George Washington Regional Commission

2012 Hazard Mitigation Plan Update

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George Washington Regional Commission
2012 Hazard Mitigation Plan Update

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CONTENTS

Acknowledgements v

Executive Summary vi

Chapter 1 – Introduction 1-1
- I. Scope 1-1
- II. How To Use This Document 1-2
- III. The Planning Commission 1-2

Chapter 2 – Regional Profile 2-1
- I. Location and Geography 2-1
- II. Population 2-4
- III. History of the GWRC Region 2-5

Chapter 3 – The Planning Process 3-1
- I. Local Government / Community Participation 3-2
- II. Step 1: Get Organized – Building the Planning Team 3-2
- III. Step 2: Plan for Public Involvement – Engaging the Public 3-2
- IV. Step 3a: Coordinate with other Departments and Agencies 3-4
- V. Step 3b: Relationship to Other Community Planning Efforts and Hazard Mitigation Activities 3-5
- VI. Step 4: Assess the Hazard 3-5
- VII. Step 5: Assess the Problem 3-6
- VIII. Step 6: Set Planning Goals 3-6
- IX. Step 7: Review Possible Mitigation Activities 3-7
- X. Step 8: Draft an Action Plan 3-7
- XI. Step 9: Adopt the Plan 3-7
- XII. Step 10: Implement the Plan, Evaluate its Worth, Revise as Needed 3-7

Chapter 4 – Hazard Identification and Risk Assessment (HIRA) 4-1
- I. Regional Hazard Identification 4-2
  - A. Dam Failure 4-3
  - B. Drought & Extreme Heat 4-6
  - C. Wildfires 4-12
  - D. Earthquakes 4-13
  - E. Sinkholes & Landslides 4-18
  - F. Flooding & Erosion 4-20
  - G. Hurricanes & Thunderstorms 4-22
  - H. Tornadoes 4-28
  - I. Winter Storms & Nor'easters 4-30
  - J. Multi-Hazard Correlation 4-35
  - K. Critical vs. Non-Critical Hazards 4-35
  - L. Probability of Occurrences 4-35
- II. Region Specific Hazard Identification 4-37
  - A. Caroline County 4-37
  - B. Town of Bowling Green 4-37
  - C. Town of Port Royal 4-37

D. City of Fredericksburg 4-55
E. King George County 4-64
F. Spotsylvania County 4-79
G. Stafford County 4-99

Chapter 5 – Vulnerability Assessment 5-1
I. Regional Vulnerability Assessment 5-1
A. Drought 5-1
B. Non-Rotational Wind, Winter Storms, and Tornadoes 5-2
C. Hurricane Regional Vulnerability Assessment 5-2
D. Regional Severe Storm Vulnerability 5-4
E. Tornado Vulnerability 5-4
F. Regional Flood Vulnerability 5-5
G. Regional Wildfire Vulnerability 5-7
II. Region Specific Vulnerability Assessment 5-18
A. Caroline County 5-19
B. Town of Bowling Green 5-20
C. Town of Port Royal 5-20
D. City of Fredericksburg 5-33
E. King George County 5-45
F. Spotsylvania County 5-62
G. Stafford County 5-76

Chapter 6 – Capability Assessment 6-1
I. Regional Capability Assessment 6-1
A. Federal Capabilities 6-3
B. State Capabilities 6-6
C. Regional Capabilities 6-10
II. Jurisdiction Capability Assessment 6-14
A. Caroline County 6-14
B. Town of Bowling Green 6-14
C. Town of Port Royal 6-14
D. City of Fredericksburg 6-20
E. King George County 6-23
F. Spotsylvania County 6-26
G. Stafford County 6-29

Chapter 7 – Mitigation Strategy 7-1
I. Planning Process 7-1
II. Mitigation Alternatives 7-2
A. Identification and Analysis of Mitigation Techniques 7-2
B. Prioritizing Alternatives 7-4
III. Goals, Objectives and Strategies 7-6
A. Goals and Strategies 7-6
B. Regional Goals, Objectives and Strategies 7-6
C. Local Mitigation Strategies 7-9

Chapter 8 – Monitoring, Evaluation, and Update 8-1
I. Adoption 8-1
II. Implementation 8-1
III. Integration 8-1
IV. Public Involvement 8-2
V. Monitoring and Maintenance 8-3

Appendix A – Adoption Resolution ..... A

Appendix B – Crosswalk ..... B

Appendix C – Meeting Materials C

Appendix D – 2006 Strategy Update ..... D

Appendix E – Public Outreach ..... E

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ACKNOWLEDGEMENTS

The George Washington Regional Commission (GWRC) would like to acknowledge the participation and service of the local and regional representatives that assisted with the development of this plan. A Mitigation Advisory Committee (MAC) was utilized to facilitate the plan's development. The MAC comprised of GWRC staff, local emergency management staff, and local planning staff. These staff provided day-to-day plan development guidance and draft review. GWRC Director of Regional Planning & Regional Demographer, Kevin Byrnes, facilitated the development of each committee. The Mitigation Advisory Committee was as follows:

Table i-1. MAC Committee Members

Name	Jurisdiction	Department/Agency
Eddie Allen	City of Fredericksburg	Fredericksburg Fire Department
Doug Boggs	Spotsylvania County	Spotsylvania County Fire/Rescue/ Emergency Services
Kevin Byrnes	George Washington Regional Commission	George Washington Regional Commission
Michael Carter	Stafford County	Stafford County Fire/Rescue
Mike Finchum	Caroline County	Caroline County Planning
Mark Garnett	Caroline County	Caroline County Fire & Rescue
Amy Howard	Virginia Department of Emergency Management	VDEM/Recovery & Mitigation
David Layman	Caroline County	Caroline County Fire Dept
Steve Lynd	King George County	King George Fire/Rescue/Emergency Services
Paul Lupe	Stafford County	Stafford County Fire/Rescue
Wanda Parrish	Spotsylvania County	Spotsylvania County Planning Department
Bruce Sterling	Virginia Department of Emergency Management	VDEM/Region 2
Stephen Manster	Town of Bowling Green	Mayor's Office
Alex Long	Town of Port Royal	Town of Port Royal

EXECUTIVE SUMMARY

The region represented by the George Washington Regional Commission (GWRC) is vulnerable to a number of natural hazards including the effects of flood and wind damage caused by hurricanes, northeasters, winter storms, and tornadoes. Fresh in the minds of the residents of the GWRC region is the recent natural disasters including Hurricane Irene, Tropical Storm Lee, the Mineral VA, Earthquake, and the snowstorms of 2009 and 2010. Other major disasters include Hurricane Isabel, which hit in September of 2003.

For the most part, the last 50 years have been relatively free of disasters throughout the GWRC region. However, the last few decades of exponential growth within the region have placed more development in the way of potential disasters. This increases the potential for severe economic and social consequences if a major disaster or other catastrophic event were to occur. Such an event could cost the town, city, and county governments, residents, and businesses millions of dollars in damages to public buildings and infrastructure, lost tax revenues, unemployment, homelessness, and emotional and physical suffering for many years to come.

The GWRC Hazard Mitigation Plan has been constructed in accordance with the requirements of the Disaster Mitigation Act of 2000 (DMA 2000) and will provide the communities and its citizens with a better understanding of the natural hazards the communities face, the assets vulnerable to those hazards, and the strategies available to mitigate those hazards. The plan will also help the communities build support for mitigation activities, develop more effective public education policies regarding mitigation and disasters, integrate mitigation processes into other community programs and processes and post-disaster recovery activities, and obtain disaster related grants in the aftermath of a disaster.

As part of the 2006 planning initiative and the 2012 update, the MAC analyzed and prioritized the natural hazards that threaten the GWRC region. The Plan focuses on the hazards that have the highest probability of occurring. The MAC considered and analyzed the potential impacts of these hazards, which were listed in the Plan's Vulnerability Assessment section. The MAC also evaluated current capabilities in mitigating certain types of hazards; this evaluation went into the Capability Assessment section of the plan. The Hazard Identification (Chapter 4), Vulnerability Assessment (Chapter 5), and the Capability Assessment (Chapter 6) were reviewed by the MAC, which then assembled to develop goals, objectives, and possible mitigation strategies. With the developed list of mitigation strategies, the Committee prioritized those strategies and made recommendations as to the actions that would be appropriate given the potential strategies. This process formed the basis for this Mitigation Plan Update.

Table i-2 lists those communities to which this plan update applies.

Table i-2. 2012 Participating Communities

2012 Plan
City of Fredericksburg
Town of Bowling Green
Town of Port Royal
Caroline County
King George County
Spotsylvania County
Stafford County

CHAPTER 1 - INTRODUCTION

The Disaster Mitigation Act of 2000 (DMA 2000), approved by Congress and signed into law (Public Law 106-390) in October 2000, is a key component of the Federal government's strategy to reduce the rising cost of disasters in the United States. The Act establishes the Pre-Disaster Mitigation Program (PDM) and new requirements for the post-disaster Hazard Mitigation Grant Program (HMGP). The Act's requirements emphasize the importance of mitigation planning at the local level.

In an effort to highlight the importance of planning in the mitigation process, DMA 2000 requires local governments to develop and submit natural hazard mitigation plans in order to qualify for PDM and HMGP grant funding. Specifically, the Act requires that the plan demonstrate "a jurisdiction's commitment to reduce risk from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards." The final plan must be adopted by the jurisdiction and then approved by the Federal Emergency Management Agency (FEMA) in order for communities to remain eligible for HMGP funding and to become eligible for PDM funding for future mitigation planning and project implementation.

In order to facilitate DMA 2000 compliance for its member jurisdictions (including the two towns), the George Washington Regional Commission (GWRC), in conjunction with its member jurisdictions and other regional agencies and area constituents, developed this Mitigation Plan Update pursuant to the requirements of DMA 2000. This plan covers natural hazards only.

Each of the chapters have been updated to reflect new information and strategies for the 2012 update. Changes include updates to the hazards that have occurred, review and revision of current capabilities, review and update of the previous plan's mitigation strategies, as well as reconsideration of the region's mitigation goals and strategies.

Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to human life and property from hazards. Planning is the process of setting goals, developing strategies, and outlining tasks and schedules to accomplish these goals. In preparing this plan, the MAC identified natural hazards that threaten its member jurisdictions; ranked these hazards; determined the likely impacts of those hazards; assessed the vulnerability of its communities to the studied hazards, as well as the region's current capability to address those hazards; set mitigation goals; and determined and prioritized appropriate strategies that would lessen the potential impacts of hazard events.

I. Scope

The GWRC Hazard Mitigation Plan is a multi-jurisdictional plan that identifies goals, information, and measures for hazard mitigation and risk reduction to make its communities more disaster resistant and contribute to the region's long-term sustainability. The plan not only addresses current concerns, but will also guide and coordinate mitigation activities and local policy decisions for future land use. FEMA has encouraged communities throughout the United States to incorporate hazard mitigation planning into the local comprehensive planning process through the development of local and regional hazard mitigation plans. As communities make decisions on future growth, development, and land use, the incorporation of hazard mitigation analysis into the process promises to reduce future damages from the natural hazards that will inevitably occur over time, and thus avoid future loss of life and property damage.

This Plan follows FEMA's DMA 2000 planning requirements and associated guidance for developing Local Hazard Mitigation Plans. This guidance sets forth a four-task mitigation planning process: 1) organize resources, 2) assess hazards and risks, 3) develop a mitigation plan, and 4) evaluate your work. The plan also utilizes the process set forth in FEMA's Crosswalk Reference Document for Review and Submission of Local Mitigation Plans.

II. How to Use This Document

The GWRC Hazard Mitigation Plan has been developed as a regional mitigation plan. Each jurisdiction-specific section has been designed to allow for each jurisdiction's review and acceptance, independent of the material in the remainder of the plan that applies to the entire region.

Chapter 4, Section I of this plan identifies each of the natural hazards that the region faces and provides some background and descriptive history of the hazards across the GWRC region. Chapter 4, Section II provides jurisdiction-specific profiles of the hazards that are considered most critical. The Region's vulnerability to those hazards based on historical occurrence and other evidence of risk is assessed in Chapter 5, Section I. Jurisdiction specific vulnerabilities are provided in Chapter 5, Section II. Jurisdiction-specific capability assessments, designed to demonstrate the mitigation tools and capabilities that each jurisdiction may employ, is presented in Chapter 6. Chapter 7 of the plan outlines broad, region-wide mitigation goals, objectives, and strategies, while also providing jurisdiction-specific mitigation goals, objectives, and strategies. Finally, Chapter 8 provides plan implementation and maintenance information that applies across the region as each community updates its material in this plan and implements mitigation projects that follow the priorities and objectives set forth in this planning effort.

Of note, each jurisdiction's elected leadership will be asked to adopt the portions of the plan that apply region-wide and those portions that apply specifically to each respective jurisdiction. Each jurisdiction will then be responsible for updating and maintaining the plan document. The DMA regulations require that the jurisdictions formally review their plans at least once every five years, coinciding with specifications in the Code of Virginia that call for local Comprehensive Plan review at least every five years. Many communities across the country that have developed hazard mitigation plans have found that more frequent updates are often warranted based on the occurrence of natural disasters and subsequent shifts in hazard mitigation priorities. For more information on plan monitoring and updating procedures, please refer to Chapter 8.

III. The Planning Commission

Participation in this plan update remained identical to that of the original 2006 plan. Table 1-1 lists those communities to which this plan update applies.

Table 1-1. 2012 Participating Communities

2012 Plan
City of Fredericksburg
Town of Bowling Green
Town of Port Royal
Caroline County
King George County
Spotsylvania County
Stafford County

CHAPTER 2 - REGIONAL PROFILE

The data and statistics in this section were updated to include the 2010 Census information for the 2012 plan update.

I. Location and Geography

The GWRC region, centered around the City of Fredericksburg, is located in northeastern Virginia and includes the Towns of Port Royal and Bowling Green, the City of Fredericksburg, and the Counties of Caroline, King George, Spotsylvania and Stafford (Figure 2-1). Neighboring communities are presented in Figure 2-2. The 1,410 square mile region surrounds the fall line of the Rappahannock River, the transitional area from the Virginia Northern Piedmont eastward into the Virginia Coastal Plain.

The GWRC region has been Virginia's fastest growing region for nearly three decades. In 2010, the population of the area was more than 325,000 persons. In 2001, the population of the area was approximately 250,000. Regional population and economic growth is due, in part, to the region's relative proximity to the Washington, D.C area. The City of Fredericksburg, along with Stafford and Spotsylvania Counties, are part of the Washington D.C. Primary Metropolitan Statistical Area (PMSA), a variation on the traditional Metropolitan Statistical Area (MSA) designation that the U.S. Census Bureau instituted 1993. Caroline County (and the Towns of Bowling Green and Port Royal) is part of the Richmond, VA Metropolitan Statistical Area (MSA). Despite its rapid growth, the GWRC region continues to retain a special character and offer high quality of life by offering residents a lower cost of living relative to other portions of the Washington, D.C. area along with a strong, local economic base and a variety of cultural and recreational opportunities.

Interstate 95 follows the fall line that divides the GWRC region into two distinct physiographic regions, the Northern Piedmont and the Coastal Plains. The Piedmont is a rolling to hilly landscape comprising the western portions of Spotsylvania and Stafford Counties. The level Coastal Plain covers sections of eastern Spotsylvania and Stafford Counties, the majority of Caroline County and the Towns of Bowling Green & Port Royal, and the entirety of King George County.

The GWRC region contains portions of three major Virginia riverine watersheds: the Potomac, the Rappahannock, and the York. The upper reaches of each watershed are typical Piedmont uplands with streams and rivers flowing across the fall line on their way to the Chesapeake Bay. Tidal marshes and flats are common throughout the lower portions of the major Chesapeake Bay tributaries.

There are several predominant soil types found within the Region. Because the area covers several major physiographic regions, each has a different set of soil characteristics and properties. The red and yellow clays of the Piedmont uplands are predominant in the western portions of the region, giving way to the sandy loam and sandy clay loams of the coastal plain towards the east. The intermediate fall line zone has a combination of both soil types.

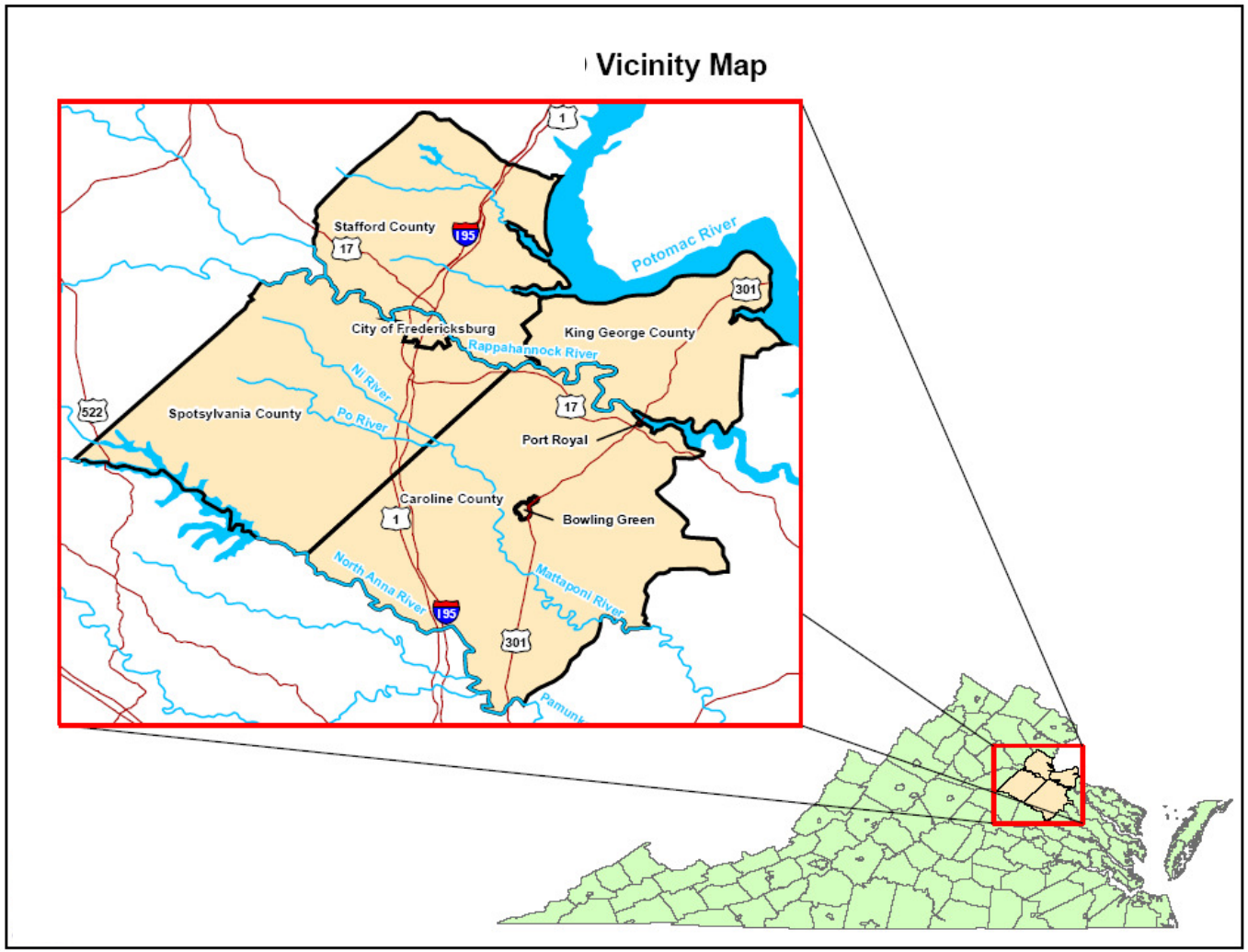

Figure 2-1. GWRC Vicinity Map.

Figure 2-2. GWRC Neighboring Communities.

II. Population

As previously mentioned, the GWRC region has been Virginia's fastest growing region for almost 30 years. Between the 1990 and 2000 Census counts, the region grew by over 41 percent; the Region's growth rate from 2000-2010 slowed somewhat to 35.98%. (see Table 2-1).

Table 2-1. Regional Population Statistics.

Jurisdiction	1990 Census	2000 Census	Percent Change '90 – '00	2010 Census	'00 – '10 % Change	Projected 2020	'10 – '20 % Change
Caroline County	19,217	22,121	15.1%	28,545	29.04%	34,867	22.15%
Town of Bowling Green	727	936	28.7%	1,111	18.70%	1,250	12.51%
Town of Port Royal	204	184	-9.8%	126	-31.52%	110	-12.70%
City of Fredericksburg	19,027	19,279	1.3%	24,286	25.97%	27,163	11.85%
King George County	13,527	16,803	24.2%	23,584	40.36%	30,234	28.20%
Spotsylvania County	57,403	90,395	57.5%	122,397	35.40%	161,473	31.93%
Stafford County	61,236	92,446	51%	128,961	39.50%	169,778	31.65%
PD 16 Regional Total	**170,410**	**241,044**	**41.4%**	**327,773**	**35.98%**	**423,515**	**29.21%**

Source: U.S. Bureau of Census, 1990, 2000, and 2010 Summary Tape File (SF-1), Table P001 found at www.census.gov.
Projections from GWRC/FAMPO Draft 2040 Long-Range Constrained Transportation Plan Update, 2011.

The GWRC region's dynamic growth the past three decades is due, in part, to its strategic location overlapping both the Washington D.C. and Richmond, VA metropolitan areas and multi-modal transportation access to the U.S. eastern seaboard. The region, located in the heart of Virginia's "urban crescent", is centrally located between Washington, D.C. to the north and the Virginia state capital in Richmond, to the south. This has proven to be a profitable location for a wide range of national and international companies. Continued regional economic growth is projected for the region (see Table 2.2), which, along with the Region's competitive location between the Washington and Richmond MSAs, will bring continued population growth (see Table 2.1).

Table 2-2. Regional Employment Estimates and Projections, 2010 – 2020.

NAICS Code	Description	2010 Jobs	2020 Jobs	2010-2020 Change	2010-2020 % Change	2011 Avg. Annual Wage	2011 Establishments
11	Agriculture, Forestry, Fishing and Hunting	1,441	1,311	-130	-9%	$16,569	32
21	Mining, Quarrying, and Oil and Gas Extraction	299	314	15	5%	$38,160	9
22	Utilities	312	334	22	7%	$109,307	11
23	Construction	9,234	10,245	1,011	11%	$43,585	965
31-33	Manufacturing	2,789	2,718	-71	3%	$53,521	169
42	Wholesale Trade	4,057	4,267	210	5%	$55,869	343
44-45	Retail Trade	18,868	20,271	1,403	7%	$28,244	941

48-49	Transportation and Warehousing	4,446	4,589	143	3%	$46,900	229
51	Information	1,812	1,936	124	7%	$51,363	107
52	Finance and Insurance	8,514	10,218	1,704	20%	$68,862	341
53	Real Estate and Rental and Leasing	6,896	8,878	1,982	29%	$18,109	294
54	Professional, Scientific, and Technical Services	11,645	15,435	3,790	33%	$73,235	971
55	Management of Companies and Enterprises	1,205	1,275	70	6%	$70,090	54
56	Administrative, Support and Waste Management & Remediation Services	6,444	7,970	1,526	24%	$26,204	380
61	Educational Services	1,983	2,625	642	32%	$23,501	92
62	Health Care and Social Assistance	14,966	19,940	4,974	33%	$49,562	1,179
71	Arts, Entertainment, and Recreation	2,879	3,159	280	10%	$11,389	89
72	Accommodation and Food Services	11,575	13,394	1,819	16%	$17,224	581
81	Other Services (except Public Administration)	7,342	8,609	1,267	17%	$27,769	673
90	Government	27,765	31,018	3,253	12%	$84,340	263
	Total	**144,472**	**168,506**	**24,034**	**17%**	**$48,761**	**7,723**

Source: EMSI Complete Employment - 2011.4

III. History of the GWRC Region

Caroline County

Caroline County was created in 1727 through the division of portions of King William, King and Queen, and Essex Counties. Caroline County was named for Caroline, the wife of King George II of England. Like each of the GWRC jurisdictions, Caroline County holds a wide variety of both Virginian and American history. Among its most notable historical figures, the County claims George Rogers Clark as a native son. Clark, along with Merriweather Lewis and the Corps of Discovery, opened the newly purchased Louisiana territory in 1803-1804. Clark's, manservant, York, one of the more highly acclaimed members of the Corps of Discovery was also a Caroline County native.

During the Civil War, more than one million men marched or camped in Caroline County. Confederate troops, under the command of General George E. Pickett fought Union troops near Milford in 1864. Confederate General Stonewall Jackson died in Guinea after mistakenly being shot by his Confederate troops at Chancellorsville. John Wilkes Booth, the assassin of President Lincoln, was allegedly shot by federal troops in Caroline County.

Caroline County covers roughly 549 square miles and remains primarily rural. The County has two incorporated towns: Bowling Green, the County seat; and the historic Town of Port Royal. The County also hosts the United States Army's Fort A.P. Hill, which operates under its own jurisdiction. The Fort is a 76,000 acre installation that provides year round administrative and logistical support and training for the U.S. Army's Active Army, reserves, and other branches of the military and the U.S. Government. Caroline County is located within 30 miles of the City of Richmond, Virginia.

Town of Bowling Green

The Town of Bowling Green, with a population of 1023, has been the County seat of Caroline County since 1803. It is located 72 miles south of Washington, D.C., 108 miles southeast of Baltimore, Maryland and 35 miles north of Virginia's Capital, Richmond. The Town traces its origins back to the 1670's, when Major John Hoomes established his "Bowling Green" plantation under charter from the English Crown. The Town's history includes three centuries of colonial and modern Virginia development. The Town has hosted such notable historical figures as George Washington and the Marquis de Lafayette. Union General Ulysses S. Grant occupied Bowling Green during the Civil War (1864) and John Wilkes Booth, assassin of President Abraham Lincoln, was apprehended in a farmhouse near the town in 1865. Bowling Green has a well-documented historic district highlighted by the Bowling Green Farm, a brick dwelling that dates back to the 17th Century.

Town of Port Royal

The Town of Port Royal was settled in 1652 when John Catlett and his half brother, Ralph Rowzee patented 400 acres. The Town was once the only chartered town in Caroline County, and is the County's oldest incorporated town. An important colonial shipping port for tobacco to Britain, it later served as a warehouse center and mover of grain, freight, and passengers on three-masted schooners. Traces of this colorful past can still be found today in the historic Town of Port Royal, which is listed in its entirety on the National Register of Historic Places.

City of Fredericksburg

Fredericksburg is an independent city situated along the Rappahannock River and bordered by Spotsylvania and Stafford Counties. The City was founded in 1728 and named after Prince Frederick Louis of Wales, the father of King George III of England. Fredericksburg was incorporated as a town in 1781 and became an independent city in 1879. The historic part of the city itself only covers 40 square blocks, but the City of Fredericksburg encompasses 10 square miles. The historic district has over 350 original buildings built before 1870. The Fredericksburg area was the boyhood home of young George Washington, James Monroe practiced law here, and Thomas Jefferson also lived in the City. Many Civil War battles were fought in or near the City, including the Battle of Fredericksburg in 1862. The City changed hands between the Union and Confederate Armies on several occasions.

The City of Fredericksburg is located just one hour south of Washington D.C. and 45 minutes north of the City of Richmond. Though the City itself only covers approximately 10 square miles, growth and development have occurred in the urbanizing areas surrounding the City. Fredericksburg is closely linked to Stafford and Spotsylvania Counties both of which spread out many miles in all directions. The Fredericksburg, Spotsylvania, and Stafford area is one of the fastest-growing areas in the Commonwealth and is one of the top 20 in the nation.

King George County

King George County, named for King George I of England, was formed in 1720 from Richmond County. Known as the "Gateway to the Northern Neck," King George County is home to 23,584 (2010 Census) citizens. Like the other jurisdictions in the region, King George County's roots are deeply imbedded in both the founding of the country and in its rural past. The County is a little over 183 square miles (113,920 acres), of which 72,718 acres are forested, and 38,105 acres are agricultural. Both the Potomac and the Rappahannock Rivers border the County. The County's location, near both the

Washington and Fredericksburg urban areas, and the serenity of Virginia's scenic Northern Neck offer a unique and vivid perspective of an emerging Virginia. Among the County's claims to fame, King George is home to St. Paul's Episcopal Church where George Washington attended services as a youth and where James Madison, the Country's fourth president, was born. Agriculture continues to be an economic anchor in King George County, but because of the County's proximity to the Washington D.C. and Fredericksburg areas and its two major thoroughfares (State Route 3 and U.S. Route 301), a growing state of the art fiber optics and telecommunications network is developing in the County. King George County is also the host community to one of the world's premier research and development centers, the Naval Surface Warfare Center at Dahlgren, the region's largest employer.

Spotsylvania County

Spotsylvania County, named after Alexander Spotswood, Colonial Governor of Virginia, was formed in 1721 and has played host to a wide variety of Virginia's history. Much of Spotsylvania County's early development is attributed to Spotswood's ironworks founded in the early 1700's. Spotswood's "Iron Mines Company," a mining and smelting operation, was founded in 1725 at Germanna. This was the first fully equipped iron furnace in the colonies and was Spotsylvania County's first industry. A blast furnace, also founded by Spotswood, was operated in this area from 1730 through 1785. Remnants of the ironworks are still found in the County. Under Spotswood's resourceful leadership, a road network for transporting the iron was laid out, and skilled laborers to build the roads were imported from Germany. Upon his death in 1740, Spotswood left behind a nearly self-sufficient iron empire that set in motion the rise of America's iron and steel industry. Spotswood's furnace was acquired in 1842 by the United States Government, which set up a forge and foundries. Here, the government made hundreds of cannons to supply the army in the Mexican War. At that time, it was one of the most important cannon works in the country.

Four major Civil War battles were fought on Spotsylvania County soils, including one of the bloodiest of the war, the Battle of Spotsylvania Court House in May 1864. Here the armies of Ulysses S. Grant and Robert E. Lee participated in one of the most intense clashes in American history: the Union attack on the Confederate-held "Bloody Angle." This battle marked the beginning of the fall of the Confederacy. It was in Spotsylvania County, at the Battle of Chancellorsville, that Stonewall Jackson fell to the misguided fire of his own men. The National Park Service maintains more than 4,400 acres of the Civil War battlefields in various locations throughout Spotsylvania County.

Stafford County

Like each of the jurisdictions in the GWRC region, Stafford County has been home to a wide variety of Virginia's history. Captain John Smith explored the Chesapeake Bay region from Jamestown to present-day Stafford. The legendary Indian princess, Pocahontas, was kidnapped from Stafford's Marlborough Point. The Brents of Maryland established the first English Catholic settlement in Virginia, on Aquia Creek, and opened it to all faiths. All of this took place before Stafford County was formally established in 1664.

Stafford's fisheries, tobacco plantations, iron works and flourmills were major suppliers of Great Britain in the Colonial period. George Washington and George Mason lived in Stafford as youngsters. James Hunter's Iron Works was one of the major industrial plants in the Revolutionary era and supplied the colonial army with arms in its fight for independence. Aquia sandstone provided stone for the White House, the U.S. Capitol, and trim for private homes. In addition, Stafford's Anthony Burns was the subject of America's first major fugitive slave case.

During the Civil War, the bloody Battle of Fredericksburg took place across the banks of the Rappahannock River in December 1862. Chatham Manor, in Stafford County, was used as the Union headquarters and a hospital to treat the wounded. It was in Stafford, the next spring that Union General Hooker bogged down his army on the famous "Mud March," on his way to another Union defeat at the Battle of Chancellorsville.

The citizens of Stafford might have been the first in the world to suffer the devastating effects of a modern war, having hosted the entire Union Army from 1862-1863. Over 125,000 men (more than today's County population) had to be housed, fed, warmed and entertained, straining the County's resources to the point of collapse.

Prosperity did not return until World War I when the U.S. Marine Corps came to Quantico. At that time, the County was primarily agricultural, with the exception of fishing industries situated along the Potomac River. In World War II, the wide expansion of the Marine Corps base created new employment opportunities. A Civilian Conservation Corps camp was located in Southern Stafford during this time.

With the completion of I-95 in the 1960's and the recent addition of commuter rail, Stafford is one of Virginia's fastest growing localities.

CHAPTER 3 - THE PLANNING PROCESS

For the 2012 update, the GWRC retained Dewberry and Davis, LLC to assist with the facilitation and overall compilation of the region's Mitigation Plan Update. Dewberry staff, a combination of professional mitigation experts, planners, and engineers, assisted GWRC with the following tasks/processes:

- Establishment of a MAC to assist with the organization and development of the GWRC -Hazard Mitigation Plan Update;
- Fulfillment of all DMA requirements as established by federal regulations, following FEMA's planning guidance;
- Facilitation of the planning process;
- Identification of the data requirements and documentation necessary to augment that data;
- Development and facilitation of the public input process, coordinated by the sub-consultant, Spangler Erkert & Associates;
- Production of the draft and final plan documents; and
- Submission for acceptance by the Virginia Department of Emergency Management (VDEM) and FEMA Region III.

GWRC utilized the DMA2K planning requirements and FEMA's associated guidance during the update of this plan. This guidance is structured around a broad, four-phase approach. The planning process incorporated another 10-step planning process that satisfies the planning requirements of several other federal programs, including FEMA's Flood Mitigation Assistance (FMA) program and flood control projects authorized by the U.S. Army Corps of Engineers. The process employed in this plan assisted the MAC with planning for the mitigation of natural hazards, using the steps presented in Table 3-1 below.

Table 3-1. DMA and FMA Planning Cross Reference.

Disaster Mitigation Act Planning Regulations (44 *CFR* 201.6)	FMA Planning Steps
1.0 Planning Process	
201.6(c)(1)	1. Get Organized
201.6(b)(1)	2. Plan for Public Involvement
201.6(b)(2) & (3)	3. Coordinate with other Departments and Agencies
2.0 Risk Assessment	
201.6(c)(2)(i)	4. Assess the Hazard
201.6(c)(2)(ii) & (iii)	5. Assess the Problem
3.0 Mitigation Strategy	
201.6(c)(3)(i)	6. Set Planning Goals
201.6(c)(3)(ii)	7. Review Possible Mitigation Activities
201.6(c)(3)(iii)	8. Draft an Action Plan
4.0 Plan Maintenance	
201.6(c)(5)	9. Adopt the Plan
201.6(c)(4)	10. Implement, Evaluate, Revise

Local Government / Community Participation

The DMA2K planning regulations and guidance stress that each local government seeking the required FEMA approval of its mitigation plan must:

- Participate in the process;
- Detail areas within the Planning Area where the risk differs from that facing the entire area;
- Identify specific projects eligible for funding; and
- Ensure that the governing bodies adopt the plan.

To help define the participation process in this plan, Dewberry assisted the GWRC staff with the identification of potential MAC members. See Appendix C for MAC meeting agendas and meeting minutes. Participation by the committee was defined as follows:

- Attending the MAC meetings;
- Providing data that is requested by the MAC;
- Reviewing and providing comments on draft plans;
- Advertising, coordinating, and participating in the Public Input; and
- Coordinating plan adoption by the individual communities.

Step 1: Get Organized – Building the Planning Team

The MAC was comprised of key GWRC and local stakeholder representatives. The GWRC Director of Planning and Regional Demographics, Kevin Byrnes, chaired the MAC. With the Committee's commitment to participate, the first step was to establish both a framework and organization for the development of this Plan. The Committee met four times during the planning period. Typical attendees of each meeting included representatives from local first response agencies, planning departments, public works, forestry, utilities and infrastructure, local emergency management personnel, and other community leaders. In addition, the Virginia Department of Forestry, private industry, as well as the VDEM participated on the MAC. A list of MAC members is included in the Acknowledgements section at the front of this Plan. Attendance and agendas for each of the MAC meetings are on file at the GWRC office in Fredericksburg and can be referenced in Appendix C. While the MAC was assembled to assist with the development of this plan, the committee structure may also facilitate updates of the plan over time as needed by the member communities and/or as required by the Act.

