present Mitigation

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 National Flood Insurance Program. 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 flood-proofed. 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. See Table 17 for participating localities and policy summary information.

Table 17

National Flood Insurance Policy & Loss Statistics through December 31, 2002

Community Name	2001 # Policies In-force	2002 # Policies In-force	2001 Insurance In-force	2002 Insurance In-force	Total Losses*	Total Payments
Blacksburg, Town of	12	13	$2,162,300.00	$2,386,900.00	5	$1,122.91
Christiansburg, Town of	15	20	$1,818,600.00	$2,485,200.00	1	$20,000.00
Floyd County	14	12	$1,108,400.00	$822,000.00	6	$66,544.67
Giles County	50	50	$3,233,000.00	$3,564,100.00	27	$314,651.26
Montgomery County	133	151	$12,816,300.00	$15,289,700.00	97	$590,968.67
Narrows, Town of	17	17	$2,360,300.00	$2,129,100.00		
Pearisburg, Town of	3	3	$156,600.00	$159,300.00		
Pembroke, Town of	20	23	$1,377,600.00	$1,879,000.00	2	$9,343.28
Pulaski County	65	63	$5,658,200.00	$5,737,900.00	30	$250,538.20
Pulaski, Town of	60	58	$9,148,600.00	$9,186,000.00	13	$41,395.79
Radford, City of	18	17	$3,736,100.00	$3,689,600.00	2	$21,413.89
Rich Creek, Town of	4	6	$228,500.00	$390,900.00		
TOTALS	411	433	$43,804,500	$47,719,700.00	183	$1,315,978.67

**Total Losses and Payments are since program inception.*

Not Participating: Towns of Dublin and Floyd.

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. See Table 18 for a summary. Additional detail is provided below for more active/affected jurisdictions.

Debris fence built by farmer above culvert in Floyd County

Table 18
NRV Localities and Past/Existing Flood Mitigation Measures

Jurisdiction	Substantial High-Risk Area	Participate in NFIP	More Stringent Development Regulation than NFIP	Initiated Additional Studies	Have Completed Fed Mitigation Project	Flood Mitigation Committee	Local Warning System	Mitigation by Non-Gov't Entities
Floyd County	No	Yes	*					Yes
Giles County	Yes	Yes		Yes	Yes			
Montgomery County	Yes	Yes	Yes**	Yes	Yes		developing	Yes
Pulaski County	Yes	Yes		Yes			developing	
City of Radford	Yes	Yes						Yes
Towns								
Blacksburg	Yes	Yes	Yes	Yes			Yes	
Christiansburg	Yes	Yes						
Dublin	unknown	No						
Floyd	No	No						
Glen Lyn	Yes	No						
Narrows	Yes	Yes						
Pearisburg	Yes	Yes		Yes				
Pembroke	Yes	Yes		Yes	Yes	Yes		
Pulaski	Yes	Yes		Yes	Yes	Yes		
Rich Creek	Yes	Yes						

*Floyd County new draft manufactured home park ordinance would not allow new development in floodplains.
**Montgomery County requires that new structures in the floodplain be elevated 1-foot or more above base flood elevation; this is 1 foot higher than the NFIP minimum

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.

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 the Virginia Department of Conservation and Recreation 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.

Montgomery County

Home elevated in the Elliston area by a private citizen.

In the 1980's and 1990's, 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. Also, following the February 2003 presidential disaster declaration, Montgomery County has requested Hazard Mitigation Assistance for several projects identified during this planning process. In addition to local government action, citizens are increasing demonstrating mitigation propensities, including the elevated house shown at right.

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 the Virginia Department of Transportation 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.

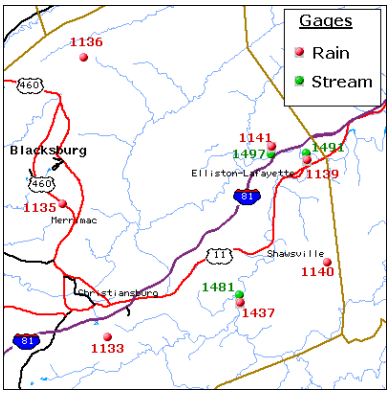
City of Radford

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 insure 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.

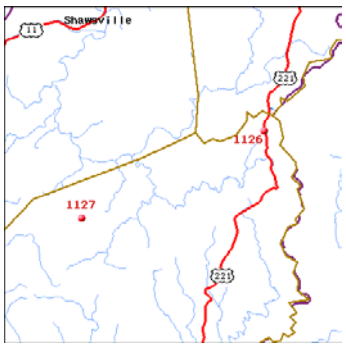
Other Existing Mitigation Programs

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 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. The figures below indicate gauge locations.