Table 3-2. Committee Meetings..

Date	Meeting Topic
November 15, 2010	Kickoff Meeting
July 12, 2011	Mitigation Goals Meeting
October 4, 2011	Regional Strategies and Public Outreach

Step 2: Plan for Public Involvement – Engaging the Public

An important component of this planning process is providing citizens from throughout the region an opportunity to learn about and provide their prospective on the draft mitigation plan. This also gives the planning committee a greater understanding of local concerns. When these suggestions and comments

are incorporated into the final plan, its chances of successful implementation are increased. This process can also increase citizen awareness in the potential natural hazards present in the region so that they can also do their part to reduce any impact.

Public awareness is a key component of the region's overall mitigation strategy aimed at making a home, neighborhood, school, business, city or county safer from the potential effects of natural hazards. The public involvement process for the plan update involved with the GWRC Hazard Mitigation Plan also provided opportunities for neighboring jurisdictions, agencies, businesses, academia, nonprofits and other interested parties to be involved in the planning process. Local jurisdictions included Community Emergency Response Teams, local planners, a representative from the University of Mary Washington and the Rappahannock Health District were all invited to comment on the draft plan. A complete list of the public outreach initiatives for each jurisdiction can be found below. Website screenshots of the draft plan posting as well as copies of the newspaper Op Eds can be found in Appendix E.

The following initiatives were undertaken by each jurisdiction in the GWRC:

Caroline County

- The draft Plan was posted for review and comment on the Caroline County website.
- The final Plan was publicized through a Letter-to-the-editor in The Free Lance Star, the newspaper of record serving the entire GWRC Region. Citizens were invited to review the final Plan on the GWRC website at www.gwregion.org to provide their input.
- An Op Ed by Kevin Byrnes, GWRC Director of Regional Planning & Regional Demographer and Chair of the MAC, was published in The Caroline Progress and on the newspaper's website www.carolineprogress.com on Feb. 2, 2012. The Op Ed articulated the need for hazardous mitigation planning, key highlights from the Plan and encouraged citizens to view and comment upon the final Plan on the GWRC website.

Town of Bowling Green

- The draft Plan was posted for review and comment on the town's website.
- The final Plan was publicized through a Letter-to-the-editor in The Free Lance Star, the newspaper of record serving the entire GWRC Region on Feb. 3, 2012. Citizens were invited to review the final Plan on the GWRC website at www.gwregion.org to provide their input.
- An Op Ed by Kevin Byrnes, GWRC Director of Regional Planning & Regional Demographer and Chair of the MAC, was published in The Caroline Progress and on the newspaper's website www.carolineprogress.com on Feb. 2, 2012. The Op Ed articulated the need for hazardous mitigation planning, key highlights from the Plan and encouraged citizens to view and comment upon the final Plan on the GWRC website.

Town of Port Royal

- The draft Plan was posted for review and comment in the town's library.
- The final Plan was publicized through a Letter-to-the-editor in The Free Lance Star, the newspaper of record serving the entire GWRC Region on Feb. 3, 2012. Citizens were invited to review the final Plan on the GWRC website at www.gwregion.org to provide their input.
- An Op Ed by Kevin Byrnes, GWRC Director of Regional Planning & Regional Demographer and Chair of the MAC, was published in The Caroline Progress and on the newspaper's website www.carolineprogress.com on Feb. 2, 2012. The Op Ed articulated the need for hazardous mitigation planning, key highlights from the Plan and encouraged citizens to view and comment upon the final Plan on the GWRC website.

City of Fredericksburg

- The draft Plan was posted for review and comment on the City of Fredericksburg website.

- The final Plan was publicized city-wide through a Letter-to-the-editor in The Free Lance Star, the newspaper of record serving the entire GWRC Region on Feb. 3, 2012. Citizens were invited to review the final Plan on the GWRC website at www.gwregion.org to provide their input.

King George County

- The draft Plan was posted for review and comment on the King George County website.
- The final Plan was publicized through a Letter-to-the-editor in The Free Lance Star, the newspaper of record serving the entire GWRC Region. Citizens were invited to review the final Plan on the GWRC website at www.gwregion.org to provide their input.
- An Op Ed by Kevin Byrnes, GWRC Director of Regional Planning & Regional Demographer and Chair of the MAC, was published in The King George Journal and on the newspaper website www.journalpress.com on Feb. 1, 2012. The Op Ed articulated the need for hazardous mitigation planning, key highlights from the Plan and encouraged citizens to view and comment upon the final Plan on the GWRC website.
- The King George held a public hearing on the final Plan on Feb. 21. 2012. There were no comments from the public.
- The final Plan was again posted to the county website following the public hearing.

Spotsylvania County

- The draft Plan was posted for review and comment on the Spotsylvania County website.
- The final Plan was publicized through a Letter-to-the-editor in The Free Lance Star, the newspaper of record serving the entire GWRC Region. Citizens were invited to review the final Plan on the GWRC website at www.gwregion.org to provide their input.

Stafford County

- The draft Plan was posted for review and comment on the Spotsylvania County website.
- The final Plan was publicized through a Letter-to-the-editor in The Free Lance Star, the newspaper of record serving the entire GWRC Region. Citizens were invited to review the final Plan on the GWRC website at www.gwregion.org to provide their input.

One comment was received regarding the final Plan, where a member of the general public advised the planning team of new population census information for the Towns of Port Royal and Bowling Green.

Step 3a: Coordinate with other Departments and Agencies

Early in the planning process, the Committee determined that the participation of other state and federal agencies would be beneficial in the data collection, mitigation and action strategy development, and plan approval process. Representatives from the following key agencies were invited to participate on the Committee:

- FEMA Region III (Mitigation Planning Division);
- Virginia Department of Forestry;
- Virginia Department of Emergency Management (Mitigation Planning Division);
- Virginia Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management); and
- Rappahannock Area Health District

Neighboring communities and academic institutions were contacted directly and provided with the opportunity to review and comment on the plan. See Appendix C for correspondence.

In addition to the agencies listed above, the Committee used the resources of the agencies set forth below in the development of this Plan. Specifically, technical data, reports, and studies were obtained from these agencies either through web-based resources or through personal contact with the agencies.

- National Climatic Data Center (NCDC)
- Virginia Department of Emergency Management (VDEM)
- Virginia Department of Conservation and Recreation (DCR)
- Colorado State University, Tropical Meteorology Project
- Virginia Department of Health (VDH)
- National Oceanic and Atmospheric Association (NOAA)
- Federal Emergency Management Agency (FEMA)
- National Weather Service (NWS)
- U.S. Geological Survey (USGS)
- U.S. Census Bureau
- University of Mary Washington

Step 3b: Relationship to Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is paramount to the success of a hazard mitigation plan. Hazard mitigation planning involves identifying existing community policies, tools, and actions that will reduce a community's risk and vulnerability to natural hazards. The Committee identified a variety of comprehensive planning mechanisms such as land use and master plans, emergency operations plans, and municipal ordinances and building codes that guide and control community development. Integrating existing planning efforts, mitigation policies, and action strategies into this Hazard Mitigation Plan establishes a credible and comprehensive plan that ties into and supports other community programs. This Plan, therefore, links the specific natural hazards that present a risk to the community with the existing mitigation elements found in community programs, other planning documents, and regulations. The development of this Plan utilized information included in the following community plans, studies, reports, and initiatives:

- Municipal Comprehensive Plans from GWRC region localities
- Codified Ordinances from GWRC region localities
- Virginia Uniform Statewide Building Code – 2009
- Jurisdiction Comprehensive Plans
- Emergency Operations Plans from GWRC region localities
- Flood Insurance Study and Flood Insurance Rate Maps for the GWRC region
- GWRC region Tax Assessor and Land Use data
- Commonwealth of Virginia Hazard Mitigation Plan

Step 4: Assess the Hazard

The MAC conducted a Hazard Identification study to determine which hazards threaten the region. Research focused on previous occurrences of natural hazards, those that might occur in the future, and the likelihood of their occurrence or recurrence. The hazards identified and investigated in the GWRC region include:

Table 3-3. Hazard Identification Reference Table.

2006 GWRC Hazard Type	2012 Realigned Hazard Type from State Plan	Plan Reference Section	2012 Section Heading
Dam Failure	Dam Failure	4.A	Dam Failure
Drought	Drought	4.B	Drought & Extreme Heat
Extreme Heat	Drought		
Wildfire	Wildfire	4.C	Wildfires
Earthquakes	Earthquake	4.D	Earthquakes
Expansive Soils	Sinkholes	4.E	Sinkholes & Landslides
Landslides	Landslides		
Erosion	Flooding	4.F	Flooding & Erosion
Flooding	Flooding		
Hurricanes	Non-Rotational Wind	4.G	Hurricanes & Thunderstorms
Thunderstorms	Non-Rotational Wind		
Tornadoes	Rotational Wind	4.H	Tornadoes
Northeasters	Winter Storms	4.I	Winter Storms & Nor'easters
Winter Storms	Winter Storms		

Step 5: Assess the Problem

Once the hazard identification step was complete, the MAC conducted vulnerability assessments to describe the impact that each identified hazard would have upon the GWRC region and its respective jurisdictions. The MAC also conducted capability assessments to determine the current ability of each jurisdiction to mitigate the hazards through existing policies, regulations, programs, and procedures. The analyses identified areas where improvements could or should be made.

Step 6: Set Planning Goals

Planning goals were established to incorporate improvement areas identified in Step 5 into the Mitigation Plan. The MAC set goals, formulated as public policy statements, that:

- Represent basic desires of the community;
- Encompass all aspects of the community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- Are time-independent, in that they are not scheduled events.

Additionally, goals from other community programs and priorities were identified and discussed. This Multi-Objective Management (MOM) assisted the MAC in striving for efficiency by combining projects/needs from various community programs and plans that are similar in nature or location. Combining projects/needs through MOM effectively results in access to multiple sources of funding to solve problems that can be "packaged" and broadens the supporting constituency base by striving towards outcomes desired by multiple stakeholder groups.

Step 7: Review Possible Mitigation Activities

Following the goal setting meeting, the MAC undertook a brainstorming session to generate a set of viable alternatives that would support the selected goals. The MAC focused on the following categories of mitigation measures:

- Prevention;
- Property Protection;
- Structural Projects;
- Natural Resource Protection;
- Emergency Services; and
- Public Information.

A facilitated discussion examined and analyzed potential alternatives. Similar to the goal-setting activity, the MAC included all previously recommended mitigation actions from existing mitigation plans in its review. After old and new mitigation actions had been identified, the MAC members used a decision-making process recommended by FEMA to prioritize mitigation measures.

Step 8: Draft an Action Plan

The prioritized mitigation measures were further developed into an action plan that identifies the following for each measure:

- Responsible office;
- Priority (high, medium, or low);
- Cost estimate;
- Benefit to the community;
- Potential funding sources; and
- Schedule for completion.

Step 9: Adopt the Plan

Each jurisdiction within the GWRC region shall adopt the plan through its respective governing body.

Step 10: Implement the Plan, Evaluate its Worth, Revise as Needed

Step 10 is critical to the overall success of hazard mitigation planning. Upon adoption, the All-Hazards Mitigation Plan faces the truest test of its worth, implementation. Many worthwhile and high priority mitigation actions have been recommended. The MAC must decide which action to undertake based upon priority and available funding.

In addition, the All-Hazards Mitigation Plan requires maintenance. There will be an ongoing effort to monitor and evaluate the implementation of the plan, and to update the plan as progress, roadblocks, or changing circumstances are recognized.

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CHAPTER 4 - HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA)

The hazard identification and risk assessment (HIRA) process provides information that allows a community to better understand its potential risk and associated vulnerability to hazards. This information provides the framework for a community to develop and prioritize mitigation strategies and to implement plans to help reduce both the risk and vulnerability from future hazard events. The HIRA followed the methodology described in FEMA publication 386-2 *"Understanding Your Risks – Identifying Hazards and Estimating Losses"* (FEMA, 2002) and was based on a four-step process:

1. Identify Hazards;
2. Profile Hazard Events;
3. Inventory Assets; and
4. Estimate Losses.

The 2012 Update included a complete re-analysis of the hazards facing the region. The information contained in this chapter provides the most up to date and the most current information on the occurrences of previous hazard events. The hazard profiles include location, extent, and previous occurrences as required by the DMA 2K Act.

The HIRA covers Planning Steps 4: Assess the Hazard and Step 5: Assess the Problem. The HIRA for the GWRC region was prepared in the following format:

REGIONAL HAZARD IDENTIFICATION

For the 2012 plan update, the GWRC MAC reviewed the 2010 Commonwealth of Virginia Hazard Mitigation Plan, as well as the hazard events over the preceding five years, and agreed with the hazard rankings for each jurisdiction in the state plan. Additionally, the committee chose to use the State's Hazard Type language as an update to the 2006 hazard type, to ensure better alignment with the state's rankings and methodologies. Hazards that were ranked High, Medium-High (and Medium for Caroline County) were further investigated in the Vulnerability Assessment. Furthermore, updates to this chapter mostly include historical occurrence updates, hazard profile updates, and new rankings.

COMMUNITY SPECIFIC HAZARD IDENTIFICATION

Chapter 4, Section II presents the community-specific sections where those natural hazards that affect each member jurisdiction differently are discussed.

REGIONAL VULNERABILITY ASSESSMENT

Chapter 5, Section I describes vulnerabilities that are common to all communities within the GWRC region.

COMMUNITY-SPECIFIC VULNERABILITY ASSESSMENT

Chapter 5, Section II presents the vulnerability assessments that were performed for each jurisdiction for critically identified hazards and the results of these analyses.

REGIONAL CAPABILITY ASSESSMENT

Chapter 6, Section I presents State, Regional, and Federal mitigation capabilities that are common to all communities within the GWRC region.

COMMUNITY-SPECIFIC CAPABILITY ASSESSMENT

Chapter 6, Section II describes each jurisdiction's capability to deal with the hazards from both a response and a policy capability. A capability assessment matrix was used for this purpose.

I. Regional Hazard Identification

The GWRC steering committee reviewed the hazards included in the 2006 plan as well as the Commonwealth of Virginia's Hazard Mitigation Plan when updating their 2012 hazard identification study. After reviewing the hazard events over the preceding five years, the committee chose to utilize the state's Hazard Type (i.e. naming system) for each hazard, and also to utilize their hazard ranking system as a the catalyst to begin their Hazard Identification and Risk Assessment update. The natural hazards identified and investigated in the 2012 Update (utilizing the 2010 state hazard type) include the following:

Table 4-1. Profiled Hazards.

2006 GWRC Hazard Type	2012 Realigned Hazard Type from State Plan	Reference Section	Section Heading
Dam Failure	Dam Failure	A	Dam Failure
Drought	Drought	B	Drought & Extreme Heat
Extreme Heat	Drought		
Wildfire	Wildfire	C	Wildfires
Earthquakes	Earthquake	D	Earthquakes
Expansive Soils	Sinkholes	E	Sinkholes & Landslides
Landslides	Landslides		
Erosion	Flooding	F	Flooding & Erosion
Flooding	Flooding		
Hurricanes	Non-Rotational Wind	G	Hurricanes & Thunderstorms
Thunderstorms	Non-Rotational Wind		
Tornadoes	Rotational Wind	H	Tornadoes
Northeasters	Winter Storms	I	Winter Storms & Nor'easters
Winter Storms	Winter Storms		

Historical data was collected for all hazard types. By examining the historical occurrences of each hazard, along with the impacts, the MAC was able to identify the hazards that pose the most significant risks to the region. This identification will allow the jurisdictions within the region to focus their hazard mitigation planning efforts on the hazards most likely to have an impact on the region in the future. Prioritizing the potential natural hazards that threaten the GWRC region required analysis of two factors: the probability that a certain type of natural hazard would affect the region and the potential extent and severity of the damage caused by that hazard. The probability of occurrence for each hazard was determined using existing technical analyses, such as the FEMA Flood Insurance Study. When data was not available, the probability was based on the history of events.

A. Dam Failure

Description

For the purposes of this plan, dam failure is addressed as a natural hazard because flooding conditions are a consequence. Dam failure can occur if hydrostatic pressure behind the dam exceeds its design capacity or the crest of the dam is overtopped and rushing flood water scours the base of the dam. The Virginia Soil and Water Conservation Board (VS&WCB) established the Virginia Dam Safety Program to provide for safe design, construction, operation and maintenance of dams to protect public safety. Dams that meet specific regulatory criteria are regulated. The owner of each regulated dam is required to apply to the VS&WCB for an operation and maintenance certificate. The application must include an assessment of the dam by a licensed professional engineer, an operation and maintenance plan, and an emergency action plan. The emergency action plan is filed with the appropriate local emergency official and the Department of Emergency Services.

A dam may be exempt from the regulation if any of the following criteria apply:

- The dam is less than six feet in height;
- The dam has a capacity less than 50 acre-feet and is less than 25 feet in height;
- The dam has a capacity of less than 15 acre-feet and is more than 25 feet in height;
- The dam is used primarily for agricultural purposes and has a capacity less than 100 acre-feet (if use or ownership changes, the dam may be subject to regulation);
- The dam is owned or licensed by the Federal Government; or
- The dam is operated for mining purposes under 45.1-222 or 45.1-225.1 of the *Code of Virginia*.

Extent and Magnitude

Regulated dams are assigned a hazard classification based on the downstream loss anticipated in the event of dam failure. It should be noted that hazard potential is not related to the structural integrity of the dam. The hazard potential classification speaks to the level of risk to life and economic loss the dam imposes on downstream properties and facilities. The classification scheme used by the VS&WCB is listed below.

- **Class I** - dams which upon failure would cause probable loss of life or excessive economic loss
- **Class II** - dams which upon failure could cause possible loss of life or appreciable economic loss
- **Class III** - dams which upon failure would not likely lead to loss of life or significant economic loss
- **Class IV** - dams which upon failure would not likely lead to loss of life or economic loss to others

Location

Table 4-2 provides the number of dams in classes I through III in each community within the GWRC region. The information contained in the table was provided by each county's Emergency Operations Plans (EOPs). Class IV dams do not require an emergency action plan and have, therefore, have not been included in the table. For further community-specific information on dams, please contact the office of the local emergency management coordinator.

Table 4-2. Dams in the GWRC Region.

Community	No. Class I Dams	No. Class II Dams	No. Class III Dams
Caroline County*	Not provided	Not provided	Not provided
City of Fredericksburg	0	0	0
King George County	3	None	None
Spotsylvania County	2	5	3
Stafford County	7	9	6

Caroline County's EOP was considered confidential and therefore not provided for review; see Caroline County EMS Department for further details
Source: Information provided in County Emergency Operations Plans (EOPs)

An additional source of information is the National Inventory of Dams (NID). With the National Dam Inspection Act (P.L. 92-367) of 1972, Congress authorized the U.S. Army Corps of Engineers (USACE) to inventory dams located in the United States. The current NID is the result of this evolutionary process. The USACE continues to work closely with the Association of State Dam Safety Officials (ASDSO), FEMA, and other state and federal agencies to update and publish the NID. Table 4-3 presents the number of dams in each community based upon the latest NID ranking of downstream hazard potential. Downstream hazard potential is defined as:

I. **Low** - Dams assigned the low hazard potential classification are those where failure or disoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.
II. **Significant** - Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.
III. **High** - Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

Table 4-3. National Inventory of Dams in GWRC Region.

Community	Downstream Hazard Potential			
	High	Significant	Low	Total Dams
Caroline County	2	10	27	39
City of Fredericksburg	0	0	1	1
King George County	1	0	7	8
Spotsylvania County	2	6	10	18
Stafford County	3	14	5	22
PD 16 Total	**8**	**30**	**50**	**88**

Source: National Inventory of Dams (http://geo.usace.army.mil/pgis/f?p=397:12:783673426788509).

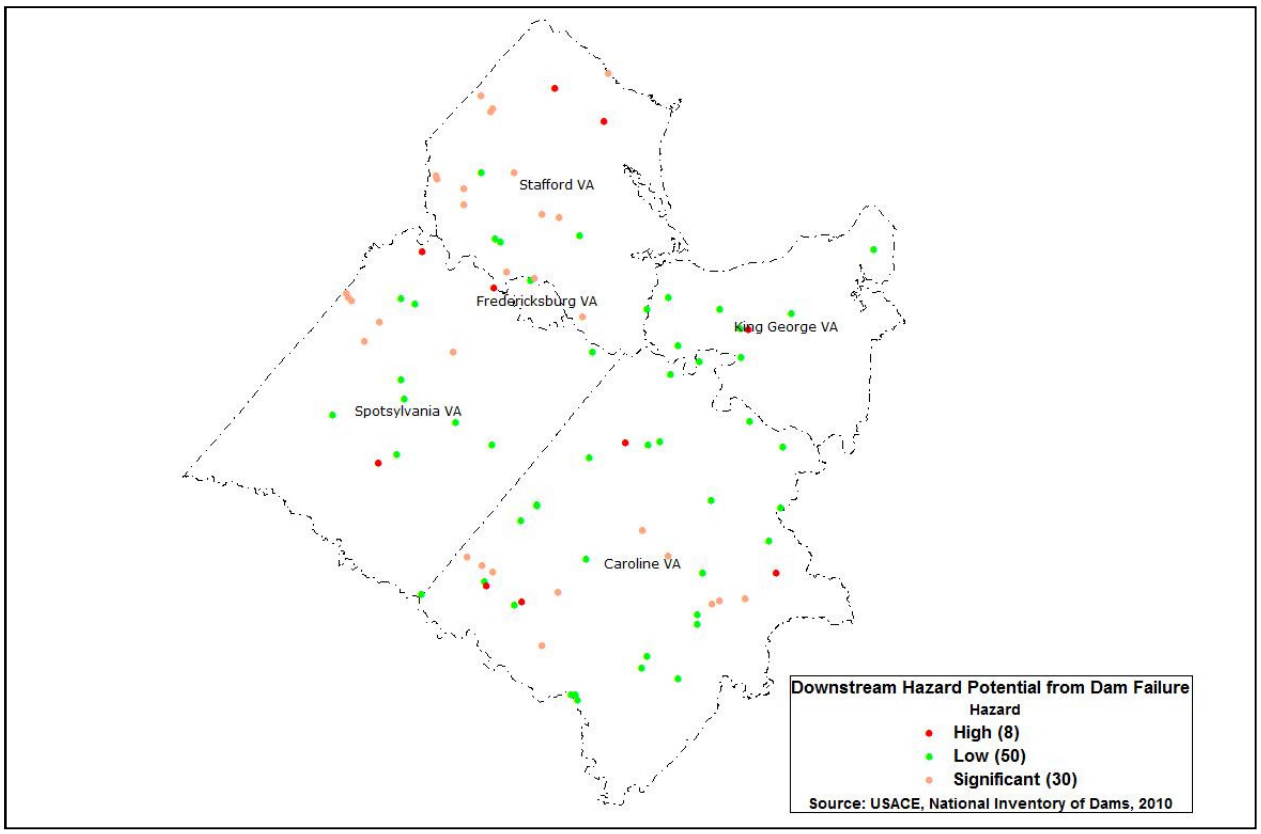


Figure 4-1. Spatial Distribution of Dams by Hazard Classification, PD 16.

Past Occurrences

Although a historical log of dam failures for the Commonwealth of Virginia has not been prepared by the Virginia Soil and Water Conservation Board (VS&WCB), MAC representatives have noted dam failures in the GWRC region. In recent history, Grant Lake within the Lake Wilderness subdivision of Spotsylvania County was placed under "alert" condition due to the potential for subsidence/sinkhole. Stafford County officials identified the potential threat of earthen dam failure at Lake Arrowhead in 2008.

Likelihood of Future Occurrences

The VS&WCB issues certificates to the owner of each regulated dam for a period of six years. If a dam has some deficiency but does not pose imminent danger, the board may issue a two-year *conditional certificate* during which time the owner is to correct the deficiency. After a dam is certified by the board, periodic inspections by an engineer are required.

B. Drought and Extreme Heat

Drought

Source: http://www.drought.unl.edu/dm/monitor.html

Description

A drought is a period of drier-than-normal conditions that results in water-related problems. In a one-year time frame, droughts are considered large when the 12-month rainfall averages approximately 60 percent of normal. On a multi-year time scale, 75 percent of normal rainfall indicates a serious problem. High summer temperatures can exacerbate the severity of a drought. Most of the soil is relatively wet, and a great deal of the sun's energy goes toward evaporation of the ground moisture. However, when drought conditions eliminate soil moisture, the sun's energy goes toward heating the ground surface and temperatures reach into the low 100's, further drying the soil. This can have a devastating effect on crops, stream levels and water reserves. A short-term precipitation deficit of six summer weeks can often ruin crops.

Extent and Magnitude

A common indicator of drought is the Palmer Drought Severity Index (PDSI). The PDSI is a soil moisture algorithm calibrated for relatively uniform regions. It is used by many U.S. government agencies and states to trigger drought relief programs. It was also the first comprehensive drought index developed in the United States. The classifications of the PDSI are presented in Table 4-4 (Hayes, 2005).

The PDSI indicates that for the period of 1895 through 1995 the GWRC region was in a severe to extreme drought five to 10 percent of the time (Figure 4-2). During periods of drought, the Governor of Virginia has called for a ban of open burning in an effort to reduce the risk of wildfire.

Although the severity of droughts to occur is relatively small compared with the rest of the nation, the entire GWRC is subject to some drought conditions (Figure 4-4).

Table 4-4. Palmer Classifications.

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

Source: Hayes, 2005.

Location

All areas of Virginia are susceptible to severe drought, which is defined by a combination of intensity and duration (Figure 4-2). High summer temperatures can exacerbate the severity of a drought; normal high summer temperatures in the central and northern Virginia areas can reach the 90 degree Fahrenheit mark and higher. Droughts lasting a year in the Mid-Atlantic occur when the region receives 60 percent of the typical 40 inches of rain, begin to draw down water wells and livestock ponds and decrease stream flows and water reserves.

Past Occurrences

There have been five major droughts in Virginia that have affected the communities in the GWRC region since the early 1900's. The drought of 1930-32 was one of the most severe droughts recorded in the state. The droughts of 1938-42 and 1962-71 were less severe; however, the cumulative stream flow deficit for the 1962-71 drought was very damaging due to its long duration. The droughts of 1980-82 and 1998-99 were the least severe for the state; however, the drought of 1998-99 hit the communities of the GWRC region particularly hard.

The drought of 1930-32 had a tremendous impact on Virginia. Numerous rivers completely dried up, crops were totally destroyed, drinking water was difficult to come by, forest fires burned approximately 300,000 acres of land (over 30 times the current annual average) and average summer temperatures were in the low 100's. After adjusting for inflation, the estimated losses for this drought were $1 billion. If the same drought were to occur in Virginia today, the devastation would be much greater due to the increased population and its demand for water resources.

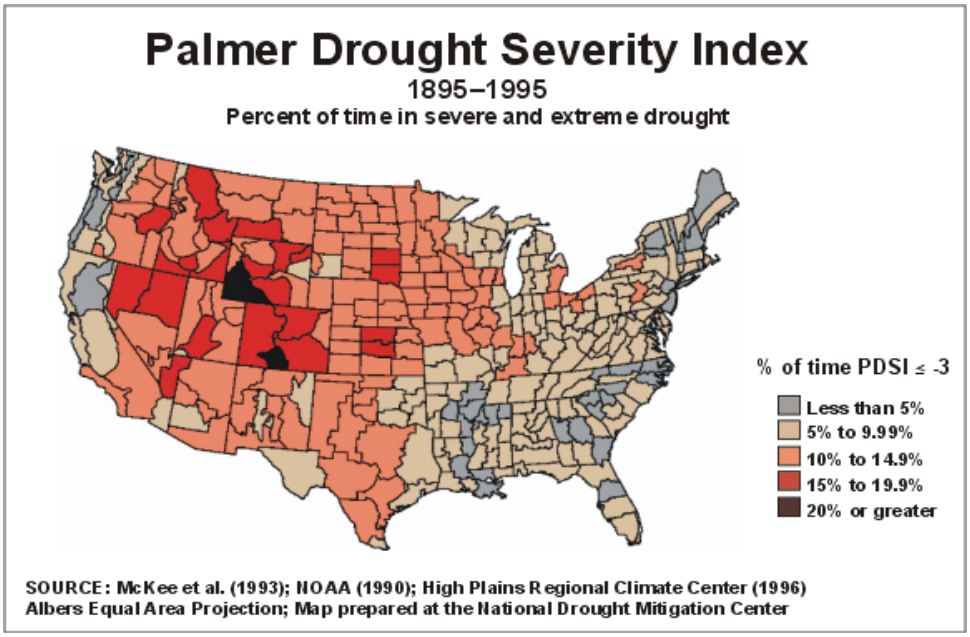


Figure 4-2. Palmer Drought Severity Index.

Source: Hayes, 2005.

The drought of 1998-99 had a particularly hard impact on the communities of the GWRC region. The region received some of the lowest rainfall totals in over 120 years. This led to the loss of crops, depletion of water and feed reserves and a number of brush fires. Many stream-gauging stations reported stream flow at or below 10 percent of the normal flow. The Rappahannock River at Fredericksburg was at 14 percent of its normal flow, 70 percent of the pasturelands were in poor to very poor condition and many crops in the region were reduced by 30 percent.

On December 1, 1998 the Governor of Virginia declared a state of emergency and called for federal aid. Losses in the Commonwealth grew to nearly $190 million.

The dry conditions in July of 2007 were particularly harsh to the GWRC region. The Short-Term Palmer Index for the region in July was on the border between moderate and severe drought. The averaged rainfall totals for the region reached as high as six inches below its normal. As a result, many jurisdictions in the region imposed restrictions on water use. The USDA reported deteriorated soil moisture conditions for the counties of King George, Caroline, and Stafford. There was noticeable crop damage, specifically to corn and soybeans. The USDA estimated that the production of corn for 2007 would be up to 60 percent below the average annual yield. Moreover, the hayfields and pastures for cattle herds were brown from the lack of precipitation. In fact, the USDA rated 70 percent of the pasturelands as in either poor or very poor condition. This forced farmers to search for alternative sources of feed and/or prematurely sell off their herds.

By August of 2007 conditions began to improve until another dry spell affected the region in September. The averaged rainfall totals for September were between 8 to 10 inches below normal. The National Drought Monitor listed much of the region under extreme drought conditions through the end of the month. Many localities continued the water use restrictions that were set in July. At this time the summer harvest was in full effect, soybean yield was only between 20 to 40 percent per acre according to a USDA report. By the end of the month the USDA designated several counties throughout the Commonwealth as

drought disaster areas. The one year period from April of 2007 to March of 2008 was the 9th driest period in the region's history and the driest since 2002. The average precipitation totals for that year were over 7 inches off the region's 5-year average. Stream flow discharge in the major creeks and rivers of the region were severely low relative to their average that summer. For example, the Rappahannock River near Fredericksburg was running at a competency of only 24 percent of its 10-year average for the months of June through September.

The summer of 2010 was harsh to the GWRC region. The month of July was the warmest month the region has ever seen. The region experienced over 20 days of temperatures exceeding 90 degrees. The summer of 2010 was the 8th driest and the worst since 1998. The region only reached 68 percent of its average rainfall. The drought conditions were particularly harsh to the region's agriculture. A USDA report at the end of July claimed that 50 percent of the dry land corn crop was lost to severely dry conditions within the region. By the middle of August the 69 percent of the state's corn conditions were rated as either very poor or poor. There was also noticeable "browning out" of the hayfields and pastures. The apparent lack of precipitation had a noticeable effect on the region's water. Streamflow discharge for the region's rivers and streams were noticeably lower than their 10-yr average for the months of June through September 2010 (NOAA, 2011).

Likelihood of Future Occurrences

VDEM rates Virginia's drought risk as "Significant," with Virginia communities experiencing approximately 20 years of severe drought in the last century, which has caused millions of dollars of damage. Proper mitigation planning can lessen a drought's impact and keep communities from being severely impacted by drought conditions.

There has been one Federally-declared disaster in the GW Region (Figure 4-3).

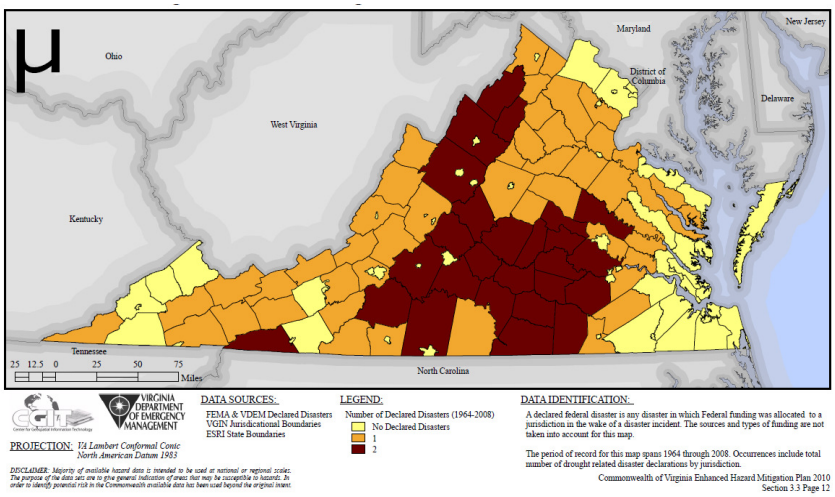


Figure 4-3. Federally Declared Drought Disasters in Virginia
Source: VA State Plan.

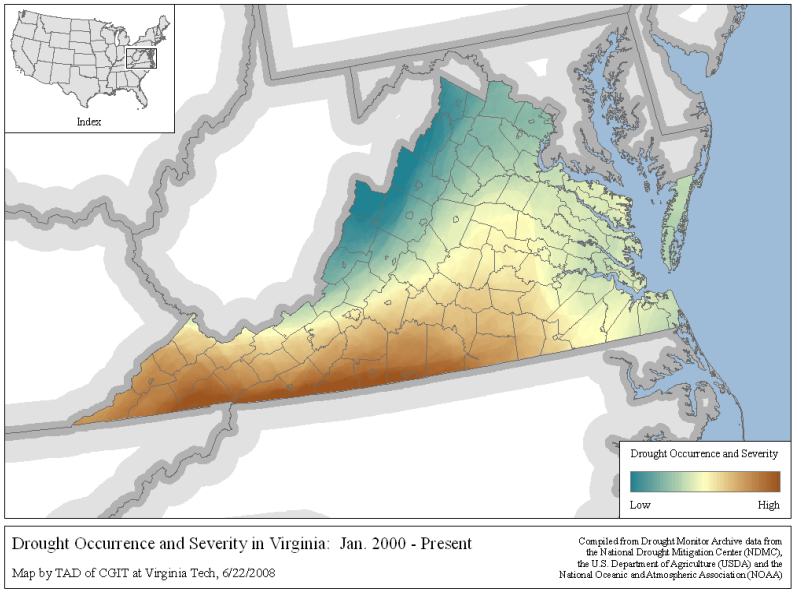


Figure 4-4. Drought Occurrence and Severity in Virginia.

Based on data compiled from the National Drought Mitigation Center, the US Department of Agriculture, and NOAA, there is a low to moderate likelihood of drought occurrence in the GW Region (Figure 4-4).

Extreme Heat

Description

The extreme heat hazard, often referred to as the silent killer, results from high daily temperatures combined with high relative humidity. High relative humidity retards evaporation, robbing the body of its ability to cool itself. On average, approximately 175 Americans die as a result of extreme heat exposure every year (NOAA 2004).

Extent and Magnitude

When heat gain exceeds the level the body can remove, body temperature begins to rise, and heat related illnesses and disorders may develop. The Heat Index (HI) is the temperature the body feels when heat and humidity are combined. Table 4-5 presents the HI that corresponds to the actual air temperature and relative humidity. This chart is based upon shady, light wind conditions. Exposure to direct sunlight can increase the HI by up to 15°F. (NOAA 2004).

Location

While the severity of extreme heat is relatively small compared with the rest of the nation, the entire GWRC region is subject to high temperatures (Figure 4-5).

Table 4-5. Temperature (F) versus Relative Humidity (%).

°F	90%	80%	70%	60%	50%	40%
80	85	84	82	81	80	79
85	101	96	92	90	86	84
90	121	113	105	99	94	90
95		133	122	113	105	98
100			142	129	118	109
105				148	133	121
110						135

Source: NOAA 2011: http://www.crh.noaa.gov/pub/heat.htm

Past Occurrences

During the summer (June-August) of 1999, the United States experienced an intensive drought and heat wave. The east coast was the area hardest hit by the drought, with record and near-record short-term precipitation deficits occurring on a local and regional scale resulting in agricultural losses and drought emergencies being declared in several states (NOAA 1999). Figure 4-5 shows the number of consecutive days of 100° temperatures, during this time period. The GWRC area experienced between three to five consecutive days in July and August of 1999.

Likelihood of Future Occurrences

The threat of extreme heat to the GWRC communities is episodic and, although it cannot be controlled, threats to population can be minimized by warnings and public awareness of the potential dangers that extreme heat presents.

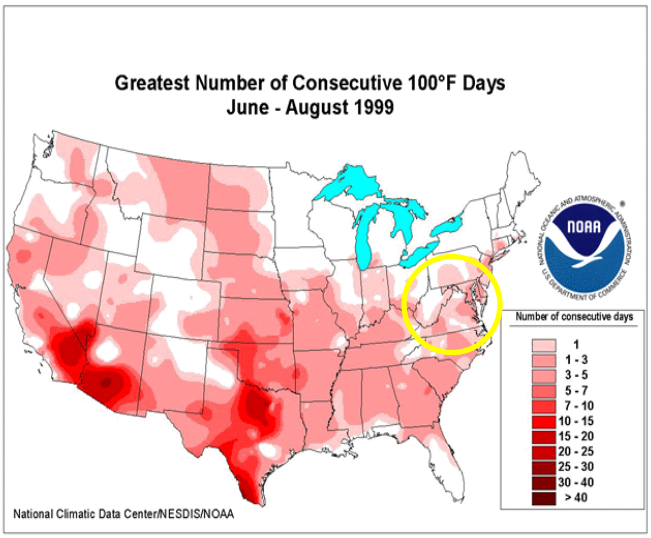


Figure 4-5. Greatest Number of Consecutive 100° F Days.

C. Wildfires

Source: http://www.dof.virginia.gov/gis/datadownload.shtml

Description

A wildfire is an uncontrolled fire spreading through vegetative fuels, possibly consuming structures. They often start unnoticed and spread quickly, often causing dense smoke that fills the area for miles around. The magnitude of a wildfire can range from a very localized event that produces little or no damage to a blaze that consumes many thousands of acres and damages buildings and infrastructure. Naturally occurring and non-native species of grasses, bush, and trees fuel wildfires. (FEMA 386-2)

Extent and Magnitude

Generally, there are three major factors to consider in assessing a community threat from wildfires: topography, vegetation, and weather.

The type of land cover in an area affects a number of factors including ease of ignition, the intensity with which a fire burns, and the facilitation of wildfire advancement. Topographic variations, such as steeper slopes, can lead to a greater chance of wildfire ignition. Generally speaking, steeper slopes are predisposed to convective pre-heating, which warms and dries the vegetative cover. Also, slopes that generally face south receive more direct sunlight than those facing north. Direct sunlight in turn dries vegetative fuels, thereby creating conditions that are more conductive to wildfire ignition. Population density has a causal relationship to wildfires because an overwhelming majority of the wildfires in Virginia are ignited intentionally or unintentionally by humans. Travel corridors increase the probability of human presence, which increases the potential for wildfire ignition. Hence, areas closer to roads have a higher ignition probability. The hurricanes of the past few years, especially Hurricane Isabel, Irene, and Tropical Storm Lee, have brought down hundreds of trees. This increase in potential fuel has initiated a public awareness campaign by the Virginia Department of Forestry (VDOF) to educate the public to this increased hazard.

Location

Geographically, wildfire risk as determined by the Virginia Department of Forestry (VDOF) varies across the GWRC region. Approximately 40.5 percent of the GWRC region is located within a high fire risk zone.

Past Occurrences

Source: http://www.dof.virginia.gov/resinfo/index.shtml

There were approximately 856 wildfire incidents in the GWRC region between 1995 and 2008. This resulted in over 1600 acres burned and over $400,000 in damages. Fortunately, with a reasonable response, over $61 million in damages were saved. The majority of these fires were caused by humans; over 70 were determined to be caused by either lightning or some unknown cause. (VDOF, 2008).

See Section II for historical wildfire data for each GWRC community.

Likelihood of Future Occurrences

Using the factors described above, VDOF assigned a “fire-risk” rating of low, moderate, or high to various areas throughout the GWRC region. With this system, VDOF has determined that approximately 40.5

percent of the GWRC area is in a high fire risk zone, 50.2 percent is in a moderate fire risk zone and 9.3 percent is in a low fire risk zone.

It is apparent that wildfires are a danger within the GWRC area. The area's specific vegetative cover, topography and urban characteristics (relatively high population and dense road networks in some areas) furnish an environment with a predominantly high fire risk. Historical evidence shows that many historic fires could have been prevented with proper mitigation, lessening the negative impact on the environment and the citizens of the GWRC area.

D. Earthquakes

Source: www.nationalatlas.gov

Description

An "earthquake" is defined as a series of elastic waves in the crust of the earth, caused by abrupt easing of strains built up along geologic faults and by volcanic action, and resulting in movements in the earth's surface. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.

Extent and Magnitude

According to the Virginia Department of Mines, Minerals and Energy (DMME), Virginia has a moderate earthquake risk (similar to most states on the eastern seaboard). This risk assessment is further supported by the USGS. The USGS rates areas of the United States for their susceptibility to earthquakes based on a two percent probability of a given peak acceleration (%g) being exceeded in a 50 year period.

Location

The GWRC region lies in an area of moderate seismic risk, with a peak acceleration of six to 10 %g, which is considered a moderate hazard probability. Figure 4-6 also displays the probability of exceeding a certain ground motion, expressed as peak ground acceleration (PGA). This particular map shows the 10 percent probability of exceeding normal ground motion in 50 years. This translates to a one in 475 chance of normal ground motion being exceeded by the amount shown on the map annually.

Past Occurrences

The first recorded earthquake in Virginia occurred in 1774. Since then, over 300 earthquakes have been recorded within or near the boundaries of the state. Nineteen of these events had a magnitude of four or higher on the Richter scale. The largest earthquakes in Virginia were the 1897 Giles County earthquake and more recently a 5.8 magnitude quake occurring at 1:51 pm EDT on August 23, 2011, and centered near Mineral, VA. The Giles County earthquake was felt in over 11 states (approximately 280,000 square miles) and also had an estimated magnitude of 5.8. The Mineral earthquake was reportedly felt as far north as Boston, as far south as Georgia and as far west as Chicago. Effects of the earthquake were reported from over 8,434 zip codes, ranging from weak (II-III intensity) to very strong (VII intensity). A map of the responses is shown in Figure 4-7.Figure 4-7. USGS Community Internet Intensity Map for August 23, 2011 Event.

Figure 4-8 (from the Virginia Division of Mineral Resources, September, 2004) presents the epicenter locations from 2,460 earthquakes in the southeast United States.

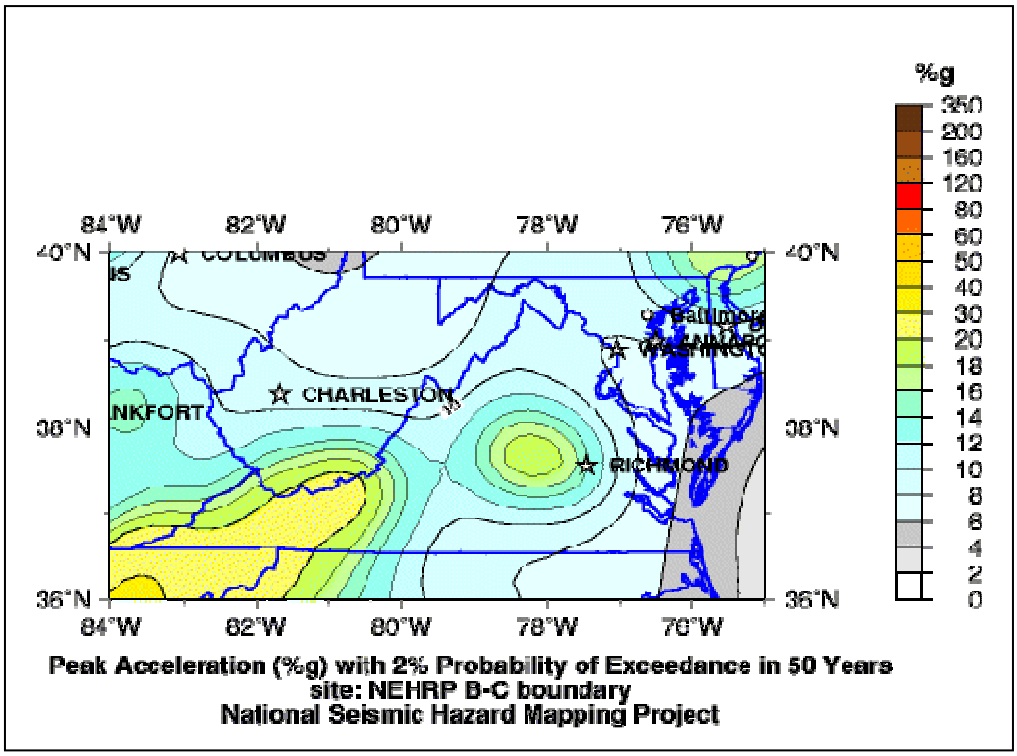


Figure 4-6. Peak Acceleration with 2% Probability of Exceedance in 50 Years.

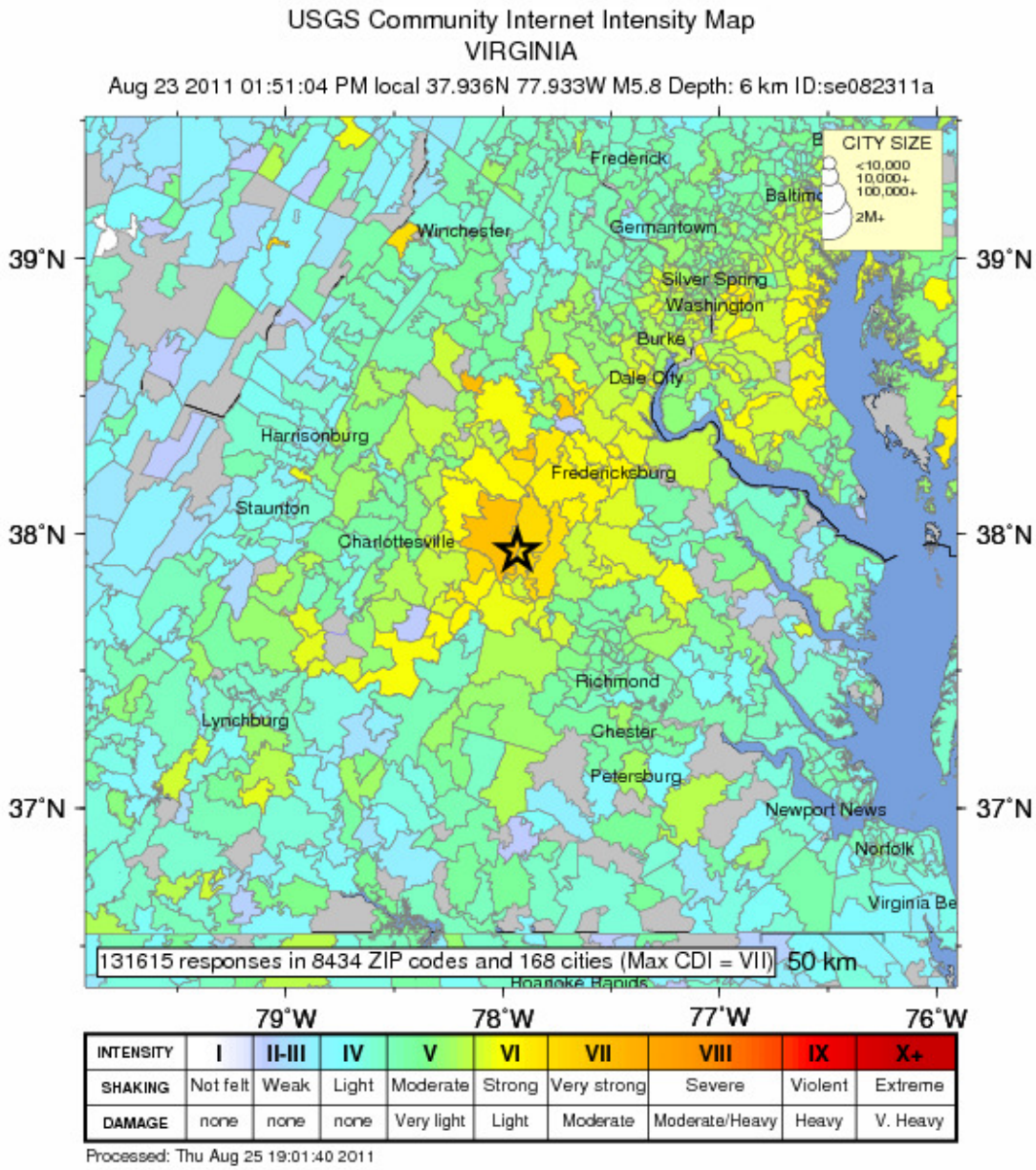


Figure 4-7. USGS Community Internet Intensity Map for August 23, 2011 Event.

Source: http://earthquake.usgs.gov/earthquakes/dyfi/events/se/082311a/us/se082311a_ciim.jpg

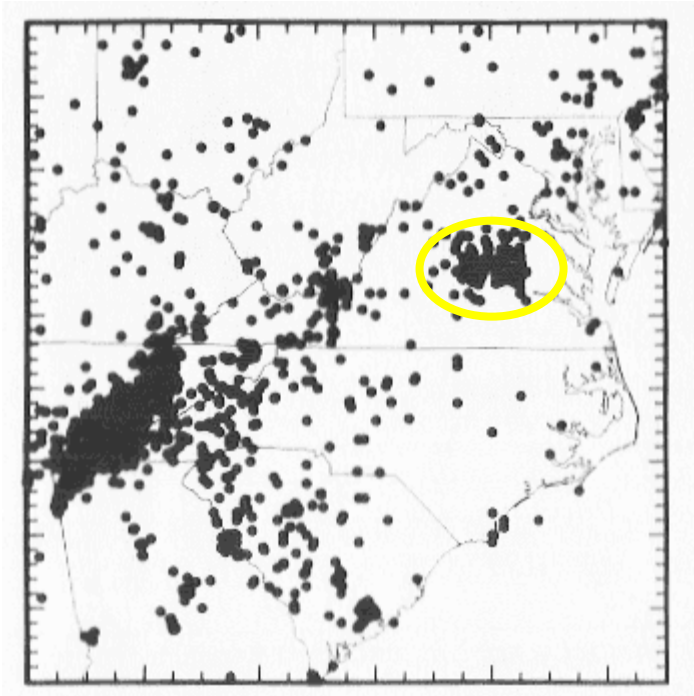
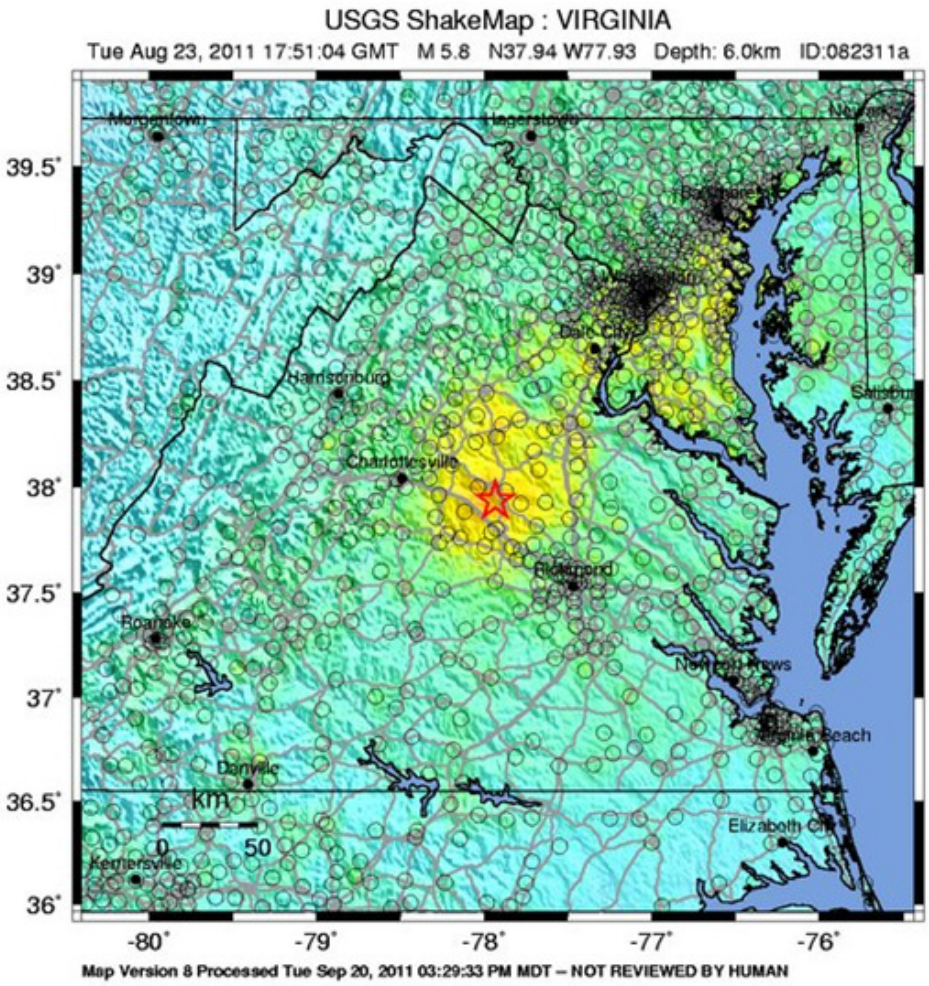


Figure 4-8. Epicenter Locations (2460) in the Southeastern United States.
Source: Virginia Division of Mineral Resources, September, 2004

Likelihood of Future Occurrences

According to DMME, Virginia and the GWRC region have a moderate earthquake risk. Although there have been a large number of earthquakes in Virginia since 1774, most have been very small in magnitude and rarely caused damage. One exception was the Magnitude 5.8 earthquake that occurred on August 23, 2011 with an epicenter in Mineral, Virginia. Although there was little physical damage outside of Mineral, strong vibrations were felt throughout the GWRC region. Figure 4-9 shows the levels of vibrations felt throughout the region as a result of this earthquake.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Figure 4-9. Shake Map for August 23, 2011 Earthquake

Source: USGS

Virginia has experienced quakes of a larger magnitude in the past, and will likely experience more at some point in the future. However, compared to the frequency of other hazards such as hurricanes and floods, the frequency with which larger, damaging earthquakes occur in Virginia is considerably lower.

E. Sinkholes and Landslides

Sinkholes

Sinkholes are natural depressions of land surfaces. A karst topography is one formed over limestone, dolomite, or gypsum and is characterized by sinkholes, caves, and underground drainage. Excessive pumping of groundwater from karst aquifers may lower the water table and cause a sudden loss of buoyant forces that stabilize the roofs of cavernous opening. Human-induced changes in surface water flow and infiltration may also cause collapse. Sinkholes can form suddenly and depending on their size and location can cause significant damage to infrastructure and other structures in their vicinity. Areas over abandon mines or those with aging underground infrastructure are also at risk of experiencing collapse/sinkholes. Karst areas are generally only in western portions of Virginia and the GWRC region is not considered to be within a karst area. Sinkholes in the area are more likely to be caused by failed underground infrastructure and in general no one particular jurisdiction is more at risk than any other.

Landslides

Description

A landslide is the movement of any mass of rock, soil, or debris down a slope. This process, known as mass movement, is driven by gravity and may occur instantaneously or quite imperceptibly. Landslides are usually triggered by heavy rainfall, rapid snow melt, stream incision, or earthquakes, while certain man-made changes to the land, such as slope modification or drainage alteration, can greatly increase the likelihood of landslides. In terms of magnitude or severity, landslides are capable of wrecking buildings, rupturing gas, water, and sewer mains, and knocking out power and telephone lines while blocking transportation routes. Soil creep and slumping cause property damage gradually, whereas rock slides and debris flows can sweep away people and property instantaneously. In the United States, landslides annually cause up to $2 billion in damages and take between twenty-five and fifty lives.

Landslides occur in many manifestations and are usually classified according to the type of material involved and the mode of downslope movement. The material can range from loose earth to blocks of solid rock to tree trunks. Modes of transport include freefall, bouncing, sliding down a slip surface, flowing in a slurry, or moving particle-by-particle. The following are some of the more important types of mass movement:

Rockfalls: entail large blocks of bedrock breaking off a cliff face and tumbling downslope.

Rockslides: occur when a detached section of bedrock moves down an inclined surface, frequently along a bedding plane.

Earthslides: involve masses of soil moving down a slip face, usually the top of the bedrock.

Creep: is the slow, continuous, imperceptible downslope movement of soil and rock particles.

Slumps: result from the rotation of a cohesive unit of soil or rock down a slip surface, leaving a curved scarp.

Debris: flows develop on steep slopes as a result of heavy rainfall or rapid snow melt that saturates the soil, which under the extra weight and lubrication breaks loose and becomes a slurry that takes everything with it, including large trees and houses. Channeled debris flows can reach speeds approaching a hundred miles an hour and strike without warning.

Avalanche: is a term reserved for landslides composed of snow and ice.

Extent and Magnitude

Landslides are Virginia's most widespread geologic hazard. The most disastrous landslide events are associated with heavy rainfall along the steep slopes of the Blue Ridge Mountains and the Appalachians, but slumping, sliding, and creep can occur even on fairly gentle slopes if local conditions exceed the natural stability of the site. Areas that are prone to mass movement include areas of previous landslides; the bases of steep slopes, particularly slopes burned by forest and brush fires; the margins of drainages; and developed hillsides, particularly where septic systems are used. Research in North Carolina has revealed that about fifty-six percent of recent landslides happened on slopes that had been altered in some way by development.

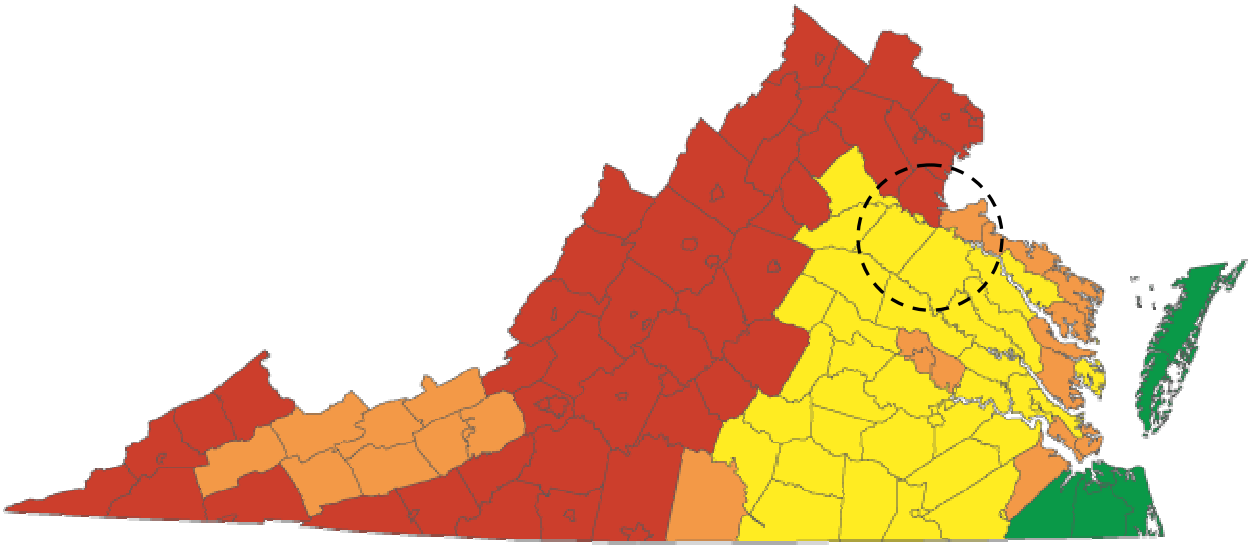


Figure 4-10. Landslide Potential in Virginia.
Red = high potential; orange = moderate potential; yellow = moderate to low potential; green = low potential
Source: Virginia Dept. of Mines, Minerals and Energy, http://www.dmme.virginia.gov/DMR3/landslides.shtml

Location

As is apparent in the Figure 4-10 below, landslide potential is considered high in Stafford County and moderate in King George County and low in Spotsylvania County, Caroline County and the City of Fredericksburg.

Past Occurrences

Data regarding past occurrences of sinkholes and landslides in the Commonwealth of Virginia is somewhat sparse. Records indicate several instances of previous events having occurred in western portions of the state and in Richmond, with only very spotty sinkhole and landslide occurrences in the GWRC region. One such documented instance involved a sinkhole measuring approximately 10 feet across and occurred next to Route 17 Warrenton Road near Berea, VA on July 23, 2010 due to drainage infrastructure failure. A search of available data does not indicate previous landslide occurrences of any significance in the region.

Likelihood of Future Occurrences

Sinkholes and landslides are considered to be low probability, and potentially high-impact events. Although future occurrences of either hazard are possible in the region, determining such probabilities is virtually impossible.

F. Flooding and Erosion

Flooding

Description

Flooding is the most frequent and costly natural hazard in the United States. Nearly 90 percent of presidential disaster declarations result from natural events in which flooding is a major component. Excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto adjacent floodplains, the lowlands adjacent to rivers, lakes, and oceans that are subject to recurring floods. While many floodplain boundaries are mapped by FEMA's National Flood Insurance Program (NFIP), floods sometimes go beyond the mapped floodplains or change courses due to natural processes (e.g., erosion, sedimentation, etc.) or human development (e.g., filling in floodplain or floodway areas, increased imperviousness within the watershed from new development, or debris blockage including cars, trailers, and propane tanks). All of the jurisdictions in the GWRC are mapped by the NFIP, and all participate in the NFIP (note that the Towns of Bowling Green and Port Royal participate through Caroline County). In addition, Stafford County participates in the Community Rating System (CRS Class 8). Since the floodplains in the United States are home to over nine million households, most property damage results from inundation by sediment and debris-filled water.

There are four basic types of floods that afflict Virginia's communities, depending on the region of the state examined: coastal flooding (tidal and storm surge), urban flooding, flash flooding, and riverine flooding. The GWRC region is most susceptible to urban flooding and flash flooding. Low-lying areas adjacent to rivers, streams, and creeks are susceptible to riverine flooding. In addition, portions of the Potomac and Rappahannock Rivers in the region are subject to tidal flooding. Urban flooding often occurs in highly impervious (pavement/rooftops/concrete) areas. Impervious surfaces do not allow water to be absorbed into the ground and increase the speed and amount of water that "runs off" property. When areas are without proper drainage, or storm drains become clogged, streets become streams and water gathers in low-lying areas. With enough rain, underpasses can rapidly fill trapping motorists and streets can accumulate enough water to submerge cars or carry them wherever the water flows.

Flash floods occur quickly and in a short period of time. Rain falls at such a high rate that water does not have time to be absorbed into the ground. It flows downhill into ditches, lowlands and small streams. As the heavy rain continues, ditches overflow, drains back up, water ponds in lowlands and streams rise over their banks. Streams and creeks can become raging rivers in just minutes. Motorists are often surprised by flash floods, and unfortunately often become victims of the flash flood. More than half of flash flood deaths in the United States occur in automobiles.

Riverine floods occur when heavy rains fall over a large area. In many cases in Virginia, it begins as widespread flash flooding of small streams. Approximately 60 percent of Virginia's river floods begin with flash flooding from tropical systems passing over or near the state. Riverine flooding also occurs because of successive rainstorms. Rainfall from any one storm may not be enough to cause a problem, but with each successive storm's passage over the basin, rivers rise until eventually they overflow their banks. If it is late winter or spring, melting snow in the mountains can produce added runoff that can compound flood problems.

Extent and Magnitude

Even short periods of heavy rainfall can cause flooding throughout the region. The majority of severe flooding is caused by intense rainfall resulting from localized thunderstorms. The effects are generally aggravated in areas where man-made and natural constructions in the floodplain impeded the passage of large flows.

Location

Flooding of vacant land or land that does not have a direct effect on people or the economy is generally not considered a problem. Flood problems arise when floodwaters cover developed areas, locations of economic importance, infrastructure, and any other critical facility. The flash flooding and urban flooding that occurs is often brought on by powerful thunderstorms that can dump one to four inches of rain in a matter of a few hours. Small creeks and streams as well as overtaxed drainage systems often cannot cope with the quick influx of rain waters. Their banks can quickly overtop resulting in dozens of flooded roads as well as personal and private property damage.

Past Occurrences

There have been over 20 significant flash floods in the GWRC area between 1996 and 2003, which demonstrates the GWRC area's susceptibility to future flooding events. The Rappahannock River has had four major floods since the early-1970's. These floods exceeded the flood stage by two to 21 feet. The "flood stage" refers to the height of the river or stream at which flooding and property damage begins. Once the water rises above flood stage, damage is expected.

Under the right conditions, flood events can be exceptionally damaging. One such event occurred on February 22, 2003. Powerful rains coupled with a large amount of snowmelt produced flash flooding over the Spotsylvania, Fredericksburg and Stafford areas. The rain washed out dozens of roads and caused the closure of others because of standing water. There were also several reports of uprooted trees as well as personal and private property damage.

See Section II for historical flooding data for each GWRC community.

Likelihood of Future Occurrences

The terms "10-year," "50-year," "100-year," and "500-year" floods are used to describe the estimated probability of a flood event happening in any given year. A 10-year flood has a 10 percent probability of occurring in any given year, a 50-year event has a two percent probability, a 100-year event has a one percent probability, and a 500-year event has a 0.2 percent probability. While unlikely, it is possible to have two 100-or even 500-year floods within years or months of each other.

The potential for flooding can change and increase through various land use changes and changes to the land surface. A change in environment can create localized flooding problems inside and outside of natural floodplains through the alteration or confinement of natural drainage channels. These changes can be created by human activities or by other events, such as wildfires, earthquakes, or landslides.

Erosion

Shorelines along Virginia's rivers and coasts are especially desirable building sites for homes and associated community businesses. These areas should be monitored for shoreline erosion. Shoreline erosion is accentuated by heavy rainfall and the increased wave activity associated with severe storms, such as tropical storms and hurricanes. Periods of significant erosion and flood events often occur simultaneously. In the GWRC region, areas along the banks of the Potomac and Rappahannock Rivers are most susceptible to erosion. The erosion rates (magnitude/severity) in the area are not well documented and vary year to year and storm to storm.

During severe storms, damage to structures might not be limited to flooding, but also might involve shoreline erosion from rising floodwaters or storm surges that result in the undermining and destruction of homes, businesses, roadways, bridges and utility lines. Scour, caused by storm water undermining bridge supports and foundations, is the number one destroyer of bridges. Bridge scour might compromise access by highway and rail service. Shoreline erosion is generally an ongoing hazard and does not typically occur in discrete events making reporting of previous occurrences generally impossible. Even so, significant storm events, including those such as Hurricane Isabel where storm surge and wave action are increased are likely to lead to periods of accelerated erosion. The likelihood of future occurrences is difficult to quantify for similar reasons. As long as there remains unprotected shoreline, erosion can be expected to continue into the future.

G. Non-Rotational Wind (i.e. Hurricanes and Thunderstorms)

Hurricanes and Tropical Storms

Description

Hurricanes and tropical storms, as well as tropical depressions, are all tropical cyclones. According to the National Hurricane Center (NHC), once they have formed, tropical cyclones maintain themselves by extracting heat energy from the ocean at high temperatures and releasing heat at the low temperatures of the upper troposphere. Hurricanes and tropical storms bring heavy rainfall, storm surge, and high wind, all of which can cause significant damage. These storms can last for several days, and therefore have the potential to cause sustained flooding and high wind conditions. Of particular importance to communities susceptible to hurricane damage is the track of an approaching storm. Proximity and direction of hit are important when determining impacts and subsequent damage from the storm.

Extent and Magnitude

Hurricane season in the North Atlantic runs from June 1st until November 30th, with the peak season between August 15 and October 15. The average hurricane duration is 12 to 18 hours. Wind speeds may be reduced by 50 percent within 12 hours. These storms are capable of producing a large amount of rain in a short period; as much as six to 12 inches of rain has occurred within a 12 to 16 hour period. The entire GWRC region is at risk for hurricane damage.

In 1971, wind engineer Herbert Saffir and hurricane expert Dr. Robert Simpson developed a scale to classify hurricanes. The Saffir-Simpson scale rates the intensity of hurricanes based on wind speed and barometric pressure measurements. The National Weather Service uses the scale to predict potential property damage and flooding levels from imminent storms. Although the scale assigns a wind speed and surge level to each category of storm, in recent years, there has been more and more recognition of the fact that wind speed, storm surge and inland rainfall are not necessarily of the same intensity for a

given storm. Therefore, there is some interest in classifying hurricanes by separate scales according to each of these risks. However, the Saffir-Simpson Scale is still the most widely used classification tool for hurricanes. The scale is outlined in Table 4-6.

Table 4-6. Saffir-Simpson Scale and Typical Damages.

Category	Sustained Wind Speeds (mph)	Tidal Surge (ft)	Pressure (mb)	Typical Damage
Tropical Depression	<39	--	--	
Tropical Storm	39-73	--	--	
Hurricane 1	74-95	4-5	> 980	*Minimal* – Damage is done to shrubbery and trees, unanchored manufactured homes are damaged, some signs are damaged, no real damage is done to structures on permanent foundations.
Hurricane 2	96-110	6-8	965-980	*Moderate* – Some trees are toppled, some roof coverings are damaged, and major damage is done to manufactured homes.
Hurricane 3	111-130	9-12	945-965	*Extensive Damage* – Large trees are toppled, some structural damage is done to roofs, manufactured homes are destroyed, and structural damage is done to small homes and utility buildings.
Hurricane 4	131-155	13-18	920-945	*Extreme Damage* – Extensive damage to roofs, windows, and doors, roof systems on small buildings completely fail, some curtain walls fail.
Hurricane 5	> 155	> 18	< 920	*Catastrophic Damage* – Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, some buildings fail completely.

Source: National Weather Service, National Hurricane Center, 2005.

Over time, researchers and meteorologists have further refined the analysis of the wind damage that hurricanes can produce by differentiating the concept of sustained winds from peak gusts. Sustained winds are measured over longer periods of time, typically a minute. A peak gust is the highest two to five second wind speed.

Location

Numerous hurricanes and tropical storms occur along the eastern seaboard each year, with direct landfall occurring somewhere along the eastern United States approximately once every three years. While the region is somewhat protected from the full strength of a hurricane, its expansive nature makes the region vulnerable to high winds, flooding, and tornadoes that often accompany these other extreme weather events.