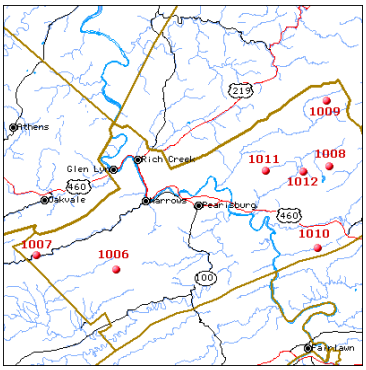
Eastern Montgomery County



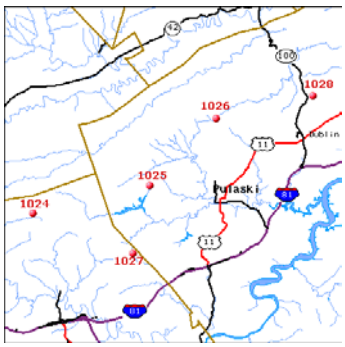
NE Floyd County



Giles County



W Pulaski County



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 Blacksburg Town service, people may choose which the types of events for which they wish to be notified. Montgomery County has a Hazard Mitigation Grant project pending which would provide reverse 911.

Additional Mitigation Opportunities

As discussed earlier, there are many types and variations of flood mitigation activities (see Figure 35). Most have been used to some extent in the New River Valley. Next, regional mitigation needs and themes are addressed. Projects for each jurisdiction will be included on the NRV Mitigation Projects list following in the regional plan summary.

Figure 35: General Flood Mitigation Opportunities in the NRV

•Preventative/legal/policy: Zoning/floodplain management, building code enforcement
•Property Protection: Acquisition, relocating, elevating, retrofitting, insurance
•Emergency Services: Monitoring, warning, rescue capabilities, etc.
•Structures: channels, floodwalls, drainage system maintenance, etc.
•Natural Resource Protection: wetlands, setbacks, best management practices, erosion & sediment control
•Public Information: newsletter, library resources, maps, technical assistance, environmental education

Region-wide

The following represent the key flood mitigation needs and themes for multiple jurisdictions in the New River Valley:

- Pursue flood mitigation opportunities with State and Federal Agencies: which include detailed studies, acquisition, structural projects, demonstration projects
- Review and update ordinances
- Develop/integrate information
  •Flood map modernization
  •GIS layers: floodplains, slopes, tree cover
  •Educate citizens regarding hazards and mitigation, such as flood insurance, retrofitting, natural resource protection, easements

•Early warning mechanisms
• Develop planning models for regional infrastructure and debris management

- Localities should pursue adequate telecommunications capacity and inter-operatibility of communication infrastructure.
- Consider creating Regional Damage-Assessment task force
- Consider creating a Regional Swift Water Rescue Team
- Give highest priority to mitigation activities with multiple benefits, such as conserving natural resources, increasing affordable housing or enhancing economic development

There is opportunity for all jurisdictions, agencies, and non-profits to encourage the activities that have broad sustainability implications. Examples would include planting trees and floodplain protection. See Figures 36 and 37 below for more information. Additional information available in Appendix G.

Figure 36
Value of Trees
From
www.americanforests.com
and Urban Ecosystem Analysis, Roanoke, Virginia 2002

Trees are the oldest and largest living things on the earth, and they are a good measure of the health and quality of our environment. Trees are the original multi-taskers. Trees provide social, ecological, and economic benefits. Their beauty inspires writers and artists, while their leaves and roots clean the air we breathe and the water we drink. . . .

Trees are nature's public utilities or infrastructure:

- *Help retain rainwater, reducing stormwater run-off and increasing groundwater recharge*
- *Improve air quality by natural filtering*
- *Reduce energy consumption by providing shading.*

According to the Urban Ecosystem Analysis in Roanoke, each acre of trees provides the same stormwater retention as $10,000 to $11,000 invested in a stormwater.

Figure 37
Natural Functions of . . .

Floods:
- ✓ Remove streambed sediment, enriching soil , water supplies

Floodplains:
- ✓ Naturally control floods by spreading flood waters over large area; reduce water velocity
- ✓ Act as a buffer, sponge (improve groundwater recharge)
- ✓ Improve water quality by filtering water
- ✓ Provide habitat for plants and animals.
- ✓ During the dry seasons, areas to walk, play, and relax.

•Houston, Jesse. "Flood Hazard Protection." http://www.town.ocean-city.md.us/flood.html

The highest priority properties for future mitigation opportunities are protecting lives, protecting or removing critical facilities in high-risk areas, and addressing repetitive loss properties. There are at least 30,000 people living, working and driving in this high-risk areas. Critical facilities located in floodplains include:

- Wastewater treatment plants in Giles and Montgomery Counties
- A school in Montgomery County
- Town offices in Pulaski and Narrows

Table 19 lists the community location of each repetitive loss property in the NRV. Note the actual property addresses were suppressed to protect privacy. Also note, the address were so old or incomplete, the properties could not be mapped.

Table 19

Number of Repetitive Loss Properties By County

County	# of Repetitive Loss Properties
Floyd	1
Giles	4
Montgomery	10
Pulaski	7
TOTAL NRV	**22**

Source: FEMA, 2003.