Past Occurrences

Historically, hurricanes have come close enough to Virginia to produce hurricane force winds (>74 mph) approximately three times every twenty years. Recently, the GWRC region's communities were damaged by Hurricanes Floyd (September, 1999), Isabel (September, 2003) and Jeanne and Gaston (2004), Ernesto (2006, Irene (2011). Hurricane Floyd moved through the area dropping four to five inches of rain within 24 hours and generated winds in excess of 40 mph. Trees and power lines were knocked down, roads flooded; over 5,500 homes were left without power.

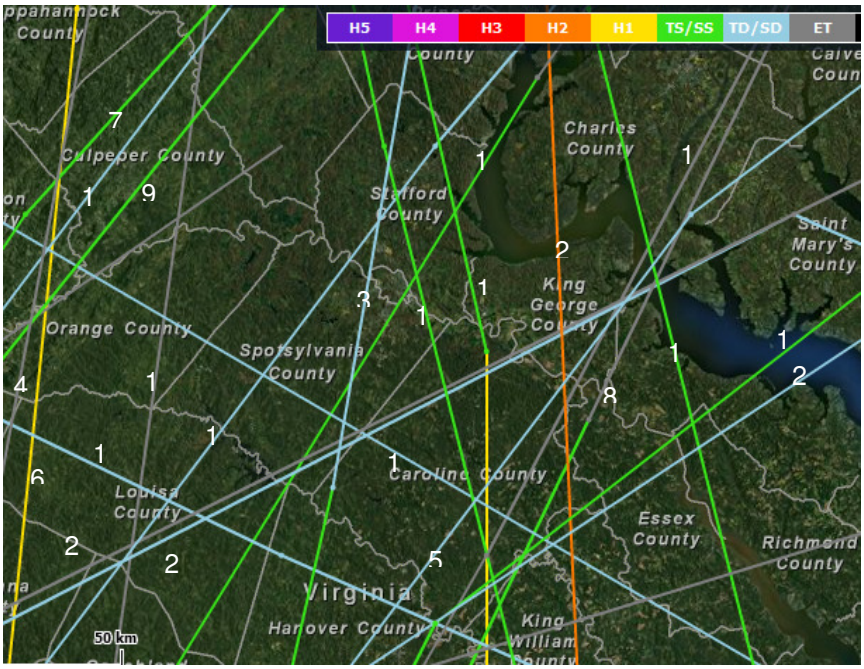


Figure 4-11. Historic Hurricane Tracks, by Severity, in Vicinity of PD 16.

Source: http://csc.noaa.gov/hurricanes/#app=1834&3e3d-selectedIndex=0

Hurricane Isabel was much more destructive. Its impact on the Commonwealth of Virginia was staggering; resulting in $1.6 billion in damages with over 1,186 homes and 77 businesses completely destroyed 9,110 homes and 333 businesses with major damage and over 107,000 homes and 1,000 businesses with minor damage. Hundreds of power lines were blown down leaving almost two million electrical customers without power. Crop losses were calculated to be $59.3 million, with another $57.6 million in damages to farming infrastructure.

Tropical Depression Ernesto struck the region on August 29, 2006. King George and Caroline County among others were declared as major disaster areas. There were 7 fatalities with total damages (not including economic losses) exceeding $118 million. Over six hundred homes were destroyed or damaged. The storm surge and excessive rain led to flooding throughout Northern Virginia.

Tropical Storm Lee was a broad tropical disturbance originating in the Gulf of Mexico in the beginning of September and working its way north. The storm struck the state of Virginia on September 8 & 9, causing widespread damage. Nationally, the storm caused several deaths spurred numerous tornadoes (Official numbers have not been released as of yet, 12/6/2011). Within Virginia, the storm caused millions of dollars worth of damages. On November 17, 2011, Remnants of Tropical Storm Lee was declared a Major Disaster in Virginia by the President. This action makes Public Assistance available for reimbursement of disaster related costs.

In evaluating the localized threat of hurricanes and tropical storms to the region, the MAC analyzed hurricane track data from the National Oceanic and Atmospheric Association (NOAA) from 1851 to 2008 to identify storms that have posed a threat to the area (Table 4-7). Based on these data, 30 storms, including hurricanes, tropical storms, tropical depressions, and extratropical storms tracked through or impacted the GWRC region during that time period. Of the 31 storms, eleven were tropical depressions and extra-tropical storms (winds <39 mph), and eleven were tropical storms (winds of 39-73 mph). In addition, the 2004 hurricane season was one of the most severe in recorded history. Five separate

tropical cyclones (Charley, Frances, Ivan, Jeanne, and Gaston) of varying magnitude hit the eastern and Gulf coasts of the United States. It should be noted that the GWRC communities have been affected by storms that did not track across its borders. High winds and large rain events associated with passing storms have caused localized damage in the past. Examples include Hurricanes Camille (1969), Agnes (1972), Bertha (1996), Floyd (1999), and Gaston (2004).

Thunderstorms

Description

Thunderstorms are defined as localized storms, always accompanied by lightning, and often having strong wind gusts, heavy rain and sometimes hail or tornadoes. Thunderstorms can produce a strong out-rush of wind known as a downburst or microburst, or straight-line winds which may exceed 120 mph. These storms can overturn mobile homes, tear roofs off of houses and topple trees.

Extent and Magnitude

Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena:

- Hail measuring ¾ inch or greater;
- Winds gusting in excess of 50 knots (57.5 mph); or
- A tornado.
- A *severe thunderstorm watch* is issued by the National Weather Service when the weather conditions are such that a severe thunderstorm is likely to develop. This is the time to locate a safe place in the home and to watch the sky and listen to the radio or television for more information.
- A *severe thunderstorm warning* is issued when a severe thunderstorm has been sighted or indicated by weather radar. At this point, the danger is very serious and it is time to go to a safe place, turn on a battery-operated radio or television, and wait for the "all clear" from authorities.

Among the hazards that thunderstorms can bring is ground striking lightning. Lightning can strike up to 10 to 15 miles from the rain portion of the storm. The lightning bolt originates from the upper part of the thunderstorm cloud known as the anvil. A thunderstorm can grow up to eight miles into the atmosphere where the strong winds aloft spread the top of the thunderstorm cloud out into an anvil. The anvil can spread many miles from the rain portion of the storm, but it is still a part of that storm. Lightning from the anvil may strike several miles in advance of the rain. Lightning bolts may also come from the side or back of the storm, striking after the rain and storm may seem to have passed or hitting areas that received little or no rain.

Location

The entire GWRC region is at risk for thunderstorm damage.

Past Occurrences

There have been seven people injured and well over $100,000 in property damage caused by lightning strikes in the GWRC area between 1993 and 2003. The majority of the damage caused by lightning in the area involved home strikes, small brush fires, power line failures and animal deaths. For example, in June of 1994, lightning killed three cows and downed several trees and power lines in the GWRC area, resulting in over 7,500 residents left without power. A similar instance occurred in August of 1996 where

lightning hit multiple power lines, transformers and homes. Minor property damage occurred and 2,100 people were left without power. Like many other natural hazards that can affect a very small area but have a large impact on the area affected, air-to-ground lightning strikes are likely to occur far more frequently than current statistics would indicate. This information is based upon best available data. HIRA research was done through the end of

See Section II for historical thunderstorm data for each GWRC community.

Table 4-7. Historic Hurricanes in Vicinity of GWRC Communities, 1851 to 2008.

Month, Year	Map Reference	Name	Pressure (mb)	Wind (mph)	Wind (knots)	Category*
1876	1	Not Named	NA	58	50	TS
1878	2	Not Named	NA	46	40	TS
1883	3	Not Named	NA	92	80	H1
1885	4	Not Named	NA	46	40	TS
1886	5	Not Named	NA	40	35	TS
1893	6	Not Named	NA	35	30	H2
1893	7	Not Named	NA	40	35	TS
1899	8	Not Named	NA	58	50	TS
1915	9	Not Named	NA	46	40	TD
1927	10	Not Named	NA	40	35	TS
1928	11	Not Named	NA	46	40	TS
1929	12	Not Named	NA	40	35	ET
1933	13	Not Named	NA	58	50	TS
1939	14	Not Named	NA	40	35	TD
1944	15	Not Named	NA	40	35	TS
1945	16	Not Named	1012	35	30	TS
1954	17	Hazel	970	92	80	ET
1960	off map	Camille	NA	29	25	TD
1979	18	Bob	1010	23	20	TD
1981	19	Bret	1006	35	30	TD
1999	off map	Floyd	NA	69	60	H1
2000	off map	Gordon	1006	29	25	TD
2003	off map	Isabel	975	63	55	H1
2004	off map	Charley And Bonnie				H1
2004	off map	Frances				H1
2004	20	Ivan	1000	17	15	H1
2004	21	Jeanne	994	58	50	H1
2004	off map	Gaston	1002	35	30	TD

2005	22	Cindy	1006	26	22.5	ET
2006	off map	Ernesto	1008	46	40	TS
2008	off map	Hanna	1007	35	30	H1

Source: National Weather Service, National Hurricane Center, 2005.
Source: NOAA, National Hurricane Center, 2011 data
* Category "Local" Hurricanes include: (# of regional occurrences)
H2 = Category 2 (96 – 100 mph) (1) H1 = Category 1 (74 – 95 mph) (8)
TS = Tropical Storm (39 – 73 mph) (12) TD =Tropical Depression (17 – 38 mph) (7)
ET = Extra-tropical Storm (3) NA – Data not available

Likelihood of Future Occurrences

VDEM rates Virginia's overall wind risk as "High," and the GWRC communities are no exception. Historical occurrences of high winds generated by hurricanes and tropical storms are a strong indication of future events. With proper planning, the impact and amount of damage caused by high winds can be lessened. According to *Minimum Design Loads for Buildings* (ASCE 7-05), the design wind speed for the GWRC region is less than 90 mph (Figure 4-12. ASCE Design Wind Speeds for Virginia.).

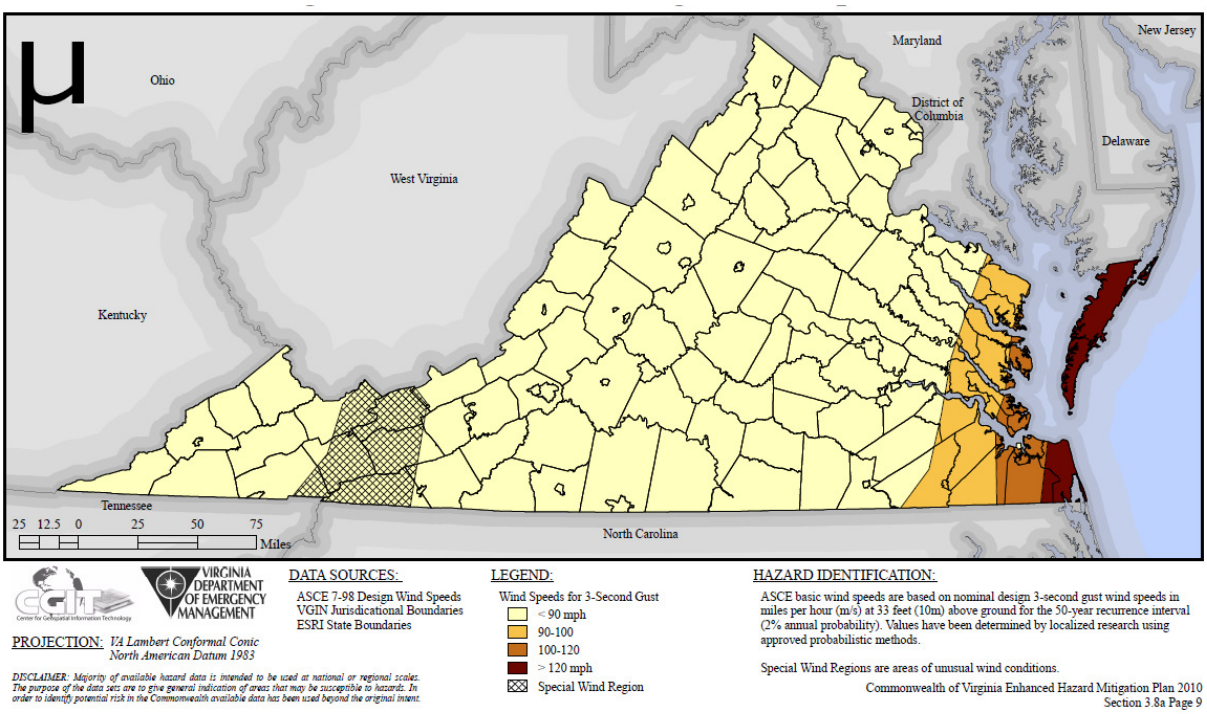


Figure 4-12. ASCE Design Wind Speeds for Virginia.
Source: VA State Plan.

H. Tornadoes (i.e. Rotational Wind)

Description

Tornadoes are one of nature's most violent storms. In an average year, approximately 1,000 tornadoes are reported across the United States, resulting in 80 deaths and over 1,500 injuries. A tornado is a rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one mile wide and 50 miles long.

Extent and Magnitude

A tornado's destructive power (magnitude) is measured using the Fujita Damage Scale (Table 4-8).

Table 4-8. Fujita Damage Scale.

Scale	Wind Estimate (MPH)	Typical Damage
F0	< 73	Light Damage, some damage to chimneys; branches off trees; shallow-rooted trees pushed over; sign boards damaged.
F1	73-112	Moderate Damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable Damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
F3	158-206	Severe Damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating Damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.

Source: Fujita 1971, NOAA, http://www.spc.noaa.gov/faq/tornado/f-scale.html

Location

In Virginia, most tornadoes occur from April to October. However, tornadoes can strike at any time during the year. Tornadoes are not more likely to strike one jurisdiction over another in the GWRC area. Each jurisdiction is considered to have roughly the same probability of experiencing a tornado.

Past Occurrences

A tornado's intense power often destroys homes, downs power lines, and can cause significant tree damage. One such instance occurred on July 24, 1999 in the GWRC area. An F1 tornado moved through 20 miles of the area. It uprooted and snapped hundreds of trees and power lines, did minor damage to several homes, businesses, and farms, and tore the roof off of a local school. Although there were no injuries reported, damages totaled over $1.0 million.

The GWRC area has experienced 17 tornadoes since 1960, with damages totaling nearly $2.0 million. Most of the tornadoes in the area are of a magnitude F0 – F1 (15 since 1960). However, two tornadoes in the area have reached a magnitude of F2 – F3.

Hurricanes Frances and Charley of the 2004 hurricane season spawned numerous tornadoes in the region, three of which were confirmed by the National Weather Service. As detailed information relating to damage and wind speed intensity on the Fujita scale become available over time, the region's communities may wish to update this portion of the plan. As described in the section discussing lightning strikes, it is important to note that tornadoes other than the ones reported here might have occurred in the region over time. However, unconfirmed tornadoes cannot be included in the body of tornado statistics.

See Section II for historical tornado data for each GWRC community.

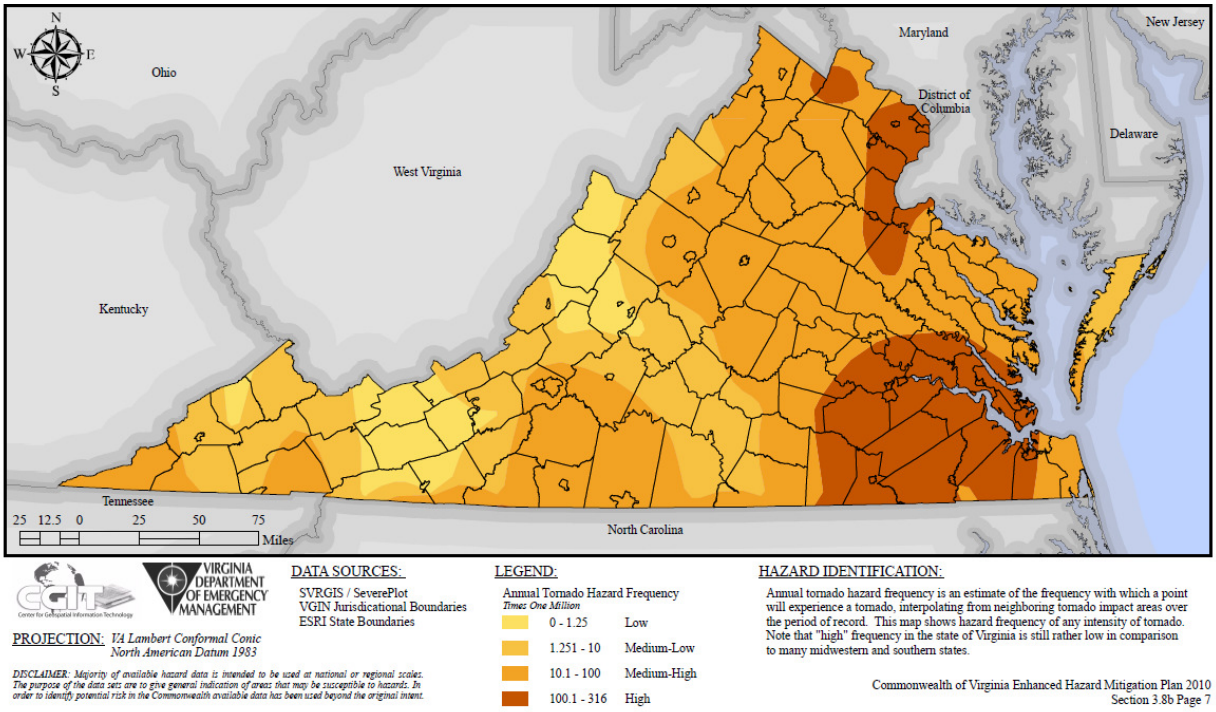


Figure 4-13. Average Number of Tornadoes per Year.

Source: VA State Plan.

Likelihood of Future Occurrences

Every locality in the GW Region has a medium-high to high tornado risk compared with the rest of the state; note that this risk is relatively low compared to other regions of the US (Figure 4-13).

I. Winter storms and Nor'easters

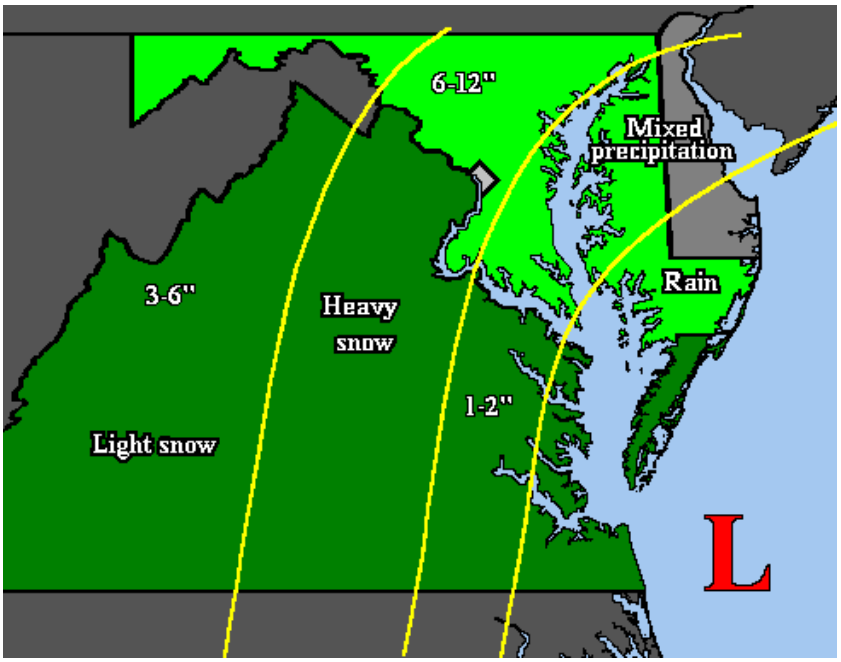
Winter Storms

Description

Winter storms can combine different types of precipitation including snow, freezing rain, and ice, as well as high winds, and cold temperatures. These storms can range from being a minor inconvenience to crippling, and potentially life-threatening events. Winter storms can be very disruptive, particularly in areas where they do not occur frequently. Strong winds with these intense storms can knock down trees, utility poles, and power lines. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. These storms can disrupt communications and power for days while utility companies work to repair the potentially extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Heavy snow can immobilize a region and paralyze a community, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. The cost of snow removal, repairing damages, and loss of business can also have a significant economic impact on communities.

Extent and Magnitude

Winter storms and freezing rain have the potential to impact the region as a whole. These events typically occur between December and March.



Source: VDEM 2004

Figure 4-14. Local Precipitation Map.

Location

It is quite common for the rain-snow line to fall right over Petersburg, Richmond, or Fredericksburg. Heavy snow often falls in a narrow 50-mile wide swath approximately 150 miles northwest of the low pressure center (Figure 4-14). The GWRC area often finds itself within this 50-mile wide swath of dangerous winter weather.

Past Occurrences

It is also not uncommon for the GWRC area to experience sleet, freezing rain and ice storms. Table 4-9 identifies significant winter storm events in the GWRC region.

Table 4-9. Significant Winter Storm Events – GWRC Region.

Date	Description
January 6-8, 1996	Much of the eastern seaboard received 1 to 3 feet of snow during the "Blizzard of '96." Wind gusts of over 50 mph were common and resulted in blizzard conditions for much of the east coast, including Virginia. Many areas of Virginia received over 20 inches of snow. Numerous accidents and flood related damages were reported in the area, along with 13 deaths in Virginia. Virginia, along with Ohio, Pennsylvania, Maryland, West Virginia and New York were declared Presidential Disaster Areas. All totaled, the blizzard and resulting flooding killed an estimated 187 people and caused approximately $3 billion in damages along the eastern seaboard.
January 25, 2000	A significant winter storm dumped over one foot of snow across much of central and eastern Virginia, with isolated amounts close to two feet. Caroline County reported over 12 inches of accumulation. There was also significant blowing and drifting of snow as winds gusted over 30 mph during the storm. This resulted in very hazardous conditions and snow drifts of 3 to 5 feet.
February 22, 2001	A winter storm dropped 2 to 5 inches of snow in the GWRC area. The amount of snow itself is not as significant as the amount of time in which it dropped. Several areas received a brief period of heavy snow at the beginning of the event, which created whiteout conditions. An interstate pileup of record proportions (131 vehicles) occurred in Stafford County on I-95 around 10:30 AM. Across Virginia, officers responded to 1520 crashes involving a total of 400 vehicles.
January 02, 2002	A winter storm dumped 7 to 8 inches of snow in Caroline County and other areas across central and eastern Virginia. Local law enforcement agencies reported numerous accidents and most schools were closed through January 4th due to slippery road conditions.
February 06, 2003	A winter storm produced 4 to 7 inches of snow across the piedmont of central Virginia and the Virginia Northern Neck. Some of the highest snow amounts in the region occurred in Caroline County. Very slippery road conditions lasted through February 7th, resulting in numerous accidents and school closings.
February 15, 2003	A winter storm produced 4 to 9 inches of snow, along with sleet and freezing rain, across central and eastern Virginia. Caroline County had some of the highest snow amounts with 9 inches of accumulation. Very hazardous road conditions lasted through February 18th. Local law enforcement agencies reported several accidents and schools in the area were closed.
February 5, 2004	A winter storm produced one to two tenths of accumulated ice on roads and surfaces. The ice coated surfaces downed power lines and felled trees. This resulted in school closures/delays, automobile accidents, and scattered power outages. In Stafford County, an automobile accident claimed the lives of two students as they travelled to school. A third student was seriously injured.

December 5, 2005	A winter storm produced 4 to 6.5 inches of heavy snow in Northern Virginia. The storm was a heavy wet snow that caused trees to fall and property damages of 40k.
February 12, 2006	A historic snowstorm occurred through the night of February 11th to the morning of the 12th in Northern and Central Virginia. Snowfall accumulation was between 8 and 14 inches. There were several instances of downed powerlines and trees due to the heavy snow, causing outages in some areas. Total outages were reported to be around 300,000 in the Greater Washington/Baltimore region. Amtrak reported major delays. Total property damage was estimated at 250k.
March 1, 2009	A winter storm produced up to nine inches of snow in Spotsylvania and Stafford Counties.
December 18, 2009	A winter storm produced between 19 and 23 inches of snow across the counties of Stafford and King George. President Obama and FEMA would declare this storm a natural disaster in February of the following year. The Commonwealth of Virginia received over 29 million in financial assistance to be spread across 48 counties and 10 independent cities for public assistance, snow removal, and hazard mitigation.
January 30, 2010	A winter storm produced between 5 and 12 inches of snow across Northern Virginia.
February 5, 2010	A winter storm produced between 8 and 17 inches across the region. Power outages were reported throughout the area due to the weight of the snow on trees and power lines. Total damage was estimated at 5k. Governor McDonnell declared a state of emergency and several schools in the area were closed through the following week.

Source: Watson 2004. NCDC 2011.

Likelihood of Future Occurrences

There were six recorded winter storm events in the GWRC region between 1996 and 2003 (a seven year period), suggesting a near annual recurrence interval. Since 2003, there have been seven recorded winter events over a period of seven years. These storms exceeded five inches of accumulated snow or less than an inch of accumulated ice. Winter storms in the region have knocked down power lines, created slippery road conditions resulting in automobile accidents and fatalities, school closures, and delayed commutes. A particular storm in 2009 was declared as a natural disaster by the Commonwealth of Virginia and FEMA, resulting in over $29 million in financial assistance to the state for cleanup and payouts to private and public utility damages. The region has identified the probability of occurrence for winter storms as high.

Nor'easters

Description

Northeasters are slow moving, low-pressure systems that typically form either in the Gulf of Mexico or in the Atlantic Ocean. Although typically associated with winter storm events, Northeasters can occur during anytime of the year. Low-pressure systems develop into storms that bring strong northeast winds, heavy rains/precipitation and storm surge to coastal areas. The winds and storm surge resulting from northeasters are generally less intense than that of hurricanes. However, unlike hurricanes, these storms can linger for several days over a given area allowing larger accumulations of precipitation as well as more damage to structures, since they are exposed to wind and flooding for longer periods of time.

Extent and Magnitude

The Dolan-Davis Scale (1993), as presented in Table 4-10, was developed to identify and classify the damages that may occur during these storm events. This scale is a useful tool for estimating the damage

potential of a northeaster. This scale is especially useful to those communities in the GWRC region that experience tidal flooding.

Table 4-10. Dolan-Davis Northeaster Intensity Scale (Davis and Dolan, 1993).

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (Weak)	Minor changes	None	No	No
2 (Moderate)	Modest; mostly to lower beach	Minor	No	Modest
3 (Significant)	Erosion extends across beach	Can be significant	No	Loss of many structures at local level
4 (Severe)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community-scale
5 (Extreme)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars

Source: North Carolina Division of Emergency Management, http://www.dem.dcc.state.nc.us/mitigation/noreaster.htm

Location

Northeasters are slow moving, low-pressure systems that typically form either in the Gulf of Mexico or in the Atlantic Ocean. Low-pressure systems develop into storms that bring strong northeast winds, heavy rains/precipitation and storm surge to coastal areas. As a result, they affect the entire eastern seaboard.

Past Occurrences

Table 4-11 is a listing of historic northeasters for the GWRC region.

Table 4-11. Historic Northeasters - GWRC Region.

Date	Description
January 28, 1772	This storm was named the "Washington and Jefferson Snow Storm" since it was recorded in both of their diaries. The storm left near 30 to 36 inches (3 feet) of snow from Charlottesville to Winchester to Washington. It was the greatest snow anyone could remember at that time and remains the unofficial record to present day (official records begin in 1872). People were unable to travel for up to two weeks due to the deep snow pack. It took 5 weeks for postal service to resume.
"The Hard Winter of 1779-1780"	This winter was so cold that ice was said to have been piled 20 feet high along the Virginia Coast and stayed there until spring. The upper portion of the Chesapeake Bay was frozen allowing people to walk from Annapolis to Kent Island, Maryland. The Virginia portion of the Bay was frozen to near the mouth. All waterways (rivers) in Virginia were reported firm enough to support crossing of soldiers and in some cases, loaded wagons. America was in its War of Independence. In March, a regiment of the Virginia Infantry marched from Falmouth to Fredericksburg. They were able to cross the Rappahannock River, which had been frozen since the previous November.

Date	Description
January 6-7, 1821	A Northeaster of great intensity hit the Eastern Seaboard from Charleston, SC to New England. The band of deep snow stretched from the Virginia interior to the New Jersey Coast. Winchester had 8 inches of snow. Washington DC had between 12 and 18 inches. Temperatures fell to below zero in some areas behind the storm.
January 21, 1863	A severe coastal storm dropped heavy rains on the Fredericksburg area. It rained for 30 hours dropping upwards of two inches. The subsequent mud was so deep that mules and horses died in the attempt to move equipment. The rivers became too high and swift to cross. It disrupted the Union Army offensive operation in the ill-famed "Mud March".
January 13-14, 1912	An arctic cold wave struck the region with subzero temperatures. Washington DC fell to -13°F, Quantico fell to -16°F, Fredericksburg -11°F, Culpeper -20°F, Lincoln (Loudoun County) -25°F, Woodstock -22°F, Harrisonburg -25°F , Staunton -12°F and Lexington -16°. In Rockingham County and Loudoun County these were the coldest temperatures ever recorded beating the arctic blast in February 1899.
February 15-16 and March 20-21, 1958	Over 14 inches of snow fell in Northern Virginia in the Washington area in a mid-February storm. Transportation was paralyzed. Two deaths in Virginia were attributed to the storm. Another Northeaster struck on March 21, dropping another 10 to 15 inches in the central mountains and across northern Virginia.
February 10-11, 1983	Known as the "Blizzard of '83", this storm event covered an unusually large area of Virginia with more than a foot of snow. The storm set a new 24-hour snowfall record in Lynchburg with 14.6 inches, Roanoke with 18.6 inches and Richmond with 16.8 inches. Richmond received 18 inches total and parts of Northern Virginia measured as much as 30 inches on the ground. Winds gusted over 25 mph all day on February 11 in the Richmond area causing three-foot high drifts. This was the third heaviest snowfall on record for Richmond for the last 100 years. The cost of clearing the snow from state roads came to $9 million.
February 2-3 and February 16, 1996, Storms	A continuing series of Alberta clippers followed by strong Northeasters struck the Commonwealth. The storm on February 2-3 dropped one to two feet of snow from Charlottesville to Fredericksburg and across the Northern Neck. 6 to 10 inches of snow fell to the north of the heavy snow band and significant icing occurred to the south of the band. Some counties along the North Carolina border saw approximately half of its population lose power. The ice caused approximately a half million dollars in damage and caused widespread disruptions in the Hampton Roads area. Following the fresh snow and ice came a cold wave from the 3rd through the 6th with many areas dropping below zero. On the 5th, several places set new records. Lynchburg set a new all-time record low temperature reaching -10° F and Burkes Garden recorded -22° F, which is one of the coldest temperatures ever recorded in Virginia. On the 16th, another Northeaster moved up the coast dumping 6 to 12 inches of snow in a swath across Virginia from Nottoway to Fredericksburg with Charlottesville on the west side of the heavy band and Richmond on the east side.
Winter of 1995-1996	Much of Virginia, mainly north and west of Richmond, had either a record seasonal snow total or a top three snowfall for the 20th century. Lynchburg set a new record with 57 inches of snow and Dulles with 62 inches. Blacksburg had 76 inches. Bluemont recorded 87 inches. Fredericksburg and the Northern Neck saw nearly 60 inches of snow. Roanoke recorded its third snowiest season with 53.4 inches.
January 24-25, 2000	The Northeaster spread heavy snow into Virginia during the night of the 24th and through the 25th. Storm warnings were posted for the late news on the 24th, but those who went to bed early without catching the news were startled to see the heavy white stuff falling in the morning. Several inches of snow was on the ground at daybreak, with winds gusting at 25 to 45 mph creating blizzard conditions in some areas. The region was at a standstill. Airports and transit systems were shut down. Schools were closed. Federal, state and county government offices were closed or quickly closed once the full impact of the storm was realized. Some federal employees in Northern Virginia who begin their commutes well before the government shutdown at 7 am were left battling the storm to attempt to return home. Drifts of four to five feet were common. Snow mixed with sleet and freezing rain in some of the eastern counties.

Source: VDEM 2011.

Likelihood of Future Occurrences

According to the neighboring emergency management agency of North Carolina, the frequency of major northeasters (class four and five on the Dolan-Davis Scale) has increased in recent years. In the period 1987 to 1993, at least one class four or five storm has occurred each year along the Atlantic seaboard of the United States, a situation duplicated only once in the last 50 years.

J. Multi-Hazard Correlation

While this plan investigates individual hazard history and occurrence, it should be noted that hazards typically occur together or result in other hazards later in time. For example, hurricanes are defined by sustained wind speed but not all hurricane damage is from wind. Heavy rains associated with these storms and storm surge generated by waters piled up on shore result in devastating flooding. The effects of natural hazards can last years after the initial devastating events. High wind events blow down trees, which can increase the wildfire hazard for years to come due to an increase in downed dead or dying woody debris. In addition, uprooted trees in low-lying or typically damp areas can cause other problems. The root bulb from the fallen tree can excavate large holes in the landscape, which when filled with rainwater can provide breeding grounds for mosquitoes.

K. Critical vs. Non-critical Hazards

Based on readily available data, local knowledge and observations, the steering committee performed a two-stage evaluation of above-mentioned hazards utilizing the Natural Hazard Ranking Sheet. First, they grouped the hazards into two categories; critical and non-critical hazards (Table 4-12).

- **Non-critical hazards**: those hazards resulting in slight to negligible property damages (less than 25% of critical and non-critical facilities and infrastructure); moderate to negligible quality of life lost; injuries or illnesses do not result in permanent disability and there are no deaths; and critical facilities are shut down for less than one week.
- **Critical hazards**: those hazards resulting in severe to moderate property damages (greater than 25% of critical and non-critical facilities and infrastructure); injuries or illnesses result in permanent disability and at least one death; and critical facilities are shut down for more than 1 week.

Secondly, the MAC, in conjunction with the consulting team, ranked each critical hazard based on the probability of occurrence (Table 4-12). Hazards that ranked critical with a medium to high probability of occurrence were then investigated further and a vulnerability analysis was performed.

L. Probability of Occurrence

The probability of occurrence of a hazard event provides an estimation of how often the event occurs. This is generally based on the past hazard events that have occurred in the area and the forecast of the event occurring in the future. This is done by assigning a probability factor, which is based on yearly values of occurrence. The numerical value assigned to each category will be used to determine the risk rating of each hazard. These values were assigned by high, medium, and low occurrence:

- **High** – Frequent events with a well documented history of occurrence. Annual probability greater than 1.
- **Medium** – Occasional occurrences with at least two or more documented historic events. Annual probability is between 0.1 and 0.99.
- **Low** – Rare occurrences with at least one documented or anecdotal historic event. Annual probability less than 0.1.

Table 4-12. Hazard Identification Results.

	Caroline County		Town of Bowling Green		Town of Port Royal		City of Fredericksburg		King George County		Spotsylvania County		Stafford County	
Hazard type	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence	Critical vs. Non-Critical	Probability of Occurrence
Dam Failure	C	L	C	L	C	L	C	N/A	C	L	C	L	C	L
Drought & Extreme Heat	NC	M	NC	M	NC	M	C	M-H	C	M-H	C	M	NC	M-H
Earthquakes	NC	L	NC	L	NC	L	NC	M	NC	L-M	NC	M-L	NC	L
Flooding	C	L	C	L	C	L	C	H	NC	M-H	NC	H	C	H
Sinkholes and Landslides	NC	L	NC	L	NC	L	NC	L-M	NC	L	NC	L	NC	L-M
Hurricanes and Thunderstorms	NC	H	NC	H	NC	H	NC	H	NC	H	NC	H	NC	H
Tornadoes	C	M-H	C	M-H	C	M-H	C	H	C	H	C	M-H	C	H
Wildfires	C	M-H	C	M-H	C	M-H	C	M-H	C	M	C	M	C	M-H
Winter storms and Nor'easters	C	M-H	C	M-H	C	M-H	C	H	C	H	C	H	C	H

II. Community Specific Hazard Identification

This section presents the community-specific sections where those natural hazards that affect each member jurisdiction differently are discussed.

A. Hazard Identification: Caroline County, including the Towns of Bowling Green and Port Royal

For the 2012 plan update, the GWRC steering committee reviewed the 2010 Commonwealth of Virginia Hazard Mitigation Plan, as well as the hazard events over the preceding five years, and determined a hazard ranking for each of the hazards below. For this update, the committee chose to use the State's Hazard Type language as an update to the 2006 hazard type, to ensure better alignment with the state's rankings and methodologies. The new rankings can be seen below in Table 4-13. For Caroline County, Town of Bowling Green and Town of Port Royal, hazards that ranked high and medium-high were then investigated further and a vulnerability analysis was performed

Table 4-13. Prioritization of Natural Hazards – Caroline County, Towns of Bowling Green and Port Royal.

2006 Hazard Type	2012 Realigned Hazard Type from State Plan	2012 Section Heading	2010 Hazard Ranking from State Plan	2012 Hazard Ranking from County
Dam Failure	Dam Failure	Dam Failure	N/A	Low
Drought	Drought	Drought and Extreme Heat	Medium	Medium
Extreme Heat	Drought			
Wildfire	Wildfire	Wildfires	Medium	Medium-High
Earthquakes	Earthquakes	Earthquakes	Medium-Low	Low
Expansive Soils	Sinkholes	Sinkholes and Landslides	Low	Low
Landslides	Landslides			
Flooding	Flooding	Flooding and Erosion	Low	Low
Hurricanes	Non-Rotational Wind	Non-Rotational Wind	Medium-High	Medium
Thunderstorms	Non-Rotational Wind		Medium-High	High
Tornadoes	Rotational Wind	Tornadoes	Medium-High	Medium-High
Northeasters	Winter Storms	Winter Storms and Nor'easters	Medium-High	Medium-High
Winter Storms	Winter Storms			

Wildfires

In evaluating the localized threat of wildfires to Caroline County (including the Towns of Bowling Green and Port Royal), the MAC analyzed data documented by the Virginia Department of Forestry. These data included wildfires that occurred between the years 1995-2001 with a total number of acres burned, forest or non-forest, greater than 1 acre. Fires occurring on federal lands were not included. These past occurrences are presented in Table 4-14. Locally, the 77 wildfires have burned over 535 acres, with only one (1) incident resulting in a burn of over 40 acres. Based on information from 1995-2001, Caroline

County averages 12.8 wildfires per year. From 2002-2008 there were 137 observed fires with an additional burn of 348 acres. Based on that information over a 7-year period Caroline County averaged approximately 19.05 wildfires per year. Therefore, the probability of future occurrences is ranked as high.

Flooding

In evaluating the localized threat of hurricanes to Caroline County (including the Towns of Bowling Green and Port Royal), the MAC analyzed NOAA data from 1950-2010 to identify storms that may have posed a threat to the communities. The analysis included both floods and flash floods that impacted the region. These past occurrences are presented in Table 4-15. Flooding has caused:

- Property and road damage;
- Displacement of individuals;
- Road closures;

Historically there have only been six recorded flooding events in Caroline County. Therefore the probability of future occurrences is ranked as low.

Non-Rotational Wind (Hurricane and Thunderstorms)

In evaluating the localized threat of hurricanes to Caroline County (including the Towns of Bowling Green and Port Royal), the MAC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the communities. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms, which passed through the region and the effects on the local community. These past occurrences are presented in Table 4-16. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage; and
- Multiple power outages.

In July of 2001 a thunderstorm produced lightning that injured two boys at a Boy Scout Jamboree at Fort A.P. Hill in Caroline County.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, Caroline County experiences approximately 0.22 hurricanes per year

Tornadoes

In evaluating the localized threat of tornadoes to Caroline County (including the Towns of Bowling Green and Port Royal), the MAC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 and the Virginia Department of Emergency Management to identify storms that may have posed a threat to the community. Most tornado activity occurred from May to September, although a historic event in February was noted. These past occurrences are presented in Table 4-17. Locally, the seven (9) tornadoes have caused:

- Property damage, including the destruction of mobile homes;
- Tree damage and resultant power outages; and
- Loss of life.

The probability of future occurrences is ranked as medium. With 7 tornadoes occurring between 1975 and 2004, Caroline County experiences approximately 0.24 tornadoes per year. With 9 tornadoes occurring between 1975 and 2011, Caroline County Experiences approximately 0.27 tornadoes per year.

Winter Storms and Nor'easters

Evaluating the localized threat of northeasters and winter storms to Caroline County (including the Towns of Bowling Green and Port Royal) was completed by the MAC through analysis of local severe weather data from the NOAA from 1950 to 2010 to identify storms that may have posed a threat to the community. These past occurrences are presented in. Locally, the 42 northeasters and winter storms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages; and
- Injury to human life.

A noted ice storm occurring during 1993 caused a power outage in Caroline County that lasted for several weeks. A significant blizzard struck the area in 1996 dumping up to 13 inches of snow. A storm in the winter of 1998 created hazardous conditions from accumulated ice and freezing rain resulted in over 400,000 power outages lasting as long as ten days. A storm in late January of 2000 brought over a foot of snow to Caroline County; shortly following that was an ice storm that caused numerous power outages to the region. From 2002-2010, Caroline County experienced a winter storm event that exceeded five inches of snow with the exception of the winter of 2008.

The probability of future occurrences is ranked as medium. With 42 events occurring between 1993 and 2010, Caroline County experiences approximately two winter events per year.

Table 4-14. Historic Wildfire Events – Caroline County, Towns of Bowling Green and Port Royal.

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
02/23/1995	2	20	0	Debris Burning
03/13/1995	3	0	0	Debris Burning
03/13/1995	2	0	0	Smoking

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/16/1995	2	0	0	Incendiary
03/17/1995	2	0	0	Debris Burning
03/18/1995	2	75	0	Smoking
03/22/1995	3	0	0	Debris Burning
03/26/1995	2	0	0	Smoking
04/05/1995	7	0	0	Smoking
04/25/1995	1	0	0	Equipment Use
03/24/1996	2	0	0	Children
07/10/1996	13	0	0	Incendiary
02/20/1997	1	0	0	Railroad
02/27/1997	1	0	0	Incendiary
04/01/1997	18	0	0	Smoking
04/04/1997	1	0	0	Incendiary
04/04/1997	1	0	0	Incendiary
06/26/1997	2	0	0	Equipment Use
10/10/1997	3	0	0	Smoking
12/20/1997	3	0	0	Smoking
03/15/1998	1	0	0	Children
03/28/1998	22	0	0	Smoking
04/03/1998	28	0	0	Lightning
04/05/1998	1	0	0	Equipment Use
07/02/1998	1	0	0	Children
07/06/1998	3	0	0	Debris Burning
07/07/1998	1	0	0	Miscellaneous
07/07/1998	1	0	0	Smoking
07/20/1998	2	0	0	Incendiary
08/06/1998	1	0	200	Incendiary
09/05/1998	3	0	0	Smoking
09/05/1998	1	0	0	Smoking
09/07/1998	1	0	0	Smoking
09/07/1998	30	0	0	Miscellaneous
09/12/1998	1	0	0	Smoking
10/02/1998	1	0	0	Smoking
11/16/1998	1	0	0	Incendiary
11/29/1998	4	0	0	Debris Burning
11/30/1998	5	500	0	Smoking
12/06/1998	1	0	0	Smoking
12/08/1998	6	0	0	Incendiary
01/29/1999	2	0	0	Debris Burning
03/07/1999	3	0	0	Smoking
03/17/1999	14	0	0	Debris Burning
03/18/1999	1	0	0	Children

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
04/08/1999	145	0	0	Miscellaneous
04/28/1999	3	0	0	Incendiary
05/01/1999	13	0	0	Miscellaneous
05/10/1999	2	0	0	Debris Burning
05/11/1999	1	0	0	Children
05/22/1999	3	0	0	Smoking
06/01/1999	1	0	0	Debris Burning
11/08/1999	3	0	0	Smoking
01/01/2000	1	0	0	Incendiary
05/19/2000	1	0	0	Miscellaneous
06/13/2000	3	0	0	Miscellaneous
10/31/2000	1	0	0	Debris Burning
11/07/2000	7	0	0	Debris Burning
12/05/2000	6	0	0	Railroad
01/04/2001	11	0	0	Debris Burning
01/30/2001	18	0	0	Debris Burning
02/06/2001	13	0	100	Debris Burning
02/08/2001	1	0	0	Miscellaneous
02/21/2001	1	0	0	Miscellaneous
02/21/2001	5	0	0	Debris Burning
03/14/2001	1	0	0	Smoking
03/16/2001	3	0	0	Miscellaneous
03/26/2001	1	0	0	Railroad
05/02/2001	1	0	0	Children
05/14/2001	15	0	0	Debris Burning
10/24/2001	3	0	0	Debris Burning
10/27/2001	3	0	0	Incendiary
10/27/2001	6	500	0	Debris Burning
10/27/2001	37	0	0	Equipment Use
10/28/2001	1	0	0	Debris Burning
11/05/2001	6	0	0	Incendiary
11/20/2001	13	0	0	Incendiary
2/1/2002	5	0	90000	Debris Burning—Rural Burner
2/2/2002	15	0	0	Utility Row
2/12/2002	2	0	300000	Hot Ashes
2/14/2002	2	0	0	Debris Burning—Rural Burner
2/16/2002	0.3	0	0	Smoking
2/21/2002	1	0	150000	Children—Juvenile
2/23/2002	1	200	250000	Children—Juvenile
3/6/2002	0.2	0	0	Utility Row
3/7/2002	0.5	0	150000	Smoking
3/7/2002	0.1	0	0	Equipment Use—Lawnmower

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
3/8/2002	2	0	50000	Hot Ashes
3/10/2002	18	0	600000	Smoking
3/15/2002	5	0	250000	Debris Burning—Rural Burner
3/30/2002	0.2	0	0	Camping—Hot Ashes
4/9/2002	0.1	0	0	Child—Age 7-
4/16/2002	0.5	0	0	Electric Fence
5/16/2002	1	0	100000	Hot Ashes
5/17/2002	1.5	0	500000	Incendiary—Automobile
5/27/2002	1	0	100000	Children—Juvenile
6/2/2002	10	0	0	Prescribed Burn
6/5/2002	0.5	0	0	Smoking
8/4/2002	0.5	0	0	Debris Burning—Land Clearing
8/9/2002	0	0	0	Smoking
8/14/2002	1.5	2000	160000	Children—Juvenile
8/16/2002	8	0	0	Lightning
8/24/2002	2	0	0	Smoking
9/13/2002	0.2	0	0	Debris Burning—Rural Burner
11/30/2002	0.5	0	0	Utility Row
5/12/2003	4.6	0	200000	Railroad
12/23/2003	0.2	0	150000	Debris Burning
1/13/2004	0.1	0	0	Person in Car
2/17/2004	0	0	0	Person in Car
2/25/2004	0.2	0	50000	Hot Ashes
2/27/2004	0.1	0	10000	Smoking
2/28/2004	0.1	0	0	Smoking
2/29/2004	0.5	0	0	Debris Burning—Rural Burner
3/5/2004	0.1	0	0	Smoking
4/18/2004	0.1	0	0	Smoking
4/29/2004	0.2	0	0	Children—Juvenile
12/27/2004	1	0	150000	Debris Burning—Rural Burner
2/14/2005	1	0	0	Rural Burner
3/16/2005	0.3	0	0	Incendiary
4/6/2005	1.6	0	0	Debris Burning
4/15/2005	4	0	75000	Debris Burning
4/16/2005	9.5	0	50000	Debris Burning
4/18/2005	0.5	0	55000	Debris Burning
5/12/2005	1	0	0	Railroad
9/7/2005	0.1	0	0	Children—Juvenile
10/5/2005	0.2	0	300000	Smoking
11/5/2005	0.1	0	0	Equipment Use—Car
11/12/2005	1.5	0	500000	Utility Row
11/13/2005	0.5	0	0	Debris Burning—Rural Burner

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
11/16/2005	0.1	0	0	Debris Burning—Rural Burner
2/2/2006	0.1	0	0	Debris Burning—Rural Burner
2/16/2006	0.3	0	0	Debris Burning—Rural Burner
3/5/2006	0.7	0	0	Debris Burning—Rural Burner
3/8/2006	0	0	0	Debris Burning—Rural Burner
3/10/2006	3	0	0	Debris Burning—Rural Burner
3/10/2006	0.2	0	50000	Debris Burning—Rural Burner
3/12/2006	1	0	0	Utility Row
3/16/2006	36	0	50000	Smoking—Cigar Ash
3/20/2006	0.2	0	0	Incendiary
3/27/2006	0.2	0	100000	Children—Juvenile
3/31/2006	0.1	0	0	Children—Juvenile
4/7/2006	0.1	0	0	Smoking
4/9/2006	0.5	0	0	Utility Row
4/13/2006	0.1	0	0	Debris Burning—Rural Burner
4/15/2006	0.2	0	0	Lightning
4/24/2006	0	0	0	Railroad
5/27/2006	0.2	0	0	Debris Burning—Rural Burner
7/31/2006	0	0	0	Automobile
8/17/2006	0.1	0	0	Smoking
8/19/2006	0.1	0	0	Smoking
8/27/2006	1	0	75000	Debris Burning—Rural Burner
12/6/2006	1	0	0	Hot Ashes
12/12/2006	1	0	0	Utility Row
2/5/2007	0.1	0	0	Debris Burning—Rural Burner
2/22/2007	0	0	0	Utility Row
3/3/2007	3.5	0	0	Smoking
3/6/2007	0	0	250000	Wood Furnace
3/12/2007	0	0	0	Smoking
3/19/2007	2	0	200000	Hot Ashes
3/23/2007	0	0	100000	Railroad
3/29/2007	0	0	0	Railroad
4/3/2007	0.1	0	0	Debris Burning—Rural Burner
4/25/2007	0.1	0	0	Smoking
6/1/2007	5.5	1000	0	Unknown
6/12/2007	0.1	0	0	Smoking
7/6/2007	0	0	0	Smoking
7/6/2007	0.1	0	0	Fireworks
7/8/2007	0	0	0	Smoking
7/18/2007	0	0	0	Utility Row
7/22/2007	0	0	0	Automobile
7/22/2007	0.1	0	0	Hot Ashes

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
8/4/2007	0.1	0	0	Smoking Game
8/15/2007	0	0	0	Smoking
8/16/2007	0	0	0	Utility Row
9/5/2007	1	0	0	Railroad
9/14/2007	0.5	0	0	Smoking
9/23/2007	0.2	0	0	Smoking
10/1/2007	1	0	900000	Smoking—Person Walking
10/7/2007	1	0	0	Smoking
10/12/2007	0.1	0	0	Smoking
10/12/2007	1	0	0	Incendiary
10/13/2007	1	0	0	Extension Cord
10/14/2007	0.1	0	0	Children—Ages 7 and Under
10/20/2007	0.1	0	0	Smoking
10/21/2007	0.1	0	0	Automobile
10/22/2007	0.2	0	75000	Hot Ashes
10/31/2007	1	0	0	Automobile
11/7/2007	0	0	0	Truck Fire
1/8/2008	10	0	0	Utility Row
2/10/2008	0.1	0	0	Utility Row
2/10/2008	2	0	0	Utility Row
2/10/2008	44	10000	150000	Automobile
2/10/2008	40	0	0	Utility Row
2/10/2008	1	0	0	Utility Row
2/10/2008	1	0	0	Utility Row
2/10/2008	1	0	0	Utility Row
2/10/2008	1	0	0	Utility Row
2/10/2008	1	0	0	Utility Row
2/10/2008	10	0	0	Debris Burning—Rural Burner
2/10/2008	51	0	0	Debris Burning—Rural Burner
2/10/2008	1	0	0	Utility Row
3/17/2008	0.1	0	0	Debris Burning—Rural Burner
3/19/2008	6	0	0	Utility Row
4/15/2008	1.5	0	0	Automobile
4/16/2008	1	0	0	Automobile
4/16/2008	0.7	0	0	Equipment Use—4 wheeler
5/4/2008	0.3	0	0	Hot Ashes
7/4/2008	0.5	0	0	Railroad
8/18/2008	0.1	0	0	Utility Row
8/21/2008	0.1	0	0	Utility Row
8/22/2008	1	0	0	Utility Row
8/22/2008	2	0	0	Smoking—Truck Driver
8/24/2008	0.1	0	0	Smoking

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
8/30/2008	0	0	0	Railroad
Totals	**883.8**	**$14,295**	**$6,190,300**	

Source: Virginia Department of Forestry, 2009

Table 4-15. Historic Flooding Events – Caroline County. Towns of Bowling Green and Port Royal.

Date	Event	Comments
January 19,1996	Urban/Stream Flood	Low lying areas of Caroline County roads experienced flooding from heavy rain and snow melt. Clogged storm drains further assisted this problem.
September 16, 1999	Flood	Caroline County received heavy rain from the remnants of Hurricane Floyd. Recorded rainfalls in the eastern portion of Caroline County exceeded 7 inches. Several roads in the region were washed out. The effects of Floyd were evident across the Commonwealth of Virginia and Maryland. The NCDC classified this as a 500-yr flood of record. Agriculture losses and property damages were reported at an estimated value of 122K.
July 28, 2000	Flash Flood	Heavy rains caused the flooding of secondary roads near Sparta in Caroline County.
March 20, 2003	Flood	Numerous roads closed across Caroline County and the surrounding areas due to high water. Roads closed included German School Road, Route 781, Route 615, Route 606, Route 644, Route 613, Route 658, Route 698, and Route 611.
June 26, 2006	Flash Flood	Heavy rains caused the closure of portions of Rte. 625 near Central Point in Caroline County.
June 28, 2006	Flash Flood	Heavy rains caused flash flooding and the closure of portions of Ladysmith Road near Bowling Green.

Source: National Climatic Data Center, 2011.

Table 4-16. Historic Hurricane Events – Caroline County, Towns of Bowling Green and Port Royal.

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	The Free-Lance Star reported massive flooding.

Storm Name	Date	Category	Total Est. Damage	Descriptions
Floyd	September 16, 1999	Tropical Storm	No estimate available.	Gusty winds from 30 to 50 mph 2 to 5 inches of rain 16,000 power outages
Isabel	September 18, 2003	Tropical Storm	$55.1M–property $130,000–crop	Highest sustained wind was73 mph Uprooted thousands of trees and downed numerous power lines Over 2 million Virginians without power
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	Highest sustained wind was 73 mph Uprooted trees and downed numerous power lines Over 2 million Virginians without power Heavy rain and wind gust
Frances	September 8, 2004	Hurricane	Unknown	Generated 9 tornadoes in Central Virginia High winds Large amounts of rainfall/flooding
Ivan	September 17, 2004	Hurricane	Unknown	Spawned unconfirmed tornadoes Power outage (66,000) Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	Flash flooding/heavy rainfall Power outage
Gaston	August 30, 2004	Tropical Depression	Unknown	Hard rains that processed flooding Roads under water Power outage (99,600 statewide)

Source: NOAA 2004, VWC 2004, and local emergency management.

Table 4-17. Historic Tornado Events – Caroline County. Towns of Bowling Green and Port Royal.

Date	Magnitude	Property Damage ($)	Descriptions
March 24, 1975	F1	25K	NA
July 8, 1977	F0	25K	NA
August 12, 1977	F0	25K	NA
June 26, 1988	F0	0K	NA
April 1, 1998	F2	200K	Supercell thunderstorm produced a tornado along a 9 mile path extending from near Coatesville in northwest Hanover County eastward into south central Caroline county southeast of Ruther Glen. The damage path was nearly continuous along this track, with damage intensity ranging from F0/F1 to strong F2/F3. Damage path ranged from approximately 200 yards wide to near one quarter of a mile wide at its widest. Two mobile homes were destroyed in Caroline county. Several churches sustained damage, and several outbuildings were severely damaged or destroyed. One minor injury in Caroline county.

Date	Magnitude	Property Damage ($)	Descriptions
September 8, 2004	F1	25K	Town of Bowling Green - F1 tornado damaged or destroyed several buildings. Numerous trees downed or sheared. This tornado tracked into King George County.
September 17, 2004	F1	500K	F1 tornado downed numerous trees near Cosbys Corner. Many trees snapped off 10 feet above ground level. Cinderblock detached garage (30 x 32 foot) totally destroyed. Two vehicles damaged minor damage to home, and mobile home destroyed by falling tree. F1 tornado downed numerous trees on Friendship Road. Many trees snapped off 10 feet above ground level. One tree fell on a house and caused significant damage. Town of Port Royal - F1 tornado downed numerous trees near the intersection of Route 615 and Route 728 around Four Winds Golf Course. Many trees snapped off about 10 feet above ground level, and significant damage to 2 homes.
April 20, 2008	F0	15K	A supercell thunderstorm produced a tornado with F0 intensity 1 mile West South West of Sparta in Caroline County at around 15:45. The tornado destroyed the roof and exterior siding of a resident's garage blowing debris over a half-mile away. Top speeds of this tornado were estimated between 75 and 85 mph.
April 26, 2011	F1	NA	F1 tornado touches ground at Carmel Church in Caroline County. It travelled for a distance of one mile with a width of 100 yards. Wind gusts were recorded between 86 and 110 mph. Damage unknown.

Source: National Climatic Data Center, 2005; Virginia Department of Emergency Management, 2011 NA = Data not available.

Table 4-18. Historic Northeaster and Winter Storm Events – Caroline County. Towns of Bowling Green and Port Royal.

Date	Event	Property Damage ($)	Comments
December 23, 1998	Ice Storm	20M	A major ice storm affected central and eastern Virginia from Wednesday, December 23rd into Friday, December 25th. A prolonged period of freezing rain and some sleet resulted in ice accumulations of one half inch /0.50/ to one inch /1.00/ in many locations. The heavy ice accumulations on trees and power lines caused widespread power outages across the region. Approximately 400,000 customers were without power during the maximum outage period, Christmas Eve day. Some customers were without power for about ten days. Many accidents occurred due to slippery road conditions, especially bridges and overpasses. Many secondary roads were impassable due to fallen tree limbs and in a few cases, whole trees.
January 8, 1999	Winter Weather	0	Sleet, freezing rain and freezing drizzle occurred off and on during Friday, January 8th across portions of the piedmont of central Virginia into the Virginia northern neck. This precipitation resulted in ice accumulations on many roads and bridges, and in turn, several accidents were reported.

Date	Event	Property Damage ($)	Comments
January 15, 1999	Winter Weather	0	A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The City of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident. The combination of a weakening storm over the Ohio Valley, and a developing storm off the South Carolina coast produced 2 to 5 inches of snow across portions of the Virginia piedmont eastward into the Virginia northern neck Tuesday afternoon into early morning Wednesday. Beaverdam in Hanover county and Hague in Westmoreland county received 5 inches of snow. Ruther Glen in Caroline county and King and Queen in King and Queen County received 4 inches of snow.
January 19, 2000	Winter Storm	0	An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas. Two to three inches of snow fell overnight as an area of low pressure passed south of the region. The highest amounts were measured along a line from Caroline county in the north, through the city of Richmond, then along the southern shore of the James River to near the Newport News area. Snow briefly fell heavily after midnight, creating hazardous driving conditions.

Date	Event	Property Damage ($)	Comments
January 25, 2000	Winter Storm	0	A significant winter storm dumped over one foot of snow across much of central and eastern Virginia, with isolated amounts of up to 19 inches reported. There was also significant blowing and drifting of snow as winds gusted over 30 mph during the storm. The Richmond International Airport was closed during this storm. A very cold air mass built into the region after the storm, preserving the snowpack for over a week in many areas. Snow drifts of 3 to 5 feet were reported, especially in the south central Virginia counties of Dinwiddie, Brunswick, and Mecklenburg. Specific county totals were: Mecklenburg county 13 to 16 inches, Lunenburg county 13 to 14 inches, Brunswick county 12 inches, Nottoway county 12 to 15 inches, Dinwiddie county including Petersburg city 14 to 18 inches, Prince George county including Hopewell 10 to 15 inches, Chesterfield county including Colonial Heights 9 to 15 inches, Charles City county 15 inches, Henrico county including Richmond city 10 to 12.5 inches, New Kent county 16 inches, Hanover county 9 to 12 inches, King William county 12 to 16 inches, King and Queen county 14 to 16 inches, Caroline county 12 inches, Essex county 16 to 17 inches, Richmond county 11 to 12 inches, Westmoreland county 12 to 13 inches, and Northumberland county 12 inches.
January 30, 2000	Ice Storm	465K	Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties. At one point, 300,000 people were without power in the Richmond vicinity due to the weight of ice downing trees and power lines. One Richmond TV station was knocked off the air for 45 minutes Two people were reported injured in Richmond; one while cutting downed trees with a chainsaw, another in a sledding accident.
February 12, 2000	Winter Storm	0	A low pressure system tracked eastward from the Ohio valley and spread mainly light snow, sleet, and freezing rain across portions of central and eastern Virginia. Accumulations ranged from one to two inches, with one report of three inches of snow received from southern Louisa County. Warmer air moved in during the late afternoon and changed the precipitation over to rain.

Date	Event	Property Damage ($)	Comments
February 22, 2001	Winter Storm	0	This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 2, 2002	Winter Storm	0	A winter storm produced 5 to 8 inches of snow across the piedmont of central Virginia, the Virginia northern neck, the middle peninsula, and the Virginia eastern shore. Some specific higher snow totals included: City of Richmond 7-8", City of Colonial Heights 8", Gloucester Point in Gloucester county 8", Mechanicsville in Hanover county 8", Nassawadox in Northampton county 8", Parksley in Accomack county 7", and Ruther Glen in Caroline county 7.5". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Thursday, January 3rd and Friday, January 4th due to very slippery road conditions.
January 19, 2002	Winter Storm	0	Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday. A winter storm produced a mixture of snow, sleet, and freezing rain across portions of central Virginia. Snowfall totals were 2 to 4 inches, except up to 5 inches occurred in parts of Fluvanna County. Local law enforcement agencies reported numerous accidents due to very slippery road conditions.
December 4, 2002	Winter Storm	0	A winter storm produced 4 to 7 inches of snow along with less than 1/4 inch of ice across the piedmont of central Virginia and the Virginia northern neck. Some specific higher snow totals included: Louisa in Louisa county 7", Cumberland in Cumberland county 6", Goochland in Goochland county 5.5", Blackstone in Nottoway county 6", Ruther Glen in Caroline county 5", Farmville in Prince Edward county 5", Powhatan in Powhatan county 5.5", Palmyra in Fluvanna county 5", Amelia in Amelia county 5", Ashland in Hanover county 4.5", King William in King William county 5", Tappahannock in Essex county 5", and Montross in Westmoreland county 4". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Thursday, December 5th and Friday, December 6th due to very slippery road conditions.
December 11, 2002	Winter Weather/mix	0	Freezing rain caused minor ice accumulations on trees, power lines, bridges and overpasses across portions of the central Virginia Piedmont. A few power outages and accidents were reported.

Date	Event	Property Damage ($)	Comments
January 6, 2003	Winter Weather/mix	0	A weak winter storm produced only a dusting to 1 inch of snow across portions of central and eastern Virginia. Some specific snow totals included: City of Hampton 1", Eastern Newport News 1", City of Suffolk 1", City of Norfolk 0.5", Pembrooke area of Virginia Beach 0.5", Gloucester in Gloucester county 0.5", and Ruther Glen in Caroline county 0.5". Accumulations from this storm were mostly on cars and grassy areas, with roadways remaining generally wet although some slush was reported.
January 14, 2003	Winter Weather/mix	0	A weak winter storm produced one half (0.5) to one and one half (1.5) inches of snow across portions of the Virginia northern neck, middle peninsula, and Hampton Roads area. Some specific snow totals included: Kilmarnock in Lancaster county 1.5", Saluda in Middlesex county 1.5", King and Queen in King and Queen county 1-1.5", City of Newport News 1", City of Williamsburg 1", Ruther Glen in Caroline county 0.75", and Wallops Island in Accomack county 0.5".
January 16, 2003	Winter Storm	0	A winter storm produced 4 to 8 inches of snow across portions of central and eastern Virginia. Some specific higher snow totals included: Toano in James City county 8", Northern portion of York county 8", Gloucester in Gloucester county 7", Deltaville in Middlesex county 6.5", Mathews in Mathews county 6.5", Chincoteague in Accomack county 6", City of Newport News 6", Eastville in Northampton county 5.5", City of Hampton 5", City of Williamsburg 5", Surry in Surry county 5", West Point in King and Queen county 5", and Mangohick in King William county 5". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Friday, January 17th due to very slippery road conditions.
January 30, 2003	Winter Storm	0	A winter storm produced 3 to 5 inches of snow across portions of central Virginia. Some specific higher snow totals included: Crewe in Nottoway county 5", Farmville in Prince Edward county 4", Trenholm in Powhatan county 4", Gum Spring in Louisa county 4", Montpelier in Hanover county 4", Fife in Goochland county 4", Ashby in Cumberland county 4", and Ruther Glen in Caroline county 4". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were dismissed early on Thursday, January 30th due to very slippery road conditions.
February 6, 2003	Winter Storm	0	Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches. A winter storm produced 4 to 7 inches of snow across the piedmont of central Virginia and the Virginia northern neck. The higher snow amounts occurred in Caroline, Cumberland, Essex, Fluvanna, Goochland, Hanover, and Louisa counties. Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Friday, February 7th due to very slippery road conditions.

Date	Event	Property Damage ($)	Comments
February 10, 2003	Winter Weather/mix	0	A weak winter storm produced 0.5 to 1 inch of snow across portions of the piedmont of central Virginia and the Virginia northern neck. Although, Louisa county reported 2 to 3 inches of snow. Accumulations from this storm were mostly on cars and grassy areas, with roadways remaining generally wet although some slush was reported.
February 15, 2003	Winter Storm	0	A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported. A winter storm produced 4 to 9 inches of snow, along with sleet and freezing rain, across central and eastern Virginia. Some specific higher snow totals included: Ruther Glen in Caroline county 9", Dunnsville in Essex county 8", Louisa in Louisa county 8", Newland in Richmond county 8", Heathsville in Northumberland county 7.5", Amelia in Amelia county 6.5", King William in King William county 6.5", Palmyra in Fluvanna county 6", Montross in Westmoreland county 6", Lancaster in Lancaster county 5.5", Northern Accomack county 5", Midlothian in Chesterfield county 5", Goochland in Goochland county 5", and Doswell in Hanover county 5". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Monday, February 17th due to very slippery road conditions.
February 26, 2003	Winter Storm	0	A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery. A winter storm produced 1 to 4 inches of snow, along with sleet and 1/8 to 1/2 inch of ice accumulation, across central and eastern Virginia. Some specific higher snow totals included: Ruther Glen in Caroline county 4.5", Bowling Green in Caroline county 3", West Point in King William county 3", Reedville in Northumberland county 3", Beaverdam in Hanover county 2.5", Louisa in Louisa county 2-3", and Montross in Westmoreland county 2-3". Local law enforcement agencies reported numerous accidents. Most, if not all schools in the area, were closed Thursday, February 27th due to very slippery road conditions.
December 14, 2003	Winter Storm	0	An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches. One to four inches of snow, and 1/4 to 1/2 inch of ice due to freezing rain, occurred across portions of central Virginia. The freezing rain on power lines resulted in scattered power outages, and roadways were very slippery.

Date	Event	Property Damage ($)	Comments
January 25, 2004	Winter Storm	0	An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed. Four to as much as six inches of snow and sleet fell across portions of central Virginia. Some higher amounts included: Farmville in Prince Edward county 6", Cumberland in Cumberland county 6", Montpelier in Hanover county 6", Columbia in Fluvanna county 5", Goochland in Goochland county 5", Glen Allen in Henrico county 5", and Tappahannock in Essex county 5". The snow and sleet produced very slippery roadways, which resulted in numerous accidents and school closings for a few days.
February 17, 2004	Winter Weather/mix	0	One half inch to two inches of snow fell across portions of central Virginia and the Virginia northern neck. The snow produced slippery roadways, which resulted in a few accidents.
December 19, 2004	Winter Weather/mix	0	One half inch to as much as three inches of snow fell across central and eastern Virginia. The snow produced slippery roadways, which resulted in several accidents. The highest amounts were reported at Lawrenceville in Brunswick county 3", Montross in Westmoreland county 3", South Hill in Mecklenburg county 2", and Sandston in Henrico county 2".
January 25, 2004	Winter Storm	0	Snow accumulation in Central Virginia reached as high as 6 inches. The snow and sleet produced very slippery roadways, which resulted in numerous accidents and school closings for a few days.
February 17, 2004	Winter Weather/Mix	0	Snow accumulation of .5 to 2 inches occurred across portions of Central Virginia. The snow produced slippery roadways, resulting in a few accidents.
December 19, 2004	Winter Weather/Mix	0	Snow accumulation of .5 to 3 inches fell across Central and Eastern Virginia. The snow produced slippery roadways, resulting in several accidents.
January 19, 2005	Winter Weather/Mix	0	Snow accumulation of .5 to 2 inches occurred across portions of Central Virginia. The snow produced slippery roadways, resulting in a few accidents.
January 21, 2005	Winter Weather/Mix	0	Snow accumulation of .5 to 3 inches fell across Central and Eastern Virginia. The snow produced slippery roadways, resulting in several accidents
January 22, 2005	Winter Storm	0	Freezing rain produced .25 to .75 of an inch of ice across portions of Central Virginia. The freezing rain caused power outages, and roadways were very slippery resulting in numerous accidents.

Date	Event	Property Damage ($)	Comments
January 29, 2005	Winter Storm	0	A mixture of freezing rain, sleet, and snow produced .25 to .5 of an inch of ice and 1 inch of snow across Central Virginia. The freezing rain on power lines caused outages, and roadways were slippery causing automobile accidents.
February 3, 2005	Winter Weather/Mix	0	Snow accumulation of .5 to 2 inches fell across the region. A few isolated areas reported close to 4 inches of snow. The snow produced slippery roadways, resulting in several accidents.
February 24, 2005	Winter Storm	0	Snow accumulation of 2 to 4 inches fell across Central Virginia. The snow produced slippery roadways, resulting in numerous accidents. Bowing Green in Caroline County reported 3.5 inches of snow.
February 28, 2005	Winter Weather/Mix	0	Snow accumulation of .5 to 2.5 inches of snow fell across Central Virginia. Ruther Glen in Caroline County reported 2 inches. The snow produced slippery roadways, resulting in several accidents.
December 5, 2005	Winter Storm	0	A winter storm produced 4 to 7 inches of snow and sleet across Central Virginia. Ruther Glen in Caroline County reported 4.5 inches of snow. The snow caused hazardous driving conditions, resulting in several reported accidents.
February 12, 2006	Winter Storm	0	A winter storm produced 4 to as much as 8 inches of snow across Caroline County. The highest amounts were reported in Corbin (8''), Bowling Green (6"), Ruther Glen (5"), and Burruss Corner (4.3"). The snow caused hazardous driving conditions, which resulted in numerous accidents.
April 7, 2007	Heavy Snow	0	Snow accumulation of 4 to 6 inches occurred in Central Virginia.
March 1, 2009	Winter Storm	0	Snowfall amounts were between 6 and 11 inches across Caroline County. Several school closures were reported across the area.
January 30, 2010	Winter Storm	0	Snowfall amounts were between 8 and 12 inches across the county.
February 5, 2010	Winter Storm	0	Snowfall amounts were between 8 and 11 inches across Caroline County.
December 25, 2010	Winter Weather	0	Snowfall amounts were between 2 and 4 inches across Caroline County.

Source: National Climatic Data Center, 2011.

B. City of Fredericksburg Hazard Identification

For the 2012 plan update, the GWRC steering committee reviewed the 2010 Commonwealth of Virginia Hazard Mitigation Plan, as well as the hazard events over the preceding five years, and determined a hazard ranking for each of the hazards below. For this update, the committee chose to use the State's Hazard Type language as an update to the 2006 hazard type, to ensure better alignment with the state's rankings and methodologies. Those rankings can be seen below in Table 4-19. For the City of Fredericksburg, hazards that ranked high were then investigated further and a vulnerability analysis was performed.

Table 4-19. Prioritization of Natural Hazards – City of Fredericksburg.

2006 Hazard type	2010 State Hazard Type	2012 Section Heading	2010 State Ranking for City of Fredericksburg	2012 Hazard Ranking by City
Dam Failure	N/A	Dam Failure	N/A	N/A
Drought	Drought	Drought and Extreme Heat	Medium-High	Medium High
Extreme Heat	Drought			
Wildfire	Wildfire	Wildfires	Medium-High	Medium-High
Earthquakes	Earthquakes	Earthquakes	Medium	Medium
Expansive Soils	Sinkholes	Sinkholes and Landslides	Medium-Low	Medium-Low
Landslides	Landslides		Medium	Medium
Flooding	Flooding	Flooding and Erosion	High	High
Hurricanes	Non-Rotational Wind	Non-Rotational Wind	High	High
Thunderstorms	Non-Rotational Wind		High	High
Tornadoes	Rotational Wind	Tornadoes	High	High
Northeasters	Winter Storms	Winter Storms and Nor'easters	High	High
Winter Storms	Winter Storms			

Flooding

Flooding is one of the most significant natural hazards faced by the City of Fredericksburg. The primary source of floodwaters affecting the City is riverine flooding from the Rappahannock River that occurs in conjunction with heavy rains associated with hurricanes, tropical storms and northeasters. Urban and flash flooding also affects the City. Flooding can occur during any season of the year. Listed in Table 4-20 and Table 4-21 are the significant flood events for the City of Fredericksburg along the Rappahannock River (FEMA 1979; NOAA 2004). Areas located with the 100-year flood boundary as delineated on the FEMA FIRM are at risk of flooding. Low-lying areas that border streams and creeks are particularly at risk. Any areas where waters can pond due to obstruction to the stormwater system are also susceptible to flooding.

FEMA published a Flood Insurance Study (FIS) for the City of Fredericksburg dated January 1979, then provided an update in September, 2007. The Flood Insurance Rate Maps (FIRMs), which accompany this FIS, delineate the 100- and 500-year flood hazard boundaries for flooding sources within the City limits. Individual FIRM panels are available at the FEMA Map Service Center (http://msc.fema.gov/). The

FIS states that the 100-year base flood elevations for the Rappahannock River range from approximately 38 to 45 feet (referenced to the National Geodetic Vertical Datum, 1929). In addition, this study established a floodway for the Rappahannock River for its entire reach within the City.

Noted Problem Areas

The MAC representatives for the City of Fredericksburg noted two locations within the community where flooding was a known concern: the City Dock area and Kenmore Bottom. Within the City Dock area, located near Lower Sophia Street, structures have begun to flood prior to the Rappahannock River reaching flood stage (18 ft). During previous flood events, these structures noted flooding beginning at a stage of approximately 12 ft.

Kenmore Avenue below the University of Mary Washington, also known as the Kenmore Bottom area, is prone to flash flood events. Residents within this area have noted basement flooding, impacts to the sanitary and storm sewer systems, and restricted access within the area due to flood waters overtopping roadways.

The probability of future occurrences is ranked as high. A 100-year event has a one percent probability of occurring in any given year. The 100-year floodplains for the City of Fredericksburg have been identified.

Non-Rotation Wind (Hurricane and Thunderstorms

In evaluating the localized threat of hurricanes to the City of Fredericksburg, the MAC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and the affected the local community. These past occurrences are presented in Table 4-22. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage; and
- Multiple power outages.

In July of 2001 a thunderstorm produced lightning that struck a home injuring its resident in Fredericksburg.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, the City of Fredericksburg experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to the City of Fredericksburg, the MAC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. Three tornado events are noted as crossing into the City limits. The most costly event occurred in 1999 and caused approximately $20,000 worth of damage. As stated in other community-specific sections numerous tornadoes have occurred across the region. These past occurrences are presented in Table 4-23. Locally, the three (3) tornadoes have caused:

- Excessive winds and lightning;
- Large hail; and
- Tree and property damage.

The probability of future occurrences is ranked as medium. With three tornadoes occurring between 1999 and 2004, the City of Fredericksburg experiences approximately 0.6 tornadoes per year.

Winter Storms

In evaluating the localized threat of northeasters and winter storms to the City of Fredericksburg, the MAC analyzed local NOAA severe weather data from 1851 to 2004 to identify storms that may have posed a threat to the community. These past occurrences are presented in
Table 4-24. Locally, the 24 northeasters and winterstorms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages; and
- Injury and loss of life.

The probability of future occurrences is ranked as medium. With 24 events occurring between 1993 and 2004, the City of Fredericksburg experiences approximately 2.8 winter events per year.

Table 4-20. FIS - Summary of Significant Flood Events – City of Fredericksburg.

Flood	Discharge [1](cfs)	Frequency Interval [1] (yrs)	* Crest [2](ft)
May 27, 1771	N/A	N/A	--
June 1, 1889	96,000	45	32.2
May 23, 1901	N/A	N/A	27.2
May 13, 1924	66,900	16	25.1
October 1, 1924	N/A	N/A	22.8
April 26, 1937	134,000	125	39.1
October 16, 1942	140,000	145	42.6
August 19, 1955	N/A	N/A	26.9
June 22, 1972	107,000	60	39.1
June 29, 1995	N/A	N/A	25.1
September 8, 1996	N/A	N/A	26.9

[1] City of Fredericksburg Flood Insurance Study dated, January 1979
2 NOAA advanced Hydrologic Prediction Service http://ahps.erh.noaa.gov/cgi-bin/ahps.cgi?lwx&fedv2#Historical
* The flood stage for the Rappahannock River is 18.0 feet

Table 4-21. Historic Flood Events – City of Fredericksburg.

Date	Event	Comments
September 3, 2000	Flash Flood	The City of Fredericksburg was hit especially hard by flash flooding after a total of 2.24 inches of rain fell. Several residents of homes and ground floor apartments reported damaged from rapidly rising water that entered the structures through sewer systems, basement windows, and doors. Several motorists had to be rescued from their cars after driving into flooded sections of roadway. Some cars were submerged up to their windshields in water. High water blocked access to Mary Washington Hospital. A 4-foot-deep sinkhole appeared along Snowden Hills Boulevard after the deluge.
July 10, 2003	Flash Flood	In Fredericksburg, an apartment building was struck by lightning. Also, two homes in Normandy Village on Woodford Street caught fire after being hit by lightning. Lightning also damaged asphalt on William Street at Sunken Road. Cowan Boulevard was closed by flooding.
July 13, 2005	Flash Flood	In Fredericksburg, reports of flooding occurred in the early evening. Fall Hill Avenue closed due to high water. There were reports of additional flooding on roads leading to Mary Washington Hospital. Several cars stalled at the hospital entrance.
August 25-26, 2006	Flash Flood	Persistent rain across a 5 day period resulted in double digit rainfall totals across Northern Virginia. There were extensive power outages across the region and the VRE was temporarily inoperable. In Fredericksburg, the Rappahannock River was out of its banks at the Falmouth Bridge on U.S. 1. At Alum Springs Park a woman and her children stalled their pickup truck. Total estimates of property damage were 10K.

Source: NOAA 2011

Table 4-22. Historic Hurricane Events – City of Fredericksburg.

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	Gusty winds from 30 to 50 mph 2 to 5 inches of rain 16,000 power outages

Storm Name	Date	Category	Total Est. Damage	Descriptions
Isabel	September 18, 2003	Tropical Storm	$55.1 million – property $130,000 – crop	Highest sustained wind was73 mph Uprooted thousands of trees and downed numerous power lines Over 2 million Virginians without power
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	Highest sustained wind was 73 mph Uprooted trees and downed numerous power lines Over 2 million Virginians without power Heavy rain and wind gust
Frances	September 8, 2004	Hurricane	Unknown	Generated 9 tornadoes in Central Virginia High winds Large amounts of rainfall/flooding
Ivan	September 17, 2004	Hurricane	Unknown	Spawned unconfirmed tornadoes Power outage (66,000) Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	Flash flooding/heavy rainfall Power outage
Gaston	August 30, 2004	Tropical Depression	Unknown	Hard rains that processed flooding Roads under water Power outage (99,600 statewide)

Source: NOAA 2004, VWC 2004, and local emergency management.

Table 4-23. Historic Tornado Events – City of Fredericksburg.

Date	Magnitude	Property Damage ($)	Descriptions
July 24, 1999	F1	20K	Spotsylvania County tornado crossed over the City of Fredericksburg Warm and humid air ahead of a cold front combined to produce scattered thunderstorms across the northern half of Virginia from midday through sunset. The first batch of thunderstorms developed over Rockingham County around 12:30 PM EDT and moved eastward to the Potomac River by 3:00 PM EDT. These storms produced winds in excess of 55 MPH, large hail, frequent lightning, and a tornado that crossed parts of Orange, Spotsylvania, and Stafford County. A tornado developed near Lake of the Woods in Orange County. It stayed on the ground for 20 miles and moved across northern Spotsylvania County, the city of Fredericksburg, and the northwest portion of Stafford County. The tornado was of F1 strength for most of its path, occasionally weakening to F0 strength in some locations. Next, the storm passed directly over the southern half of the city of Fredericksburg, downing several more trees and power lines, blocking roads and knocking power out for 12,000 customers. Nine buildings in the city were significantly damaged.

May 7, 2004	F1	10K	At 7:51 p.m., an F1 tornado touched down near Shiloh. At least a dozen dwellings and 10 boats were damaged. Several trees were also uprooted or had their tops ripped out along the storm's three-mile path. In Stafford County, 80 to 90 mph winds destroyed two homes and caused major damage to 20 others. The Japazawas Subdivision in eastern Stafford County had approximately 40 trees down. Three Amtrak trains were stalled between the Chatham area of Stafford and Fredericksburg due to downed trees and power lines. In Spotsylvania County, the main stage at the re-enactment of the Battle of Spotsylvania collapsed due to strong winds. A number of tents and a couple of portable toilets were also blown over. Estimated damages were $10,000.
September 17, 2004	F1	0K	A thunderstorm moved from Spotsylvania County into the eastern portion of the City of Fredericksburg. No property damage was reported, with debris scattered along Dixon Street.

Source: National Climatic Data Center, 2005; NOAA 2004 and VDEM

Table 4-24. Historic Northeaster and Winter Storm Events – City of Fredericksburg.

Date	Event	Rain Fall (in.)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.
January 12, 1996	Heavy Snow	350K	Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches. In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.

Date	Event	Rain Fall (in.)	Comments
February 16, 1996	Heavy Snow	0	A strong "Alberta Clipper", diving southeast from the upper Midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.
January 14, 1999	Winter Weather	0	A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.
January 20, 2000	Winter Weather	0	An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.
January 25, 2000	Northeaster	0	Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.

Date	Event	Rain Fall (in.)	Comments
January 30, 2000	Ice Storm	0	Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.
February 12, 2000	Winter Weather	0	Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.
December 13, 2000	Winter Weather	0	A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.
February 22, 2001	Winter Storm	0	This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 3, 2002	Winter Storm	0	Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.

Date	Event	Rain Fall (in.)	Comments
February 6, 2003	Winter Storm	0	Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.
February 26, 2003	Winter Weather/mix	0	A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches.
January 25, 2004	Winter Weather/mix	0	An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.

Source: National Climatic Data Center, 2005.

C. King George County Hazard Identification

For the 2012 plan update, the GWRC steering committee reviewed the 2010 Commonwealth of Virginia Hazard Mitigation Plan, as well as the hazard events over the preceding five years, and determined a hazard ranking for each of the hazards below. For this update, the committee chose to use the State's Hazard Type language as an update to the 2006 hazard type, to ensure better alignment with the state's rankings and methodologies. Those rankings can be seen below in Table 4-25. For King George County, hazards that ranked high and medium-high were then investigated further and a vulnerability analysis was performed.

Table 4-25. Prioritization of Natural Hazards – King George County.

2006 Hazard type	2010 State Hazard Type	2012 Section Heading	2010 State Hazard Ranking for King George County	2012 Hazard Ranking from King George County
Dam Failure	N/A	Dam Failure	N/A	Low
Drought	Drought	Droughts and Extreme Heat	Medium-High	Medium-High
Extreme Heat	Extreme Heat			
Wildfire	Wildfire	Wildfires	Medium	Medium
Earthquakes	Earthquakes	Earthquakes	Medium-Low	Medium-Low
Expansive Soils	Sinkholes	Sinkholes and Landslides	Low	Low
Landslides	Landslides			
Flooding	Flooding	Flooding and Erosion	Medium-High	Medium-High
Hurricanes	Non-Rotational Wind	Non-Rotational Wind	High	High
Thunderstorms	Non-Rotational Wind			
Tornadoes	Rotational-Wind	Tornadoes	High	High
Northeasters	Winter storms	Winter Storms and Nor'easters	High	High
Winter Storms	Winter storms			

Drought

According to the National Climatic Data Center, there have been fourteen drought events reported in GWRC region between January 1, 1950 and July 30, 2005. These past occurrences are presented in Table 4-26. Locally, droughts have caused:

- Requests to the Governor for disaster status;
- Voluntary and mandatory reductions in water usage;
- Reduction in crop yields:
- Grazing losses;
- Increase in forest and brush fires; and
- Reduction in streamflow and water table.

The probability of future occurrences is ranked as medium. According to the National Weather Service, Climate Prediction Center, drought development in the GWRC region, including King George County, is likely through December 2005.

Wildfire

In evaluating the localized threat of wildfires to King George County, the MAC analyzed data from the Virginia Department of Forestry from 1995 to 2008 and Local Emergency Management (prior to 1995) to identify incidents that may have posed a threat to the community. These past occurrences are presented in Table 4-27 and Table 4-28. Locally the 39 wildfires have burned over 3600 acres across King George County. The 39 fires across a 45 year time period relates to an average of .86 fires per year. Therefore, the probability of future occurrences is ranked as medium.

Flooding

In evaluating the localized threat of floods to King George County, the MAC analyzed data from the NOAA from 1950-2010 to identify incidents that may have posed a threat to the community. These past occurrences are presented in Table 4-29. There have only been five floods in the area since 1950. The probability of future occurrences is ranked as medium-high.

Non-Rotational Wind (Hurricanes and Thunderstorms)

In evaluating the localized threat of hurricanes to King George County, the MAC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and affected the local community. These past occurrences are presented in Table 4-30. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage; and
- Multiple power outages.

Hurricane Isabel, occurring in 2003, resulted in trees down over every road in the County. Debris removal was the initial problem in getting roads open for use. Several roads took three to four days to clear. There was low to moderate damage to hundreds of homes. Fortunately, no families were displaced, although approximately 200 citizens utilized the shelter during the storm. Ice and water were requested from the State. Power outages around the County lasted for up to 15 days.

Hurricane Frances, occurring in 2004, spawned at least two tornadoes which caused minor damage to five homes in the Berry Planes subdivision. Again in 2004, Hurricane Ivan spawned two tornadoes which caused moderate damage to 25 homes in the Lake Jefferson subdivision and surrounding areas of Igo Road and Little Chatterton Lane.

Tropical Storm Lee was a broad tropical disturbance originating in the Gulf of Mexico in the beginning of September and working its way north. More than 20 inches of rain fell between September 8 & 9 throughout Virginia. The rain caused flooding, washed out roads, and toppled trees. King George County Service Authority suffered about $40,000 in losses according to Deputy Emergency Management

Coordinator Steven Lynd[1]. On November 17, 2011, Remnants of Tropical Storm Lee was declared a Major Disaster in Virginia by the President. This action makes Public Assistance available for reimbursement of disaster related costs.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, the King George County experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to King George County, the MAC analyzed local emergency management data and NOAA severe weather data from 1950 to 2010 to identify storms that may have posed a threat to the community. Most tornado activity occurred from May to September, although a historic event in February was noted. These past occurrences are presented in Table 4-31. Locally, the nine (9) tornadoes have caused:

- Property damage, including the destruction of boats;
- Tree damage and resultant power outages; and
- Loss of life.

Multiple tornadoes during the 2004 season caused damage throughout the County:

- A tornado in Waugh Point Area destroyed one house with three occupants inside, uprooted huge trees, twisted tops out of huge trees, and rolled 15 large boats off trailers at marina. Significant damage was noted to a second house.
- A tornado started at Port Conway near Montigue Baptist Church and continued to Shiloh area. There was moderate damage to the church, extensive tree damage, and debris from trees in roadways.
- A tornado came from Caroline County across the Rappahannock River and moved through the Sealston area just missing the Sealston Elementary school. The tornado continued into Stafford County where there was extensive home damage in a subdivision. Debris from damaged trees caused minor cosmetic damage to some homes.
- A tornado came from Caroline County across Dogue to Rokeby and continued through Lake Jefferson subdivision and down to Little Chatterton Lane. There was moderate damage to 35 homes from falling trees. One home on Windy Hill was partially destroyed when the roof was lifted off and walls blown out of the garage. Debris from trees was moderate except for isolated roads in the Lake Jefferson subdivision, specifically Daws Drive and Igo Road.

The probability of future occurrences is ranked as medium. With 9 tornadoes occurring between 1960 and 2010, the King George County experiences approximately 0.21 tornadoes per year.

Winter Storms

In evaluating the localized threat of winter storms to King George County, the MAC analyzed local NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4-32. Locally, the 29 northeasters and winterstorms have caused:

- Excessive snow, sleet, and freezing rain;

[1] *County Reimbursed for Expenses for Damages from Tropical Storm Lee.* Cathy Dyson. November, 22, 2011.

- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages; and
- Injury and loss of life.

A noted winter event in January 2000 cause power outages to over 3,000 customers in King George County, the City of Fredericksburg; and Spotsylvania County.

The probability of future occurrences is ranked as medium. With 24 events occurring between 1993 and 2004, King George County experiences approximately 2.8 winter events per year.

Table 4-26. Historic Drought Events – King George County.

Date	Crop Damage ($)	Descriptions
August 14, 1980	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
September 1, 1983	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
September 15, 1988	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
August 7, 1995	0	Dry weather, combined with periods of excessive heat, caused some damage to several crops, and limited the production of healthy livestock, during a month-long period that extended through mid-September. August, normally one of the wettest months, was the sixth-driest on record at Washington/National Airport (Arlington County), with barely seven-eighths of an inch (normal: 3.91 inches). Across the region, monthly precipitation averaged one to two inches, with virtually all of it falling before August 7th. The drought continued into mid-September, when it was alleviated somewhat by steady rains late on the 16th and early on the 17th. However, mean temperatures were much lower in September, ironically due to drier air masses, which allowed temperatures to plummet into the 50s on several mornings. Nonetheless, Washington/National broke an all-time record for consecutive days without measurable precipitation, with 33.
February 18, 1997	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
August 1, 1998	0	Persistent high pressure brought unusually dry weather during the entire month for much of northern and central Virginia. Only 0.45 inches of rain fell at Washington Dulles Airport, which was significantly less than the normal of 3.94 inches. Similar readings were found across most of central and northern Virginia. The lack of rainfall substantially reduced crop yields. The lack of rainfall also contributed to increasingly dry timber and brush. The U.S. Forest Service reported the George Washington and Jefferson National Forests were twice as dry as normal, and five fires broke out in these parks during the first week of the month. A water emergency was declared in Spotsylvania Co (VAZ056) on the 30th as the Ni River reservoir had neared dangerously low levels.

Date	Crop Damage ($)	Descriptions
November 1, 1998	0	This was the fifth month in a row that drought conditions were seen across Northern Virginia. Persistent high pressure over the Southeast U.S. forced rain producing low pressure systems to steer north of the region. Only 0.91 inches of rain fell at Reagan National Airport in Arlington County during the month of November, 2.19 inches below normal. The 5 month total at the airport was only 5.78 inches, 11.38 inches below normal. The independent cities of Fredericksburg received only 1.0 inches. By the end of the month, the Ni Reservoir, main water supply in Spotsylvania County, had only backup reserve water left and was at a record low level. The county was forced to continue mandatory water restrictions and buy additional water from Stafford County. The agricultural community continued to suffer through the second worst drought in the past 100 years. This was the first year the Farm Service Agency had to make direct payments for grazing losses. The drought has also contributed to a nearly unprecedented amount of forest and brush fires. Sixty-five fires were reported across Virginia between November 1st and 20th. Stafford County reported several significant brush fires during the month, and dozens of smaller fires burned in several other locations.
December 1, 1998	0	This was the sixth month in a row that drought conditions were seen across Northern Virginia. Only 1.74 inches of precipitation fell at Washington Reagan National Airport in Arlington County during December, 1.38 inches below normal. In the past 127 years, only one other July through December on record (1930) received less precipitation than the last half of 1998. The 6 month total at the airport was only 7.45 inches, 12.82 inches below normal. The Ni Reservoir, main water supply in Spotsylvania County, remained at a record low level through the month. Mandatory water restrictions continued across the county for the fifth straight month, and on the 8th, county businesses were banned from using water outdoors. The Palmer Index rated Northern Virginia in a severe to extreme drought, and the Governor declared a state of emergency across Virginia on December 1st due to the dry weather and resulting extreme fire danger. An open burning ban continued across Virginia through December 10th.
May 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. Conditions on the Shenandoah and Rappahannock River were also extremely dry. Some stations in these two watersheds reported streamflow at or below the 90th percentile exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. With such low water tables, Spotsylvania County was forced to reinstate voluntary water restrictions. The Ni River Reservoir, main water source for the county, had already dipped 4 inches below the spillway by mid month. The lack of precipitation also played havoc with spring planting and livestock maintenance. Trees were prematurely shedding leaves in orchards, hay and pastureland were wilting, and watering holes and irrigation sources were slowly drying up.
June 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. This weather pattern directed rain producing low pressure systems north of the region and continued the climatological drought that has gripped the area since last summer. By the last week of June, the Palmer Drought Index, a measure of long term drought conditions, indicated Northern Virginia was in a severe drought. Flows in the Potomac, Shenandoah, and Rappahannock basins, were equal to or slightly below minimum June daily mean flow values recorded during the 1980-82 drought. Many gauging stations reported streamflow at or below the 90 percent exceedence, and a few reported streamflow values at or below the 95th percentile. Streamflow of the Rappahannock River at Fredericksburg was only 14% of normal. With such low water tables, the city of Fredericksburg was forced to start voluntary water restrictions. The Ni River Reservoir, main water source for Spotsylvania County, dipped 16 inches below full by mid month.

Date	Crop Damage ($)	Descriptions
July 1, 1999	83.0M	High pressure was the dominant weather feature across Northern Virginia during the month. This forced most rain producing storm systems to steer north of the region and resulted in the continuation of the climatological, meteorological, and hydrological drought that had plagued the area since last summer. Many stations on the Shenandoah and Rappahannock watersheds reported streamflow at or below the 90 percent exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. The Rappahannock River was approaching 10% of normal flow, and west of Fredericksburg was flowing with just a few feet of water. Twenty miles upstream of Fredericksburg, the river was too shallow for canoes. The Ni River Reservoir, main water source for Spotsylvania County, dipped 4 inches below the spillway by mid month. In addition to agricultural lands, forest and rural vegetation were also dangerously dry. The Virginia Department of Forestry reported a record fire season January through July, 1320 fires burning 6146 acres. This number already exceeded the amount of fires reported in 1998. During the month of July alone, 61 fires burned 280 acres. The Cumulative Severity Index, a measure of fire danger which ranges from 1 to 800, gave Northern Virginia a rating of 628 by month's end. Animal control officials also attributed an increase of wildlife entering populated areas in search of food and water to the drought.
August 1, 1999	41.7M	High pressure was the dominant weather feature across Northern Virginia through the 24th of August. Most rain producing storm systems steered north of the region through the period. This resulted in the continuation of the climatological, meteorological, and hydrological drought which has plagued the area since last summer. Heavy rain fell east of the Blue Ridge Mountains on the 25th and 27th, helping to fill surface reservoirs. Unfortunately, because most of the rain fell in the form of thunderstorm downpours, most of the moisture ran off into rivers before it had the chance to seep into the aquifer supply. Via resolution, on August 17, 1999, the King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
September 1, 1999	5.0M	Rainfall from two land falling hurricanes made a tremendous impact on the drought that plagued the region since the summer of 1998. Across Northern Virginia, the greatest amount of rain fell north of a line from Staunton to Fredericksburg. The water shortage came to an end in this area by mid month. Locations to the south recorded a major increase in water supplies, upgrading their condition from an extreme drought to a mild drought, but not enough rain fell to completely wipe out the shortage. The Ni River Reservoir returned to 71% of its capacity by the end of the month, allowing officials in Spotsylvania County to lift mandatory water restrictions that were in effect for 13 months.
August 6, 2002	0	Via resolution, King County Board of Supervisors requested that the Governor of Virginia declare King George County a disaster area due to drought.
July 17-31, 2007	0	The Mid Atlantic hydrologic service area experienced severe agricultural drought conditions from the middle of July in 2007 through the end of the month in King George County. Some locations averaged as high as six inches below normal. Some jurisdictions restricted water use. Several locations were included in primary natural disaster areas due to reductions in farm production.
September 25-30, 2007	0	The Mid Atlantic hydrologic service area obtained severe agricultural drought conditions from September 25th of 2007 through the end of the month in King George County. Some locations averaged rainfall totals as high as 8 to 10 inches below normal. Severe drought status was obtained in July before conditions slightly improved. Several jurisdictions continued water use restrictions.

Source: National Climatic Data Center, 2011; and local emergency management

Table 4-27. Wildfire History (prior to 1995) – King George County.

Date	Location	Descriptions
March 14, 1963	Dogue	The King George News reported 79 acres of woodlands burned. One out building destroyed.
April 20, 1963	Route 301 & 205 and East towards Westmoreland	As reported in the Free-Lance Star / Richmond Times-Dispatch / King George News, 3500 acres of woodland burned and two to four homes in King George County. Started by a Burn Barrel.
January 11, 1966	2.5 miles east of King George Courthouse	The Free-Lance Star reported 36,000 gallons of fuel (Kerosene, Gasoline, and heating oil) burned destroying 4 of 5 tanks at the Southern States Petroleum Service Station. Several acres of woodlands also burned. Ashland Mill Road by Canterbury.
August 22, 1966	1.5 miles west of King George Courthouse	The Free-Lance Star reported saw mill and grounds destroyed by fire. Where current Post Office is on Rt. 3
Easter 1968	County Wide	Seven fires totaling 22 acres and one home destroyed
July 23, 1969	County Wide	The King George News reported an electrical storm came through King George causing structural fires.
July 12, 1986	NA	10 acres lost in field fire

Source: Local emergency management; NA = Data not available.

Table 4-28. VDOF Historic Wildfire Events – King George County.

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/17/1995	1	0	8000	Miscellaneous
08/25/1995	1	0	0	Debris Burning
06/26/1997	1	0	0	Miscellaneous
03/27/1998	1	0	0	Debris Burning
03/30/1998	14	500	0	Incendiary
09/06/1998	3	0	60000	Smoking
05/07/1999	1	0	0	Children
08/24/1999	2	0	0	Smoking
11/17/1999	1	0	0	Debris Burning
01/28/2001	18	0	0	Miscellaneous
02/20/2001	0	0	5000	Miscellaneous
03/19/2001	2	0	0	Smoking
03/07/2002	5	0	0	Debris Burning—Rural Burner
09/06/2002	2	0	0	Debris Burning—Rural Burner
03/25/2003	0.5	0	85000	Hot Ashes
04/23/2003	0.2	0	0	Utility Row
04/16/2005	0.7	0	0	Land Clearing
03/05/2006	0.3	0	0	Debris Burning—Rural Burner
03/11/2006	0.2	0	0	Debris Burning—Rural Burner
03/13/2006	0.3	0	0	Children—Juvenile
03/19/2006	2	0	215000	Children—Juvenile

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
04/05/2006	0.2	0	0	Children—Juvenile
04/03/2007	0.2	0	0	Debris Burning—Rural Burner
04/03/2007	0.1	0	0	Debris Burning—Rural Burner
04/10/2007	0.1	0	0	Debris Burning—Rural Burner
07/02/2007	0.2	0	0	Fireworks
07/11/2007	15	0	75000	Unknown
02/10/2008	7.8	0	150000	Debris Burning—Rural Burner
02/10/2008	2.3	0	0	Utility Row—Powerline
02/10/2008	1.8	0	0	Utility Row—Powerline
02/10/2008	1.7	0	0	Debris Burning—Rural Burner
03/26/2008	0.5	0	0	Debris Burning—Rural Burner
03/28/2008	1	0	0	Children—Juvenile
Totals	87.1	500	598000	

Source: Virginia Department of Forestry, 2008.

Table 4-29. Historic Flood Events—King George County.

Date	Event	Comments
January 28, 1998	Flood	An intense and lingering Nor'easter produced a large area of heavy rains across Central and Northeastern Virginia. Many streams in King George County flooded and several road closures occurred.
February 4, 1998	Flood	A powerful nor'easter dropped between 2 and 4 inches of rain across Northern Virginia resulting in widespread minor to moderate flooding. Hundreds of roads were closed across the region. The dam at Lake Jackson was reported to be over 6 feet above flood stage. Several school districts closed for the following day due to the flooding and continued threat of heavy rain. Property damage estimates were 5K.
September 16, 1999	Flash Flood	Hurricane Floyd produced thunderstorms releasing 2 to 5 inches of rain across Northern Virginia. King George County reported numerous felled trees and over 16,000 power outages were reported across Northern Virginia.
July 14, 2000	Flash Flood	A powerful cold front produced heavy rainfall, hail, and winds in excess of 55mph in Northern Virginia. King George County received over 3 inches of rain. Numerous felled trees and closed roads reported.
March 20, 2003	Flood	Across the region of Northern Virginia between 1.5 and 2.5 inches of rain fell. In King George County, water overflowed from ditches onto roads.

Source: NOAA, 2011

Table 4-30. Historic Hurricane Events – King George County.

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	Gusty winds from 30 to 50 mph 2 to 5 inches of rain 16,000 power outages
Isabel	September 18, 2003	Tropical Storm	Unknown	Trees down over every road in County. High winds to 85 mph sustained with gusts to 101mph. Over 300 emergency calls, low to moderate damage to 100's of homes, no families displaced, almost 200 in shelter during storm, ice and water request from State, power outages Countywide for up to 15 days. Isolated power outages longer. EOC operational for 5 days. Shelters opened for one night. Debris removal initially a problem getting roads open. Some roads took 3-4 days to clear. VDOT debris removal continued for one month. Major damage to infrastructure was County wide. Federal Declaration received. FEMA arrived and individual assistance provided. Major damage to many homes, some not inhabitable. Shelter opened with 85 people sheltered during storm. At least one crab business reportedly flooded.
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	Highest sustained wind was 73 mph Uprooted trees and downed numerous power lines Over 2 million Virginians without power Heavy rain and wind gust 2-4 inches of rain, mild winds, indirect hit to area. No damage noted
Frances	September 8, 2004	Hurricane	Unknown	At least two tornadoes touched down causing minor damage to 5 homes in the Berry Planes subdivision. Other areas affected were woods only. No Presidential Declaration received. Moderate wind gusts and rains. Indirect hit – hurricane.
Ivan	September 17, 2004	Hurricane	Unknown	At least two tornadoes touched down causing moderate damage to 25 homes in the Lake Jefferson subdivision and surrounding areas of Igo Road and Little Chatterton Lane. Other areas affected were woods only. No Presidential Declaration received. Moderate wind gusts and rains. Indirect hit - hurricane.
Jeanne	September 28, 2004	Hurricane	Unknown	2-4 inches of rain and moderate winds across the County. No damage reported. Tornado Watch in affect – none received. Indirect hit.

Storm Name	Date	Category	Total Est. Damage	Descriptions
Gaston	August 30, 2004	Tropical Depression	Unknown	Hard rains that processed flooding Roads under water Power outage (99,600 statewide) 2-4 inches of rain, mild winds, indirect hit to area. No damage noted

Source: NOAA 2004, VWC 2004, local emergency management, *The Free Lance and Daily Star.*

Table 4-31. Tornado History – King George County.

Date	Magnitude	Property Damage ($)	Descriptions
February 18, 1960	F1	0K	
September 5, 1979	F1	250K	
Late 1990's	NA	NA	NSWCDD to Ferry Dock Road in Dahlgren Tornado came through naval base twisting off enormous trees with minor damage to some homes mostly from falling trees. Continued through Ferry Dock Road and across Potomac Drive with tree damage.
July 2, 1999	F1	10K	Parts of southern King George County lost power after downed trees fell onto power lines.
July 10, 2003	F0	0	F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3 The tornado moved northeast and damaged trees until it lifted near Route 218 on the King George County line
May 7, 2004	F1	10K	At 7:51 p.m., an F1 tornado touched down near Passapatanzy. At least a dozen dwellings and 10 boats were damaged. Several trees were also uprooted or had their tops ripped out along the storm's three-mile path. In Stafford County, 80 to 90 mph winds destroyed two homes and caused major damage to 20 others. The Japazawas Subdivision in eastern Stafford County had approximately 40 trees down. Three Amtrak trains were stalled between the Chatham area of Stafford and Fredericksburg due to downed trees and power lines. In Spotsylvania County, the main stage at the re-enactment of the Battle of Spotsylvania collapsed due to strong winds. A number of tents and a couple of portable toilets were also blown over. Estimated damages were $10,000.

Date	Magnitude	Property Damage ($)	Descriptions
Fall 2004	NA	NA	4 Tornadoes spawned from multiple back to back hurricanes Tornado in Waugh Point Area destroyed one house with three occupants inside, uprooted huge trees, twisted tops out of huge trees, rolled 15 large boats off trailers at marina. Significant damage to a second house. Tornado started at Port Conway near Montigue Baptist Church and continued to Shiloh area. Moderate damage to church, extensive tree damage, Debris from trees in roadways. Tornado came from Caroline County across the Rappahannock River moved through Sealston area just missing Sealston Elementary school. Continued into Stafford County where there was extensive home damage in a subdivision. Debris from damaged trees minor cosmetic damage to some homes. Tornado came from Caroline County across Dogue to Rokeby and continued through Lake Jefferson subdivision and down to Little Chatterton Lane. 35 homes with moderate damage from falling trees, one home on windy hill partially destroyed when roof was lifted off and walls blown out of garage. Two barns destroyed by wind, Little Chatterton with moderate damage from tree falling on home. Not a lot of debris from trees except for isolated roads in Lake Jefferson subdivision Daws Drive and Igo Road.
September 8, 2004	F1	7K	At 3:57 p.m., an F1 tornado moved from Caroline County along the Stafford-King George County line. Numerous large trees up to three feet in diameter were uprooted and had their tops ripped from them along Route 3 near Sealston. The storm was rated an F1 due to the extensive tree damage observed. Damage was estimated at $7,000.
September 17, 2004	F1	500K	Tornado reported in the Fairview Beach area.

Source: NOAA 2004 and local emergency management; NA = Data not available.

Table 4-32. Historic Northeaster and Winter Storm Events – King George County.

Date	Event	Property Damage ($)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.
January 12, 1996	Heavy Snow	350K	Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches.

Date	Event	Property Damage ($)	Comments
			In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.
February 16, 1996	Heavy Snow	0	A strong "Alberta Clipper", diving southeast from the upper Midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.
January 14, 1999	Winter Weather	0	A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.

Date	Event	Property Damage ($)	Comments
January 20, 2000	Winter Weather	0	An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.
January 25, 2000	Northeaster	0	Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.
January 30, 2000	Ice Storm	0	Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.
February 12, 2000	Winter Weather	0	Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.
December 13, 2000	Winter Weather	0	A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.
February 22, 2001	Winter Storm	0	This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.

Date	Event	Property Damage ($)	Comments
January 3, 2002	Winter Storm	0	Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.
February 6, 2003	Winter Storm	0	Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.
February 26, 2003	Winter Weather/mix	0	A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches.
January 25, 2004	Winter Weather/mix	0	An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.
December 5, 2005	Heavy Snow	40K	A winter weather storm produced 4 to 6.5 inches of snow across Northern Virginia. There were reports of trees down in due to heavy snow accumulations.
February 11, 2006	Heavy Snow	250K	Storm snowfall across Northern Virginia produced between 8 and 14 inches. There were reports of isolated drifting of snow and downed powerlines throughout the region. This caused over 300,000 customers to be without power in the greater Washington/Baltimore area.

Date	Event	Property Damage ($)	Comments
December 19, 2009	Winter Storm	0	Snowfall amounts were reported between 16 and 21 inches across King George County.
January 26, 2011	Winter Storm	0	Snowfall accumulation totaled up to 7.5 inches in Central Virginia. The heavy snow fell in the evening rush hour, causing traffic accidents and stranded vehicles. Numerous power outages were also reported.
January 30, 2010	Winter Storm	0	Snowfall accumulation was between 5 and six inches in King George County.

Source: National Climatic Data Center, 2011.

D. Spotsylvania County Hazard Identification

For the 2012 plan update, the GWRC steering committee reviewed the 2010 Commonwealth of Virginia Hazard Mitigation Plan, as well as the hazard events over the preceding five years, and determined a hazard ranking for each of the hazards below. For this update, the committee chose to use the State's Hazard Type language as an update to the 2006 hazard type, to ensure better alignment with the state's rankings and methodologies. Those rankings can be seen below in Table 4-33. For Spotsylvania County, hazards that ranked high and medium-high were then investigated further and a vulnerability analysis was performed.

Table 4-33. Prioritization of Natural Hazards. Spotsylvania County.

2006 Hazard type	2010 State Hazard Type	2012 Section Heading	2010 State Ranking for Spotsylvania County	2012 Hazard Ranking from Spotsylvania County
Dam Failure	N/A	Dam Failure	N/A	Low
Drought	Drought	Drought and Extreme Heat	Medium	Medium
Extreme Heat	Drought			
Wildfire	Wildfires	Wildfires	Medium	Medium
Earthquakes	Earthquakes	Earthquakes	Medium-Low	Medium-Low
Expansive Soils	Sinkholes	Sinkholes and Landslides	Low	Low
Landslides	Landslide			
Flooding	Flooding	Flooding and Erosion	High	High
Hurricanes	Non-Rotational Wind	Non-Rotational Wind	High	High
Thunderstorms	Non-Rotational Wind			
Tornadoes	Tornadoes	Rotational Wind	Medium-High	Medium-High
Northeasters	Winter Storms	Winter Storms and Nor'easters	High	High
Winter Storms	Winter Storms			

Drought

In evaluating the localized threat of droughts to Spotsylvania County, the MAC analyzed NOAA data from 1951 to 2011 to identify incidents of droughts that posed a threat to the community. These past occurrences are presented in Table 4-34. Locally, droughts have caused:

- Requests to the Governor for disaster status;
- Voluntary and mandatory reductions in water usage;
- Reduction in crop yields:
- Grazing losses;
- Increase in forest and brush fires; and
- Reduction in streamflow and water table.

There have been 10 incidents of drought that affected King George County in a 12 year period from 1995 to 2007; Spotsylvania experiences .8 droughts per year. The probability of future occurrence is ranked as medium.

Wildfires

In evaluating the localized threat of wildfires to Spotsylvania County, the MAC analyzed data from the Virginia Department of Forestry from 1995-2008 to identify incidents that posed a threat to the community. The past occurrences are presented in Table 4-35. There have been 232 wildfire events since 1995. That is an average of 17.85 fires per year. Therefore, the probability of future occurrences is rated as medium.

Flooding

In evaluating the localized threat of floods to Spotsylvania County, the MAC analyzed NOAA data from 1951 to 2011 to identify incidents of flooding that may have posed a threat to the community. The analysis included both floods and flash floods. The past occurrences are presented in Table 4-36. There have been 19 flooding events in King George County since 1993. That's an average of 1.11 floods per year. Therefore, the probability of future occurrences is rated as high.

Non-Rotation Wind (Hurricane and Thunderstorms)

In evaluating the localized threat of hurricanes to Spotsylvania County, the MAC analyzed local emergency management data and NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and affected the local community. These past occurrences are presented in Table 4-37. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage;
- Road closures; and
- Multiple power outages.

Hurricane Isabel, occurring in 2003, caused power outages in 85 percent of the County, lasting for up to nine days.

Lightning from a thunderstorm in May of 1996 struck a tree in Spotsylvania County. The tree landed on a resident leaving him unconscious. A separate lightning strike started a fire in an abandoned trailer.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, Spotsylvania County experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to Spotsylvania, the MAC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have

posed a threat to the community. Most tornado activity occurred from May to September, although a historic event in February was noted. These past occurrences are presented in Table 4-38.
Locally, the nine (9) tornadoes have caused:

- Property damage, including the destruction of mobile homes;
- Damage to the stage of the re-enactment of the Battle of Spotsylvania;
- Tree damage and resultant power outages; and
- Personal injury.

Noted tornadoes occurring during 1998, 2000, and 2002 have damaged homes, industrial buildings, and mobile homes:

- In 1998, a tornado along Route 17 Bypass / CSX Railroad / Route 608 Benchmark Road damaged one home and one industrial building.
- In 2000, a tornado along Hickory Ridge Road destroyed one single wide trailer. The path of the tornado started behind Berkeley Elementary School and continued northeast to Route 608.
- In 2002, a tornado in the Paytes Area was spotted. No building damage was reported.

The probability of future occurrences is ranked as medium. With 9 tornadoes occurring between 1960 and 2004, Spotsylvania County experiences approximately 0.21 tornadoes per year.

Winter Storms

In evaluating the localized threat of winter storms to Spotsylvania County, the MAC analyzed local NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4-39. Locally, the 31 northeasters and winterstorms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents and delays;
- Tree and property damage;
- Power outages (over 3,000 customers in one incident); and
- Injury and loss of life.

A noted ice storm occurring during 1993 left one-third of the County without power for up to seven days. Two emergency shelters were utilized.

The probability of future occurrences is ranked as medium. With 31 events occurring between 1993 and 2010, Spotsylvania County experiences approximately 1.82 winter events per year.

Table 4-34. Historic Drought Events – Spotsylvania County.

Date	Crop Damage ($)	Descriptions
August 7, 1995	0	Dry weather, combined with periods of excessive heat, caused some damage to several crops, and limited the production of healthy livestock, during a month-long period that extended through mid-September. August, normally one of the wettest months, was the sixth-driest on record at Washington/National Airport (Arlington County), with barely seven-eighths of an inch (normal: 3.91 inches). Across the region, monthly precipitation averaged one to two inches, with virtually all of it falling before August 7th. The drought continued into mid-September, when it was alleviated somewhat by steady rains late on the 16th and early on the 17th. However, mean temperatures were much lower in September, ironically due to drier air masses, which allowed temperatures to plummet into the 50s on several mornings. Nonetheless, Washington/National broke an all-time record for consecutive days without measurable precipitation, with 33.
August 1, 1998	0	Persistent high pressure brought unusually dry weather during the entire month for much of northern and central Virginia. Only 0.45 inches of rain fell at Washington Dulles Airport, which was significantly less than the normal of 3.94 inches. Similar readings were found across most of central and northern Virginia. The lack of rainfall substantially reduced crop yields. The lack of rainfall also contributed to increasingly dry timber and brush. The U.S. Forest Service reported the George Washington and Jefferson National Forests were twice as dry as normal, and five fires broke out in these parks during the first week of the month. A water emergency was declared in Spotsylvania Co (VAZ056) on the 30th as the Ni River reservoir had neared dangerously low levels.
November 1, 1998	0	This was the fifth month in a row that drought conditions were seen across Northern Virginia. Persistent high pressure over the Southeast U.S. forced rain producing low pressure systems to steer north of the region. Only 0.91 inches of rain fell at Reagan National Airport in Arlington County during the month of November, 2.19 inches below normal. The 5 month total at the airport was only 5.78 inches, 11.38 inches below normal. The independent cities of Fredericksburg received only 1.0 inches. By the end of the month, the Ni Reservoir, main water supply in Spotsylvania County, had only backup reserve water left and was at a record low level. The county was forced to continue mandatory water restrictions and buy additional water from Stafford County. The agricultural community continued to suffer through the second worst drought in the past 100 years. This was the first year the Farm Service Agency had to make direct payments for grazing losses. The drought has also contributed to a nearly unprecedented amount of forest and brush fires. Sixty-five fires were reported across Virginia between November 1st and 20th. Stafford County reported several significant brush fires during the month, and dozens of smaller fires burned in several other locations.
December 1, 1998	0	This was the sixth month in a row that drought conditions were seen across Northern Virginia. Only 1.74 inches of precipitation fell at Washington Reagan National Airport in Arlington County during December, 1.38 inches below normal. In the past 127 years, only one other July through December on record (1930) received less precipitation than the last half of 1998. The 6 month total at the airport was only 7.45 inches, 12.82 inches below normal. The Ni Reservoir, main water supply in Spotsylvania County, remained at a record low level through the month. Mandatory water restrictions continued across the county for the fifth straight month, and on the 8th, county businesses were banned from using water outdoors. The Palmer Index rated Northern Virginia in a severe to extreme drought, and the Governor declared a state of emergency across Virginia on December 1st due to the dry weather and resulting extreme fire danger. An open burning ban continued across Virginia through December 10th.

Date	Crop Damage ($)	Descriptions
May 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. Conditions on the Shenandoah and Rappahannock River were also extremely dry. Some stations in these two watersheds reported streamflow at or below the 90th percentile exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. With such low water tables, Spotsylvania County was forced to reinstate voluntary water restrictions. The Ni River Reservoir, main water source for the county, had already dipped 4 inches below the spillway by mid month. The lack of precipitation also played havoc with spring planting and livestock maintenance. Trees were prematurely shedding leaves in orchards, hay and pastureland were wilting, and watering holes and irrigation sources were slowly drying up.
June 1, 1999	0	High pressure was the dominant weather feature across Northern Virginia during the month. This weather pattern directed rain producing low pressure systems north of the region and continued the climatological drought that has gripped the area since last summer. By the last week of June, the Palmer Drought Index, a measure of long term drought conditions, indicated Northern Virginia was in a severe drought. Flows in the Potomac, Shenandoah, and Rappahannock basins, were equal to or slightly below minimum June daily mean flow values recorded during the 1980-82 drought. Many gauging stations reported streamflow at or below the 90 percent exceedence, and a few reported streamflow values at or below the 95th percentile. Streamflow of the Rappahannock River at Fredericksburg was only 14% of normal. With such low water tables, the city of Fredericksburg was forced to start voluntary water restrictions. The Ni River Reservoir, main water source for Spotsylvania County, dipped 16 inches below full by mid month.
July 1, 1999	83.0M	High pressure was the dominant weather feature across Northern Virginia during the month. This forced most rain producing storm systems to steer north of the region and resulted in the continuation of the climatological, meteorological, and hydrological drought that had plagued the area since last summer. Many stations on the Shenandoah and Rappahannock watersheds reported streamflow at or below the 90 percent exceedence, which rivaled minimum daily mean flow values of the drought of 1980-82. The Rappahannock River was approaching 10% of normal flow, and west of Fredericksburg was flowing with just a few feet of water. Twenty miles upstream of Fredericksburg, the river was too shallow for canoes. The Ni River Reservoir, main water source for Spotsylvania County, dipped 4 inches below the spillway by mid month. In addition to agricultural lands, forest and rural vegetation were also dangerously dry. The Virginia Department of Forestry reported a record fire season January through July, 1320 fires burning 6146 acres. This number already exceeded the amount of fires reported in 1998. During the month of July alone, 61 fires burned 280 acres. The Cumulative Severity Index, a measure of fire danger which ranges from 1 to 800, gave Northern Virginia a rating of 628 by month's end. Animal control officials also attributed an increase of wildlife entering populated areas in search of food and water to the drought.
August 1, 1999	41.7M	High pressure was the dominant weather feature across Northern Virginia through the 24th of August. Most rain producing storm systems steered north of the region through the period. This resulted in the continuation of the climatological, meteorological, and hydrological drought which has plagued the area since last summer. Heavy rain fell east of the Blue Ridge Mountains on the 25th and 27th, helping to fill surface reservoirs. Unfortunately, because most of the rain fell in the form of thunderstorm downpours, most of the moisture ran off into rivers before it had the chance to seep into the aquifer supply.

Date	Crop Damage ($)	Descriptions
September 1, 1999	5.0M	Rainfall from two land falling hurricanes made a tremendous impact on the drought that plagued the region since the summer of 1998. Across Northern Virginia, the greatest amount of rain fell north of a line from Staunton to Fredericksburg. The water shortage came to an end in this area by mid month. Locations to the south recorded a major increase in water supplies, upgrading their condition from an extreme drought to a mild drought, but not enough rain fell to completely wipe out the shortage. The Ni River Reservoir returned to 71% of its capacity by the end of the month, allowing officials in Spotsylvania County to lift mandatory water restrictions that were in effect for 13 months.
July 17-30, 2007	0	The Mid Atlantic hydrologic service area experienced severe agricultural drought conditions from mid July through the end of the month. This area included Spotsylvania, Stafford, and King George Counties. Some locations averaged six inches below normal, leading to some jurisdictions restricting water use. Damage estimates were not available due to current harvest progress. Several locations were included in primary natural disaster areas due to reductions in farm production.
September 25-30, 2007	0	The Mid Atlantic hydrologic service area experienced severe agricultural drought conditions from September 25th through the end of the month. This area included Spotsylvania, King George, and Stafford Counties. Some locations received as much as 10 inches below normal, leading to continued restrictions on water use. Damage estimates were not available. Several locations were included in primary natural disaster areas due to reductions in farm production.

Source: National Climatic Data Center, 2005.

Table 4-35. Historic Wildfire Events – Spotsylvania County.

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
01/14/1995	2	0	0	Smoking
02/22/1995	2	0	180000	Children
02/23/1995	20	2700	300800	Debris Burning
02/24/1995	1	1000	2000	Incendiary
03/14/1995	1	400	100000	Debris Burning
03/17/1995	1	100	0	Children
03/17/1995	1	800	29000	Debris Burning
03/19/1995	1	0	200000	Incendiary
03/22/1995	1	250	0	Children
03/26/1995	1	0	0	Smoking
03/27/1995	1	100	0	Debris Burning
03/31/1995	1	300	205000	Debris Burning
04/02/1995	4	100	201400	Children
04/02/1995	1	100	0	Children
04/04/1995	3	1000	0	Smoking

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
04/08/1995	2	5700	31000	Miscellaneous
04/08/1995	1	5000	450000	Children
04/15/1995	1	500	40000	Children
04/21/1995	1	200	0	Smoking
04/27/1995	1	200	0	Debris Burning
03/05/1996	1	100	0	Children
03/13/1996	3	0	90000	Debris Burning
03/16/1996	2	0	200000	Smoking
03/23/1996	2	0	0	Debris Burning
03/25/1996	2	0	310000	Debris Burning
03/25/1996	1	100	300000	Debris Burning
04/08/1996	1	0	80000	Children
04/08/1996	1	500	75000	Miscellaneous
04/19/1996	1	700	600000	Children
04/23/1996	7	10500	2000	Debris Burning
04/23/1996	3	0	500000	Miscellaneous
04/25/1996	2	300	162000	Debris Burning
02/19/1997	2	100	200000	Miscellaneous
02/21/1997	1	0	0	Smoking
02/25/1997	4	0	0	Smoking
03/06/1997	1	0	0	Miscellaneous
03/11/1997	2	200	60500	Debris Burning
03/11/1997	1	0	0	Smoking
03/12/1997	1	0	0	Children
03/12/1997	1	100	50	Miscellaneous
03/16/1997	1	200	150000	Debris Burning
03/24/1997	2	400	40000	Debris Burning
03/27/1997	1	0	500000	Children
03/30/1997	1	100	0	Children
04/01/1997	4	200	20000	Children
04/01/1997	2	400	550000	Equipment Use
04/02/1997	3	500	500	Children
04/03/1997	3	0	50000	Smoking
04/07/1997	5	500	100500	Debris Burning
04/19/1997	1	150	0	Smoking
04/30/1997	2	400	0	Children
05/12/1997	1	300	90000	Debris Burning
05/20/1997	5	0	0	Debris Burning
05/28/1997	3	400	0	Smoking
07/14/1997	1	100	400	Smoking
08/01/1997	1	0	0	Debris Burning
08/29/1997	1	0	0	Railroad

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/14/1998	2	50	5025	Debris Burning
03/29/1998	4	0	0	Debris Burning
03/29/1998	1	0	0	Children
04/02/1998	1	100	0	Debris Burning
04/06/1998	2	0	0	Debris Burning
04/07/1998	1	100	0	Children
04/13/1998	1	0	0	Children
04/13/1998	1	400	0	Children
04/13/1998	1	200	0	Children
08/05/1998	7	100	160000	Debris Burning
08/06/1998	1	0	0	Miscellaneous
09/06/1998	2	0	0	Debris Burning
09/07/1998	2	0	0	Children
09/09/1998	1	100	80000	Lightning
10/18/1998	1	900	0	Smoking
10/28/1998	2	500	305000	Debris Burning
11/01/1998	1	500	1000000	Campfire
11/02/1998	1	500	0	Miscellaneous
11/08/1998	1	100	0	Children
11/28/1998	1	100	0	Incendiary
11/30/1998	4	100	190000	Debris Burning
12/01/1998	1	500	0	Campfire
12/02/1998	1	500	2000000	Children
12/19/1998	1	0	80000	Children
03/18/1999	38	1200	300000	Debris Burning
03/28/1999	2	500	315000	Debris Burning
03/28/1999	1	100	750000	Smoking
03/30/1999	2	0	0	Equipment Use
03/31/1999	8	2000	305000	Debris Burning
04/14/1999	3	800	0	Smoking
04/17/1999	6	2200	3000	Smoking
04/17/1999	2	200	311000	Smoking
05/11/1999	1	0	2000	Smoking
05/21/1999	1	200	0	Children
08/05/1999	30	5000	505000	Debris Burning
08/07/1999	1	400	75000	Children
08/08/1999	2	0	0	Children
08/11/1999	1	0	0	Equipment Use
11/07/1999	3	100	0	Children
11/16/1999	3	100	255000	Miscellaneous
01/13/2000	3	500	250500	Miscellaneous
02/25/2000	1	0	0	Miscellaneous

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/04/2000	1	0	0	Incendiary
03/05/2000	3	200	0	Campfire
03/05/2000	1	0	0	Campfire
03/15/2000	1	400	150000	Debris Burning
03/27/2000	1	0	0	Children
03/31/2000	1	500	20000	Debris Burning
04/01/2000	2	500	102000	Debris Burning
04/01/2000	1	6500	12000	Debris Burning
04/13/2000	1	0	100	Equipment Use
10/18/2000	1	0	73000	Debris Burning
01/30/2001	10	1000	100000	Miscellaneous
01/30/2001	4	1500	303500	Debris Burning
01/30/2001	2	0	0	Miscellaneous
01/30/2001	1	0	0	Debris Burning
04/10/2001	13	1000	0	Incendiary
04/10/2001	1	700	400	Debris Burning
04/15/2001	9	250	0	Debris Burning
04/19/2001	1	200	0	Children
04/20/2001	2	200	115000	Debris Burning
04/22/2001	9	400	0	Incendiary
04/30/2001	1	0	0	Debris Burning
07/16/2001	4	1000	0	Miscellaneous
07/16/2001	1	0	0	Debris Burning
07/17/2001	1	0	0	Smoking
08/20/2001	17	500	0	Incendiary
10/22/2001	5	0	0	Campfire
11/05/2001	3	100	1000	Debris Burning
11/06/2001	1	50	130000	Debris Burning
11/12/2001	2	300	0	Miscellaneous
11/12/2001	1	500	60000	Smoking
11/14/2001	1	1000	0	Incendiary
11/17/2001	1	0	0	Smoking
04/10/2001	1	700	400	Debris Burning
04/15/2001	9	250	0	Debris Burning
02/01/2002	1	0	100000	Utility Row
02/04/2002	1	0	0	Prescribed Burn
02/17/2002	0.2	0	0	Hot Ashes
02/27/2002	0.1	0	1000000	Incendiary
02/28/2002	0.1	0	600000	Incendiary
02/28/2002	0.1	0	600000	Incendiary
02/28/2002	0.2	0	750000	Incendiary
03/01/2002	0.2	0	200000	Hot Ashes

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/05/2002	1	0	500000	Truck Fire
03/06/2002	2	0	0	Children—Juvenile
03/10/2002	10	1500	625000	Debris Burning—Rural Burner
03/15/2002	2	50000	0	Debris Burning—Stump Pile
04/02/2002	0.1	0	0	Incendiary
04/04/2002	1	0	0	Children—Juvenile
04/08/2002	4	1000	300000	Debris Burning—Rural Burner
04/14/2002	3	100	100000	Children—Juvenile
04/17/2002	1	300	0	Incendiary—Automobile
05/24/2002	0.1	200	0	Incendiary—Automobile
05/31/2002	0.2	200	0	Incendiary—Automobile
06/07/2002	2	1000	100000	Lightning
06/12/2002	3	500	250000	Incendiary
06/20/2002	6	0	0	Prescribed Burn
06/22/2002	7	1000	0	Prescribed Burn
06/24/2002	4	0	0	Debris Burning—Rural Burner
07/11/2002	2	500	50000	Smoking
07/12/2002	0.2	0	0	Debris Burning—Rural Burner
07/22/2002	4	2000	0	Prescribed Burn
07/23/2002	1	200	0	Debris Burning—Rural Burner
08/092002	1	0	80000	Debris Burning—Rural Burner
08/18/2002	0.1	100	0	Equipment Use—Vehicle Brake
01/26/2003	0.2	0	100000	Debris Burning—Rural Burner
03/24/2003	0.1	0	230000	Debris Burning—Urban Burner
03/25/2003	1	0	250000	Children—Juvenile
04/06/2003	1	0	100000	Children—Juvenile
10/02/2003	3	0	0	Children—Juvenile
11/13/2003	1.5	0	0	Utility Row
2/23/2004	0.2	0	0	Children—Juvenile
02/29/2004	1	0	0	Debris Burning—Rural Burner
03/03/2004	0.2	0	150000	Debris Burning—Rural Burner
03/12/2004	9	0	1000000	Children—Juvenile
03/21/2004	0.1	0	0	Children—Juvenile
03/25/2004	0.1	0	0	Unknown
03/07/2005	2	0	400000	Incendiary—Juvenile
03/07/2005	4	0	0	Incendiary—Juvenile
03/19/2005	2	0	0	Incendiary
03/19/2005	2	0	0	Children—Juvenile
03/20/2005	0.2	0	100000	Children—Child Age Under 7
03/22/2005	0.1	0	200000	Debris Burning—Rural Burner
04/16/2005	1	0	0	Debris Burning—Rural Burner
4/26/2005	0.1	0	0	Children—Juvenile

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
05/10/2005	2	0	0	Debris Burning—Rural Burner
06/20/2005	2	400	0	Land Clearing
3/5/2006	0.1	0	250000	Unknown
03/09/2006	3	0	0	Land Clearing
03/09/2006	0.1	0	0	Debris Burning—Rural Burner
03/132006	1	0	0	Children—Juvenile
03/13/2006	2	0	0	Hot Ashes
03/13/2006	0.2	0	0	Hot Ashes
03/15/2006	0.6	0	800000	Utility Row
03/18/2006	2	0	0	Debris Burning—Rural Burner
03/19/2006	0.2	0	3000000	Incendiary—Juvenile
03/19/2006	0.1	0	600000	Smoking
03/19/2006	0.1	0	0	Children—Child Under Age 7
03/25/2006	0.1	0	0	Children—Juvenile
03/27/2006	0.2	0	100000	Debris Burning—Rural Burner
03/27/2006	0.2	0	0	Debris Burning—Rural Burner
04/01/2006	0.1	0	0	Debris Burning—Rural Burner
04/02/2006	0.2	0	0	Children—Juvenile
04/19/2006	0.2	0	300000	Debris Burning—Rural Burner
05/03/2006	3	0	900000	Smoking—Construction
02/23/2007	0.2	0	200000	Children—Juvenile
03/08/2007	0.4	0	0	Children—Juvenile
03/10/2007	0.2	0	500000	Debris Burning—Rural Burner
03/13/2007	4	0	300000	Debris Burning—Rural Burner
03/13/2007	0.1	0	0	Equipment Use—Lawnmower
03/29/2007	1	0	150000	Smoking—Automobile
03/29/2007	0	0	0	Incendiary—Juvenile
03/31/2007	0	0	200000	Debris Burning—Rural Burner
04/02/2007	0.1	0	0	Debris Burning—Urban Burner
04/04/2007	0.5	0	0	Incendiary—Automobile
04/23/2007	0.1	0	0	Debris Burning—Rural Burner
04/24/2007	0.1	0	0	Children—Juvenile
07/13/2007	0.2	0	700000	Children—Juvenile
09/10/2007	2	0	0	Debris Burning—Rural Burner
10/16/2007	0.7	0	0	Children—Juvenile
10/21/2007	0.1	0	0	Children—Juvenile
02/10/2008	1	0	0	Debris Burning—Rural Burner
02/10/2008	0.2	0	700000	Debris Burning—Rural Burner
02/10/2008	2.7	0	0	Utility Row
02/11/2008	2	0	500000	Utility Row
02/19/2008	1	0	500000	Utility Row
03/02/2008	0.2	0	750000	Children—Juvenile

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/21/2008	1	0	0	Utility Row
03/21/2008	0.1	0	175000	Children—Juvenile
03/22/2008	0	0	400000	Children—Juvenile
03/28/2008	0.2	0	0	Debris Burning—Rural Burner
04/15/2008	0.1	0	0	Debris Burning—Rural Burner
04/15/2008	0.1	0	0	Incendiary
05/05/2008	2.5	1000	0	Equipment Use
Totals	509.6	130,500	32,589,075	

Source: Virginia Department of Forestry, 2008

Table 4-36. Historic Flood Events – Spotsylvania County.

Date	Event	Comments
April 16, 1993	Flash Flood	N/A
January 19-22, 1996	Flood	River flooding occurred across the Commonwealth of Virginia starting in the early morning of January 19th. Snowmelt with a liquid equivalency of 2 to 3 inches combined with another 1 to 3 inches of rainfall caused the worst regional flooding in over a decade. River flooding began at the headwaters of all basins, continuing downstream for the next 3 days. Crests ranged from 3 to 21 feet above the flood stage. High water caused millions in damages, closed roads, destroyed homes and businesses, and even forced the evacuation of several towns. Total property damage estimates were at 15 million and crop damages were at 81K.
June 18, 1996	Flash Flood	Thunderstorms in Spotsylvania County produced residential and small stream flooding in the central region of the county. In the subdivision of Spotslee, water was reported at least 2 feet high. Further west, several small streams were out of their banks. Total property damage estimates were 10K.
January 28, 1998	Flood	A nor'easter lingering in the area produced heavy rains across the central and northeastern regions of Virginia. Widespread minor to moderate flooding of small streams, creeks, and low-lying areas occurred across the Northern Neck of Virginia. The Virginia Department of Transportation reported over 150 roads closed in the area due to standing water or creeks that exceeded bankful. High wind gusts exceeding 30 mph combined with highly saturated soil caused isolated cases of felled trees and power lines. Property damage estimates were around 2.5K.

Date	Event	Comments
February 4, 1998	Flood	A powerful nor'easter dropped between 2 and 4 inches of rain across Northern Virginia resulting in widespread minor to moderate flooding. Hundreds of roads were closed across the region. The dam at Lake Jackson was reported to be over 6 feet above flood stage. Several school districts closed for the following day due to the flooding and continued threat of heavy rain. Property damage estimates were 5K.
June 23, 1998	Flash Flood	A series of strong to severe thunderstorms in Northern and Central Virginia produced rainfall totals between 2 and 6 and wind gusts between 60 and 80 mph. Flooding of several low-lying areas occurred and streams in the area over spilled their banks. The storms knocked out power to at least 12,500 customers in Northern and Central Virginia.
September 16, 1999	Flash Flood	Storms from Hurricane Floyd produced rainfall totals just shy of 6 inches in Spotsylvania County. The same area observed wind gusts between 30 and 50 mph. Wind gusts caused several trees to fall down combined with high water forced the closure of several roads in the county.
September 3, 2000	Flash Flood	Heavy thunderstorms produced a total rainfall of 2.5 inches in only 50 minutes in Spotsylvania County Across the county Rtes. 17 and 1, Leavells Road, and Loreilla Park Drive were flooded and closed.
February 22, 2003	Flood	In Spotsylvania County a storm produced between 1.5 to 3 inches of rain combined with the snowmelt of a massive snowstorm led to widespread flooding across Northern Virginia. In Spotsylvania County, 1 primary and 7 secondary roads were flooded and 1 private road was washed out. County officials rescued 4 people, 2 horses, and six dogs from flood waters.
March 20, 2003	Flood	Across the region of Northern Virginia between 1.5 and 2.5 inches of rain fell. In Spotsylvania County, a handful of roads were caused by flooding.
September 18, 2003		
January 14, 2005	Flood	Flooding and a mudslide reported in Central Virginia.
June 26-27, 2006	Flash Flood	Persistent rain across a 5 day period resulted in double digit rainfall totals across Northern Virginia. There were extensive power outages across the region and the VRE was temporarily inoperable. Debris was reported over the road near Jefferson Davis High and Spotsylvania Parkway due to receded flood waters.
November 16, 2006	Flood	Thunderstorms hit Northern Virginia producing floods throughout the region. In Spotsylvania County, several trees were downed. School buses in the county were forced to return students to school due to flooding on county roadways between Massaponax Church and Leavells.

Date	Event	Comments
July 29, 2007	Flash Flood	A cold front combined with a low pressure system triggered thunderstorms across Central and Northern Virginia. Several of these storms were severe producing damaging winds and large hail. Law Enforcement officials in Spotsylvania County reported water over the road at Teton Drive and Landsdowne Road. A mudslide was reported on Route 1.
May 9, 2008	Flood	Numerous strong to sever thunderstorms struck the area of Central and Northern Virginia. Two tornadoes occurred in Central Virginia. These storms produced damaging winds that drowned trees and power lines. Spotsylvania County Emergency Management reported that West Catharpin Road in Logan was closed due to high water.
May 11, 2008	Flood	Thunderstorms in the Northern Virginia region produced strong gusty winds and heavy rains. Several trees and power lines fell across the region. Spotsylvania County Emergency Management reported numerous road closures due to flooding. Many of these roads remained closed through the following afternoon.
June 2, 2009	Flash Flood	Thunderstorms producing high amounts of heavy rainfall resulted in flooding in areas of Spotsylvania County. Water was flowing over Courthouse Road. Flooding at the intersection of West Catharpin and West Pamunkey roads caused their closures.
June 3, 2009	Flash Flood	Thunderstorms producing heavy rains led to flash flooding in Spotsylvania County. As a result, Brock Road near American Legion Road was closed.
September 30-October 1, 2010	Flash Flood	The remnants of Tropical Storm Nicole brought up to 5 inches of rain to the Northern Virginia region. Water had spilt over onto Route 17 in Spotsylvania County. A report on rainfall for the county claimed it had received near 5.5 inches. Elys Ford Road closed due to flash flooding conditions on the Rapidan River.

Source: NOAA, 2011.

Table 4-37. Historic Hurricane Events – Spotsylvania County.

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	The Free-Lance Star reported massive flooding.

Floyd	September 16, 1999	Tropical Storm	No estimate available.	Gusty winds from 30 to 50 mph 16,000 power outages 5.97 inches in Spotsylvania In Spotsylvania County, several trees were downed and high water closed several roads in the eastern portion of the county.
Isabel	September 18, 2003	Tropical Storm	$55.1 million – property $130,000 – crop	85% of County was without power for up to 9 days
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	Highest sustained wind was 73 mph Uprooted trees and downed numerous power lines Over 2 million Virginians without power Heavy rain and wind gust
Gaston	August 30, 2004	Tropical Depression	Unknown	Hard rains that processed flooding Roads under water Power outage (99,600 statewide)
Frances	September 8, 2004	Hurricane	Unknown	
Ivan	September 17, 2004	Hurricane	Unknown	Spawned unconfirmed tornadoes Power outage (66,000) Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	Flash flooding/heavy rainfall Power outage

Table 4-38. Historic Tornado Events – Spotsylvania County.

Date	Magnitude	Property Damage ($)	Descriptions
February 18, 1960	F1	0K	
September 5, 1979	F1	250K	
1998	F1	NA	Local emergency management reports tornado activity along the Rt. 17 Bypass / CSX Railroad / Rt. 608 Benchmark Road. One home and one industrial building are damaged.
July 2, 1999	F1	10K	Parts of southern Spotsylvania County lost power after downed trees fell onto power lines Most of the downed trees were in the Falmouth area.
2000	F1	NA	Local emergency management reports tornado activity along Hickory Ridge Road destroying one single-wide trailer. The area impacted started behind Berkeley Elementary School continuing northeast to Rte. 1 and 608.
2002	F1	NA	Local emergency management reports tornado activity in the Paytes area. No building damage was reported.
July 10, 2003	F0	0K	F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3 The tornado moved northeast and damaged trees until it lifted near Route 218 on the Spotsylvania County line

Date	Magnitude	Property Damage ($)	Descriptions
May 7, 2004	F1	10K	At 7:51 p.m., an F1 tornado touched down near Shiloh. At least a dozen dwellings and 10 boats were damaged. Several trees were also uprooted or had their tops ripped out along the storm's three-mile path. In Stafford County, 80 to 90 mph winds destroyed two homes and caused major damage to 20 others. The Japazawas Subdivision in eastern Stafford County had approximately 40 trees down. Three Amtrak trains were stalled between the Chatham area of Stafford and Fredericksburg due to downed trees and power lines. In the County of Spotsylvania, the main stage at the re-enactment of the Battle of Spotsylvania collapsed due to strong winds. A number of tents and a couple of portable toilets were also blown over. Estimated damages were $10,000.
September 17, 2004	FO	500K	F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3 A thunderstorm moved from Spotsylvania County into the eastern portion of the City of Fredericksburg. No property damage was reported, with debris scattered along Dixon Street. At 4:29 p.m., emergency personnel witnessed a weak tornado in the New Crest Area that caused minor damage to homes and trees. At 5:05 p.m., a brief tornado touched down near Holladay. It was videotaped by a local fire fighter. No damage or injuries were reported.
May 11, 2006	F0	80K	A cold front, combined with a strong upper-level disturbance caused widespread severe thunderstorms. Tornado touched down near Mastins Corner and continued northeast. Damage path was about 5 miles long and 75 yards wide. Structural damage was noted, due to falling trees and limbs.
May 11, 2006	F0	35K	A cold front combined with a strong upper-level disturbance caused widespread severe thunderstorms. A small tornado formed from this storm, hitting the Fredericksburg Spotsylvania Military Park. All damage was to trees only.

Source: National Climatic Data Center and local emergency management; NA = Data not available.

Table 4-39. Historic Northeaster and Winter Storm Events – Spotsylvania County.

Date	Event	Rain Fall (in.)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.

Date	Event	Rain Fall (in.)	Comments
January 12, 1996	Heavy Snow	350K	Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches. In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region. The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.
February 16, 1996	Heavy Snow	0	A strong "Alberta Clipper", diving southeast from the upper Midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.
January 14, 1999	Winter Weather	0	A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.

Date	Event	Rain Fall (in.)	Comments
March 9, 1999	Winter Storm	0	An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.
January 20, 2000	Winter Weather	0	An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.
January 25, 2000	Northeaster	0	Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.
January 30, 2000	Ice Storm	0	Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.
February 12, 2000	Winter Weather	0	Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.
December 13, 2000	Winter Weather	0	A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.

Date	Event	Rain Fall (in.)	Comments
February 22, 2001	Winter Storm	0	This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.
January 3, 2002	Winter Storm	0	Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, and then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.
February 6, 2003	Winter Storm	0	Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.
February 26, 2003	Winter Weather/mix	0	A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches.

Date	Event	Rain Fall (in.)	Comments
January 25, 2004	Winter Weather/mix	0	An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.
January 30, 2005	Winter Storm	0	A storm system brought a mix of snow, sleet, and freezing rain affecting most of Central Virginia. Freezing rain accumulated to around .25 inches resulting in hazardous driving conditions.
December 5, 2005	Heavy Snow	40K	A winter weather storm produced 4 to 6.5 inches of snow across Northern Virginia. There were reports of trees down in Spotsylvania County due to heavy snow accumulations.
February 11, 2006	Heavy Snow	250K	Storm snowfall across Northern Virginia produced between 8 and 14 inches. There were reports of isolated drifting of snow and downed powerlines throughout the region. This caused over 300,000 customers to be without power in the greater Washington/Baltimore area.
March 1, 2009	Winter Storm	0	A low pressure system produced storms releasing averaged snowfall totals of 5 inches across Spotsylvania County and the rest of Northern Virginia.
January 30, 2010	Winter Storm	0	Snowfall amounts between 5 and 6 inches were reported across Spotsylvania County.
February 16, 2010	Winter Storm	0	Snowfall totaled up to 1.5 inches in Chancellorsville in Spotsylvania County. There were several reports of accidents during rush hour near Fredericksburg and Chancellorsville.
December 16, 2010	Winter Storm	0	Snowfall was estimated around 4 inches in Spotsylvania County.

Source: National Climatic Data Center, 2011.

E. Stafford County Hazard Identification

For the 2012 plan update, the GWRC steering committee reviewed the 2010 Commonwealth of Virginia Hazard Mitigation Plan, as well as the hazard events over the preceding five years, and determined a hazard ranking for each of the hazards below. For this update, the committee chose to use the State's Hazard Type language as an update to the 2006 hazard type, to ensure better alignment with the state's rankings and methodologies. Those rankings can be seen below in Table 4-40. For Stafford County, hazards that ranked high were then investigated further and a vulnerability analysis was performed.

Table 4-40. Prioritization of Natural Hazards. Stafford County.

2006 Hazard type	2010 State Hazard Type	2012 Section Heading	2010 State Ranking for Stafford County	2012 Hazard Ranking from Stafford County
Dam Failure	N/A	Dam Failure	N/A	Low
Drought	Drought	Drought and Extreme Heat	Medium-High	Medium-High
Extreme Heat	Drought			
Wildfire	Wildfires	Wildfires	Medium-High	Medium-High
Earthquakes	Earthquakes	Earthquakes	Medium	Low
Expansive Soils	Sinkholes	Sinkholes and Landslides	Medium-Low	Medium-Low
Landslides	Landslide		Medium	Low
Flooding	Flooding	Flooding and Erosion	High	High
Hurricanes	Non-Rotational Wind	Non-Rotational Wind	High	High
Thunderstorms	Non-Rotational Wind			
Tornadoes	Tornadoes	Rotational Wind	High	High
Northeasters	Winter Storms	Winter Storms and Nor'easters	High	High
Winter Storms	Winter Storms			

Flooding

Flooding in Stafford County can occur at any time throughout the year but is more frequent during the fall and spring. The most severe flooding events have been associated with intense rainfall from hurricanes and tropical storms. The FIS has identified the historic flooding events listed in Table 4-41 and Table 4-42.

Table 4-41. Historic Flood Events (Prior to 1995) – Stafford County.

Year of flood	Discharge (cfs)	Recurrence Interval (years)
1937	134,000	135
1943*	140,000	140
1955	74,000	20
1972	107,000	30

*The flood of 1943 crested 45 feet above normal levels. Source: FEMA 1992

Table 4-42. Historic Flood Events – Stafford County.

Date	Event	Comments
March 4, 1993	Flood/Flash Flood	Moderate to heavy rain inflicted the region of Northern Virginia dumping 1 to 4 inches of rain, leading to widespread flooding. Several roads were closed and cars were damaged trying to traverse flooded sections of roads. Excessive rainfall and runoff caused several rivers of the Shenandoah Valley to flood as well.
January 19-22, 1996	Flood	River flooding occurred across the Commonwealth of Virginia starting in the early morning of January 19th. Snowmelt with a liquid equivalency of 2 to 3 inches combined with another 1 to 3 inches of rainfall caused the worst regional flooding in over a decade. River flooding began at the headwaters of all basins, continuing downstream for the next 3 days. Crests ranged from 3 to 21 feet above the flood stage. High water caused millions in damages, closed roads, destroyed homes and businesses, and even forced the evacuation of several towns. Total property damage estimates were at 15 million and crop damages were at 81K.
July 14, 1996	Flash Flood	A severe thunderstorm in Stafford County produced heavy rainfall resulting in the flooding of several roads including sections of Rt. 1, Plantation Drive, and several side streets.
September 8, 1996	Flash Flood	A slow-moving thunderstorm caused substantial local flooding in Stafford County. Federal highway 1 was flooded at Boswell's Corner. Automobiles reported flooding, and evacuations were required into the Potomac Hills. Total property damage estimates were 40K.
January 28, 1998	Flood	A nor'easter lingering in the area produced heavy rains across the central and northeastern regions of Virginia. Widespread minor to moderate flooding of small streams, creeks, and low-lying areas occurred across the Northern Neck of Virginia. The Virginia Department of Transportation reported over 150 roads closed in the area due to standing water or creeks that exceeded bankful. High wind gusts exceeding 30 mph combined with highly saturated soil caused isolated cases of felled trees and power lines.

Date	Event	Comments
February 4, 1998	Flood	A powerful nor'easter dropped between 2 and 4 inches of rain across Northern Virginia resulting in widespread minor to moderate flooding. Hundreds of roads were closed across the region. The dam at Lake Jackson was reported to be over 6 feet above flood stage. Several school districts closed for the following day due to the flooding and continued threat of heavy rain. Property damage estimates were 10K.
September 16, 1999	Flash	Storms from Hurricane Floyd produced rainfall totals between 2 and 4 inches in Stafford County. The same area observed wind gusts between 30 and 50 mph. Wind gusts caused several trees to fall down combined with high water forced the closure of several roads in the county There were reports of over 16,000 power outages across the region of Northern Virginia.
September 3, 2000	Flash Flood	Thunderstorms with heavy rainfall brought a couple inches of rain leading to flash flood incidents in Stafford County. Stafford County Officials received reports of road flooding across the southern portion of the county. A vehicle in Falmouth was damaged by flood waters.
June 13, 2002	Flash Flood	Scattered thunderstorms with high wind and heavy rainfall produced flash flood conditions throughout Northern Virginia. In the northern portion of Stafford County, powerful winds knocked down trees and power lines onto Rtes. 610, 643, 628, and 630. Wind gusts of 54mph were recorded resulting in a chimney being knocked down. Up to 1.5 feet of water covered the intersection of Route 610 and Route 1.
February 22, 2003	Flood	In Stafford County a storm produced between 1.5 to 3 inches of rain combined with the snowmelt of a massive snowstorm led to widespread flooding across Northern Virginia. Red Fern Lane in Stafford County was flooded along with four other secondary roads. Total damage estimates were 100K.
March 20, 2003	Flood	Across the region of Northern Virginia between 1.5 and 2.5 inches of rain fell. In Stafford County, many secondary roads were underwater.
May 15, 2003	Flood	A series of thunderstorms struck the region of Northern Virginia producing between 2 and 4 inches of rain. Several road closures in Stafford County were reported due to flooding.
June 14, 2003	Flash Flood	Scattered thunderstorms with high winds and heavy rains moved through Northern Virginia that afternoon. Stafford County rainfalls exceeding 2 inches resulting in flooding in the northern portion of the county. Route 1, Decatur Road, and Mountain View Road were partially closed due to flooding.
July 10, 2003	Flash Flood	Thunderstorms with high winds, frequent lightning, hail, heavy downpours, and isolated tornadoes moved through Northeast Virginia that evening. Up to 3 inches of rain caused several roads to flood including southbound I-95. Trees and power lines were felled as well. An F0 and F1 tornado both touched ground in Stafford County.

Date	Event	Comments
December 10, 2003	Flood	A thunderstorm producing heavy rainfall of 2 inches combined with melting snow produced widespread road flooding across areas of Northern Virginia. Several rivers and creeks flooded as well.
January 14, 2005	Flood	Flooding and a mudslide reported.
April 2, 2005	Flood	A cold front brought severe thunderstorms that downed trees and power lines as well as heavy downpours that flooded rivers, streams, and roadways across Northern Virginia.
July 13, 2005	Flash Flood	A mudslide was reported along US Highway 15 and Butler road in Stafford County.
October 8, 2005	Flood	The remnants of Tropical Storm Tammy caused widespread heavy rainfall between 3 to 7 inches across the region of Northern Virginia. Widespread areal flooding resulted from slow water rises. Dozens of roads were flooded and closed due to high water including Route 1 and Mountain View Road in Stafford County.
November 16, 2006	Flood	Thunderstorms hit Northern Virginia producing floods throughout the region. In Stafford County, several trees were downed. Flooding was reported at Boswell's at the corner of US1 in North Stafford.
March 5, 2008	Flash Flood	A strong cold front brought strong to sever thunderstorms with gusty winds and heavy rain to the region. Heavy rain led to several road closures due to flooding. Wind gusts of 50 to 74 mph led to several reports of downed trees and power lines. Stafford County Emergency Management reported flash flooding along the creeks running into the Rappahannock River. A water rescue was performed in Falmouth.
May 9, 2008	Flood	Numerous strong to severe thunderstorms producing flooding occurred in Northern Virginia. Stafford County Fire and Rescue Department reported numerous road closures in Stafford County, mostly in the White Oak area. Closures included Jefferson Davis Highway in front of the Fire Department, Mount Olive Road, Kellogg Road, and Holy Corner Road.
May 11, 2008	Flood	Thunderstorms in the Northern Virginia region produced strong gusty winds and heavy rains. Several trees and power lines fell across the region. Stafford County Emergency Management reported numerous roads flooded in Stafford County.
September 6, 2008	Flash Flood	Tropical Storm Hanna produced thunderstorms which dropped 4 to 8 inches of rain and heavy wind gusts across the region of Northern Virginia. This precipitation produced flash flooding leading to dozens of road closures throughout Stafford County. There were several instances of downed trees and power lines also.
September 30, 2008	Flash Flood	A storm system originating from the Caribbean dropped between 4.5 and 6.5 inches of rain to parts of Northern Virginia. There were several reports of flash flooding in Stafford County leading to hundreds of road closures including Harrel Road, Ruffian Drive at Riva Ridge Road, Jefferson Davis Highway at several locations, Route 607 at Falmouth, Ingleside Drive and River Road.

The Federal Emergency Management Agency (FEMA) has published a Flood Insurance Study (FIS) for Stafford County, dated February 4, 2005. The Flood Insurance Rate Maps (FIRMs), which accompany this FIS, delineate the 100- and 500-year flood hazard boundaries for flooding sources identified in areas of growing development or areas predicted to have future development at the time of the report. Individual FIRM panels are available at the FEMA Map Service Center (http://msc.fema.gov/). Table 4-43 identifies those streams within the County on which FEMA has performed detailed engineering analysis and, as a result of that analysis, has developed flood elevations and a floodway. Other streams within the County were studied by FEMA by approximate methods. These streams have a 100-year flood hazard boundary, but flood elevations and floodways have not been calculated.

Table 4-43. Water Bodies in Stafford County Studied by Detailed Methods.

Stream Name	
Accokeek Creek	Potomac Creek
Aquia Creek	Rappahannock River
Austin Run	Rappahannock River: Left Channel
Tributary 3 to Austin Run	Tributary 1 to Rappahannock River
Claiborne Run	Rocky Run
England Run	Tributary 1 to Chopawamsic Creek
Falls Run	Whitsons Run
Little Falls Run	

Source: FEMA 2005

The Potomac River forms the eastern border of the County and also poses a flooding threat due to tidal flooding associated with the river. The cyclical rise and fall of coastal waters are linked to the gravitational attraction of the moon and the sun. In this area the tide range is 1-2 feet (FEMA 1992) depending on location. Tidal fluctuations in nature occur independent of climatic changes. Therefore, the position of the tide can amplify the effects of rising floodwaters. The 100-year still water elevations for the Potomac River range from 7.4 to 7.7 feet (NGVD 1929) (FEMA 1992).

Noted Problem Areas

MAC representatives for Stafford County noted several areas within the community that are affected by frequent flooding. These include:

- Repeated road closures due to flooding and debris at:
  - River Road;
  - Vista Woods, Grafton Village, and Argyle Hills;
  - Harrell Road at the CSX Crossing; and
  - Aquia Drive, requiring emergency access from Decatur Road.
- Riverine flooding in several neighborhoods including:
  - The Falmouth area, which is often evacuated; and
  - The Aquia Harbour area with over 1000 homes affected.
- Tidal flooding at the marina area.

The probability of future occurrences is ranked as high. A 100-year event has a one percent probability of occurring in any given year. The 100-year floodplains for Stafford County have been identified.

Wildfires

In evaluating the localized threat of wildfires to Stafford County, the MAC analyzed data from the Virginia Department of Forestry from 1995-2008 to identify incidents of wildfires that may have posed a threat to the community. Fires were most common in Stafford County from the month of February until April. The past occurrences are presented in Table 4-44. Since 1995 there have been 74 incidents of wildfire burning approximately 194.8 acres of land with $44,000 in damages. This amounts to an average of 5.69 fires per year. Therefore, the probability of future occurrences is rated as medium-high.

Non-Rotational Wind (Hurricanes and Thunderstorms)

In evaluating the localized threat of hurricanes to Stafford County, the MAC analyzed NOAA hurricane track data from 1851 to 2004 to identify storms that may have posed a threat to the community. The analysis included hurricanes, tropical storms, tropical depressions, and extratropical storms which passed through the region and affected the local community. These past occurrences are presented in Table 4-46. Locally, the eleven (11) hurricanes have caused:

- Heavy rain;
- Gusty and high sustained winds;
- Flooding and property damage;
- Road closures; and
- Multiple power outages.

The probability of future occurrences is ranked as medium. With 11 hurricanes occurring between 1954 and 2004, Stafford County experiences approximately 0.22 hurricanes per year.

Tornadoes

In evaluating the localized threat of tornadoes to Stafford County, the MAC analyzed local emergency management data and NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. Most tornado activity occurred from May to September, although a historic event in February was noted. These past occurrences are presented in Table 4-46. Locally, the seven (11) tornadoes have caused:

- Property damage, including the displacement of boats in dry dock;
- Damage to the stage of the re-enactment of the Battle of Spotsylvania;
- Tree damage and resultant power outages.

Noted tornadoes occurring during 2003 and 2004 damaged homes, downed trees, and caused power outages for several days.

- In 2003, a tornado along the Belle Plains Area damaged homes due to wind and fallen trees. Power outages lasted for several days.
- In 2004, a tornado along the Stafford and Garrisonville Road Area caused damage to trees and homes. Wind damage to a trailer park in the Widewater / Boswells Corner area was noted.

The probability of future occurrences is ranked as medium. With 11 tornadoes occurring between 1960 and 2008, Stafford County experiences approximately 0.22 tornadoes per year.

Winter Storms

In evaluating the localized threat of winter storms to Stafford County, the MAC analyzed local NOAA severe weather data from 1950 to 2005 to identify storms that may have posed a threat to the community. These past occurrences are presented in Table 4-47. Locally, the 24 northeasters and winter storms have caused:

- Excessive snow, sleet, and freezing rain;
- Multiple traffic accidents (noted incident on Route 17) and delays;
- Tree and property damage;
- Power outages; and
- Injury and loss of life.

A noted winter weather event during 2002 resulted in a traffic accident involving over 100 vehicles on southbound interstate 95 due to icy and white-out conditions. The interstate was closed for several hours. Additional traffic accidents during the 2004 winter season resulted in the death of 3 teenagers, in separate accidents, due to wet or icy road conditions.

The probability of future occurrences is ranked as medium. With 33 events occurring between 1993 and 2010, Stafford County experiences approximately 1.94 winter events per year.

Table 4-44. Historic Wildfire Events - Stafford County.

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
03/25/1995	2	500	260000	Campfire
03/27/1995	1	200	0	Children
04/01/1995	3	500	0	Children
04/04/1995	3	1200	205000	Miscellaneous
04/07/1995	3	500	200000	Children
04/09/1995	1	500	46000	Smoking
04/22/1995	3	0	0	Miscellaneous
04/24/1995	1	0	0	Children
03/06/1996	1	0	36000	Miscellaneous
03/16/1996	2	0	7500	Debris Burning
04/17/1996	2	0	0	Incendiary
04/17/1996	1	0	0	Incendiary
04/23/1996	1	0	250000	Smoking
03/16/1997	2	0	0	Children
03/22/1997	1	0	0	Miscellaneous
03/24/1997	1	100	0	Debris Burning
04/02/1997	1	100	0	Debris Burning
03/28/1998	2	0	0	Children
03/31/1998	3	500	0	Debris Burning
03/31/1998	1	0	0	Miscellaneous
03/31/1998	1	100	0	Debris Burning

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
04/02/1998	3	200	0	Children
04/02/1998	3	300	95000	Debris Burning
04/02/1998	2	0	0	Debris Burning
04/05/1998	1	0	0	Miscellaneous
04/06/1998	7	0	0	Smoking
04/06/1998	1	0	0	Children
04/13/1998	5	0	0	Children
10/29/1998	5	500	0	Smoking
10/30/1998	1	500	500000	Debris Burning
12/30/1998	1	0	0	Children
03/20/1999	1	0	0	Children
03/29/1999	1	0	0	Miscellaneous
03/30/1999	4	0	0	Miscellaneous
03/31/1999	1	500	100000	Debris Burning
04/06/1999	3	1000	0	Children
04/06/1999	2	1200	200000	Children
04/08/1999	5	1500	1518000	Children
04/08/1999	1	100	0	Children
04/08/1999	1	200	2250000	Children
04/14/1999	2	0	0	Children
04/14/1999	1	0	0	Smoking
03/06/2000	2	500	201000	Children
04/10/2000	1	0	0	Children
11/01/2000	3	3000	0	Smoking
05/01/2001	7	0	0	Campfire
11/07/2001	1	2500	340000	Smoking
11/12/2001	4	300	305000	Children
11/12/2001	3	20300	2000	Miscellaneous
11/26/2001	3	500	0	Smoking
02/26/2002	0.2	0	0	Incendiary
02/26/2002	4	0	0	Fishermen
02/26/2002	0.1	0	0	Debris Burning—Urban Burner
03/01/2002	0.2	0	1200000	Incendiary—Juvenile
03/07/2002	5	5000	2000000	Railroad
03/24/2002	2	100	0	Children—Juvenile
04/06/2002	4	200	0	Smoking
05/16/2002	1	300	0	Incendiary
07/18/2002	1	0	0	Children—Juvenile
08/12/2002	1	100	960000	Children—Juvenile
12/02/2002	8	0	0	Equipment Use—ATV
03/15/2004	1	0	0	Children—Juvenile
04/19/2004	1	0	0	Children—Juvenile

Date Put Out	Total Acres Burned	Total Damages ($)	Total Cost Saved ($)	Cause
04/19/2004	8	0	0	Debris Burning—Rural Burner
03/17/2005	2	0	0	Children—Juvenile
06/28/2005	4	1000	600000	Debris Burning—Rural Burner
11/13/2005	1	0	0	Children—Juvenile
02/25/2006	2	0	0	Children—Juvenile
02/27/2006	7	0	0	Debris Burning—Rural Burner
03/02/2006	3	0	0	Incendiary—Mental Cases
03/05/2006	3	0	0	Children—Juvenile
03/14/2007	0.3	0	0	Debris Burning—Rural Burner
03/03/2008	24	0	271000	Children—Juvenile
03/25/2008	1	0	500000	Debris Burning—Rural Burner
Totals	194.8	44,000	12,046,500	

Source: Virginia Department of Forestry, 2008.

Table 4-45. Historic Hurricane Events – Stafford County.

Storm Name	Date	Category	Total Est. Damage	Descriptions
Hazel	October 15, 1954	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Connie	August 12, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Diane	August 17, 1955	Hurricane	Unknown	The Free-Lance Star reported flooding and property damage.
Camille	September 1960	Hurricane	Unknown	The Free-Lance Star reported massive flooding.
Floyd	September 16, 1999	Tropical Storm	No estimate available.	Gusty winds from 30 to 50 mph 16,000 power outages 5.97 inches in Spotsylvania
Isabel	September 18, 2003	Tropical Storm	$55.1 million – property $130,000 – crop	
Charley And Bonnie	August 18, 2004	Hurricane	Unknown	Highest sustained wind was 73 mph Uprooted trees and downed numerous power lines Over 2 million Virginians without power Heavy rain and wind gust
Gaston	August 30, 2004	Tropical Depression	Unknown	Hard rains that processed flooding Roads under water Power outage (99,600 statewide)
Frances	September 8, 2004	Hurricane	Unknown	

Storm Name	Date	Category	Total Est. Damage	Descriptions
Ivan	September 17, 2004	Hurricane	Unknown	Spawned unconfirmed tornadoes Power outage (66,000) Heavy rain/flooding
Jeanne	September 28, 2004	Hurricane	Unknown	Flash flooding/heavy rainfall Power outage

Source: NOAA 2004, VWC 2004, and local emergency management.

Table 4-46. Historic Tornado Events – Stafford County.

Date	Magnitude	Property Damage ($)	Descriptions
February 18, 1960	F1	0K	
September 5, 1979	F1	250K	
July 24, 1999	F1	10K	Parts of southern Stafford County lost power after downed trees fell onto power lines Most of the downed trees were in the Falmouth area.
September 24, 2001	F0	0.1K	At 4:00 p.m., the thunderstorm that produced the tornado near Sealston in King George County crossed into east Stafford County. A brief touch down occurred near Belle Plain. Minor tree damage was noted and later the same tornado briefly touched down near Aquia Bay Marina at the end of Aquia Creek Road, displacing three boats in dry dock. Damage was estimated at $10,000. At 4:18 p.m., an F0 tornado touched down in north Stafford County near Boswells Corner. Initially, the storm produced minor damage to trees, and siding and shingles were torn from a few homes. Minutes later, the storm produced extensive tree damage to the Crystal Lakes neighborhood. Damage was estimated at $50,000.
July 10, 2003	F0	0K	In Stafford County, an F0 tornado touched down approximately 5 miles southeast of Falmouth near Route 3. The tornado moved northeast and damaged trees until it lifted near Route 218 on the King George County line. The tornado was approximately 50 yards wide and was on the ground for 5 miles.
September 8, 2004	F0	10K	The thunderstorm which produced the tornado near Sealston in King George County continued into east Stafford County. A brief touch down occurred near Belle Plain (almost 4 miles NE of White Oak). Minor tree damage was noted and later the same tornado cycled and another brief touch down occurred near Aquia Bay Marina at the end of Aquia Creek Road (approximately 5 miles S of Aquia). Minor tree damage was noted there and 3 boats in dry dock were displaced. Power outage for several days.
September 17, 2004	F1	10K	At 4:42 p.m., a tornado touched down in central Stafford County near Stones Corner. The storm tracked north-northeast and lifted near Stafford. The damage was limited to mature trees and large limbs. The tornado had a six-mile intermittent track, continuing into Prince William County. Damage was estimated at $10,000. Tree damage to homes. Wind damage to a trailer park in Wildwater/Boswells Corner area.

Date	Magnitude	Property Damage ($)	Descriptions
May 11, 2006	F0	25K	A thunderstorm produced a tornado near Falmouth in Stafford County. The tornado caused noticeable tree damage on both sides of Interstate 95 near the Rte. 17 interchange.
May 8, 2008	F2	10.0M	The National Weather Service determined that a low-end F2 tornado struck the England Run North subdivision in Berea in Stafford County. There were 160 homes damaged and nearly destroyed within that subdivision. 25 of those were categorized as uninhabitable.
June 4, 2008	F1	25K	The National Weather Service announced that an F1 tornado touched down in southern Fauquier County travelling 10 miles into Stafford County. Mainly tree damage was observed.
June 4, 2008	F1	20K	An F1 tornado touched down in southern Stafford County 3 miles south of Ramouth. Maximum winds were estimated at 95 mph. Mainly tree damage was observed.

Source: National Climatic Data Center 2011 and local emergency management; NA = Data not available.

Table 4-47. Historic Northeaster and Winter Storm Events – Stafford County.

Date	Event	Property Damage ($)	Comments
December 28, 1993	Heavy Snow	0	
January 28, 1995	Heavy Snow	0	
January 9, 1996	Heavy Snow	0	Low and mid-level lift ahead of an "Alberta Clipper" added insult to injury only a day after the "Blizzard of '96", dumping 4 inches of snow in a 5 hour period near the tidal Potomac River.
January 12, 1996	Heavy Snow	350K	Less than one week after the crippling "Blizzard of '96", a new winter storm dumped substantial snow across northern and western Virginia. In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. The snow changed to freezing rain and sleet along the tidal Potomac River shortly before tapering off. The changeover suppressed accumulations to 4 or 5 inches in this region. In other portions of northern Virginia, snowfall totals were as follows: in the piedmont, 5 to 7 inches; at higher elevations, 6 to 10 inches. In southern Stafford Co (VAZ055), a woman was injured when a carport collapsed. Luckily, she was protected from serious injury by the automobile, which had its windows shattered.
February 2, 1996	Heavy Snow	0	A vigorous upper level jet stream induced low-level lifting of warm moist air over a stationary arctic front extending from Tidewater Virginia through the Tennessee Valley early on the 2nd, producing a 75 mile-wide band of heavy snow which extended from the central piedmont through the Northern Neck region.

Date	Event	Property Damage ($)	Comments
			The heaviest snows fell in a narrow band from northern Albemarle Co through King George Co. Accumulations in these areas ranged from 8 to 13 inches, and snowfall rates were as high as 3 inches per hour.
February 2, 1996	Heavy Snow	0	The continuation of a strong upper-level jet stream, combined with additional mid-level dynamics, generated surface low pressure over central Georgia by evening on the 2nd. As the low moved to near Cape Hatteras overnight, a broad area of heavy snow overspread all of northern Virginia. Areas that received 4 to 13 inches during an early morning event (on the 2nd) picked up an additional 4 to 6 inches, leaving most areas from the central piedmont through the northern neck with a grand total of 12 to 18 inches.
February 16, 1996	Heavy Snow	0	A strong "Alberta Clipper", diving southeast from the upper Midwest into the deep south, linked up with subtropical moisture lurking along the southeast U.S. coast to develop a classic nor'easter, which moved from northeast South Carolina to off the Virginia Capes during the day on the 16th. As the area of low pressure intensified, it wrapped Atlantic moisture well to the west, where modified arctic air was pouring in from southern Canada. The result was a thin band of heavy snow which extended from southwest Virginia through the upper eastern shore of Maryland.
February 8, 1997	Heavy Snow	25K	A winter storm dumped 4 to 8 inches of heavy, wet snow across all of northern and western Virginia on the 8th.
January 14, 1999	Winter Weather	0	A strong arctic cold front moved slowly southeast across the Mid-Atlantic region from late on the 13th to midday on the 15th. By 9am on the 15th, ice accumulations from one quarter to nearly one inch occurred north of a line from Augusta County to Spotsylvania County. The ice this storm left behind had a large impact on the region. Hundreds of car accidents, slip and fall injuries, downed trees, and power outages were reported. In Stafford County, a jackknifed tractor trailer closed State Route 3 and 621, and Interstate 95 had to be temporarily shut down to clear fallen trees. Over 215,000 customers lost power from the storm across Northern Virginia, and Central Virginia reported over 6,000 additional outages.
March 9, 1999	Winter Storm	0	An area of low pressure moved from the Ohio Valley to North Carolina from late on the 8th through the evening of the 9th. Snowfall rates were in excess of 1 1/2 inches per hour in many locations during the storm. Stafford County received between 4 to 8 inches. Spotsylvania and King George County received between 2 and 6 inches. The city of Fredericksburg reported over 100 accidents. On Interstate 95 in Spotsylvania County, a woman was killed in a morning car accident.
January 20, 2000	Winter Weather	0	An area of low pressure moved from west to east across the Mid-Atlantic region on the 20th, dropping 2 to 6 inches of snow between midnight and mid-afternoon. Gusty winds of 35 to 45 MPH developed during the afternoon causing the snow to drift across roadways and reduce visibilities in open areas.

Date	Event	Property Damage ($)	Comments
January 25, 2000	Northeaster	0	Low pressure off Cape Hatteras rapidly intensified late on the 24th and developed into a nor'easter which tracked northward along the Eastern Seaboard on the 25th. Very heavy snow and near-blizzard conditions were seen throughout the day east of the Blue Ridge Mountains, resulting in extremely hazardous travel conditions. Wind gusts of up to 45 MPH were recorded and several roads were drifted shut by blowing snow. The governor of Virginia declared a state of emergency as the storm battered the eastern part of the state.
January 30, 2000	Ice Storm	0	Cold air was in place east of the Blue Ridge Mountains on the 29th and 30th, keeping surface temperatures below freezing. Low pressure moved from the Lower Mississippi Valley northeastward to the Mid-Atlantic region early on the 30th, creating the perfect conditions for freezing rain around the Fredericksburg area, a mix of sleet and snow east of Skyline Drive, and moderate snowfall in the mountains. Ice accumulations between 1/4 and 3/4 of an inch coated roads, trees, and power lines in Fredericksburg and Stafford, Spotsylvania, and King George Counties. Electrical outages were reported as trees and branches weighed down by ice fell onto power lines. Disruptions affected 3000 customers in Fredericksburg and Spotsylvania and King George Counties.
February 12, 2000	Winter Weather	0	Low pressure moved from Tennessee to the North Carolina Coast on the 12th, spreading snow across the Central Shenandoah Valley and the Northern and Central Piedmont. Periods of light snow occurred from sunrise to late afternoon with accumulations ranging from 1 to 5 inches. A period of freezing drizzle also occurred around sunset.
December 13, 2000	Winter Weather	0	A strong cold front brought chilly air into the region on the 12th. By the afternoon of the 13th, an upper level disturbance brought warm air into the mid levels of the atmosphere and caused snow that fell from the system to melt to rain on its way down. When the rain hit the ground where temperatures were below freezing, ice accumulated.
February 22, 2001	Winter Storm	0	This system produced mainly light to moderate snowfall across the region between 9 AM and 10 PM. Snowfall amounts ranged from 2 to 5 inches. A 50 vehicle crash occurred on the northbound lanes near Masaponax in Spotsylvania County. The accident occurred as motorists crested the top of a hill, hit near zero visibility, and slammed on their breaks. Three people were treated for serious injuries and another 18 suffered minor injuries. The highway remained closed for three hours while the wreckage was cleared. A 30 vehicle pileup occurred on the southbound lanes just north of the Falmouth/Route 17 interchange in Stafford County. As whiteout conditions struck, three cars slid into each other. Within seconds, the minor fender bender turned into a pileup including tractor trailers, cars, trucks, and an empty bus. Three people were injured and the highway was blocked for nearly three hours.

Date	Event	Property Damage ($)	Comments
January 3, 2002	Winter Storm	0	Low pressure tracked across extreme southeast Virginia during the morning of the 3rd. This storm brought light to moderate snowfall to the Central Piedmont and Fredericksburg areas between 5 AM and 3 PM. In Stafford County, an inch of snow caused slippery roads and delayed school openings. In Spotsylvania and King George Counties, snowfall totals ranged from 3 to 5 inches.
January 19, 2002	Winter Weather	0	Low pressure that moved across North Carolina on the 19th brought mixed precipitation to the region between 6 AM and 11 PM. In most locations, the precipitation started off in the form of snow, and then changed to a mix of sleet and rain around midday.
December 5, 2002	Winter Storm	0	This storm produced accumulating snowfall across the entire region as it moved by. Across the Central Piedmont and Fredericksburg area, freezing rain and sleet was mixed in with the snow. The snow and sleet accumulations ranged from 4 to 6 inches in this area.
February 6, 2003	Winter Storm	0	Low pressure tracked from the Gulf Coast to the Carolinas on the 6th then off the Atlantic coast on the 7th. This storm dropped light to moderate snow between the evening of the 6th and Noon on the 7th. Accumulations ranged from 3 to 7 inches.
February 14, 2003	Winter Storm	8.9M	A complex storm system produced copious amounts of wintery precipitation across the northern third of Virginia between the evening of the 14th and midday on the 18th. After the precipitation came to an end, record breaking snow and sleet accumulations were reported.
February 26, 2003	Winter Weather/mix	0	A series of low pressure systems that tracked from the Gulf Coast to Cape Hatteras dropped light snow off and on between the morning of the 26th and midday on the 28th. A total of 5 to 8 inches of snow accumulated across the northern third of Virginia during the storm. Minor traffic accidents were reported after the fallen snow made roads slippery.
December 14, 2003	Winter Weather/mix	0	An area of low pressure developed over the Gulf Coast region and tracked northeast into the Mid Atlantic region. The storm produced a mixture of snow, sleet and freezing rain. Snowfall totals across Northeast Virginia averaged 3 to 4 inches.
January 25, 2004	Winter Weather/mix	0	An area of low pressure developed off the coast of North Carolina and tracked north. This storm produced widespread snow, sleet and freezing drizzle over the region. Two to four inches of snow fell over the Central Foothills and the Northern Piedmont of Virginia. The snow mixed with sleet and finally changed over to freezing drizzle before tapering off. Several other minor accidents occurred according to Emergency Operations Centers. Dozens of school districts closed.
February 5, 2004	Winter Weather/Mix	0	A low pressure system produced freezing rain and sleet in Northern Virginia. 1 to 2 tenths of ice accumulated. The ice coated surfaces downed power lines and felled trees. There were several school closures/delays, automobile accidents, and power outages. In Stafford County, an automobile accident claimed the lives of two students as they traveled to school. A third student was seriously injured.

Date	Event	Property Damage ($)	Comments
December 5, 2005	Heavy Snow	40K	A winter weather storm produced 4 to 6.5 inches of snow across Northern Virginia. There were reports of trees down in Stafford County due to heavy snow accumulations.
February 11, 2006	Heavy Snow	250K	Storm snowfall across Northern Virginia produced between 8 and 14 inches. There were reports of isolated drifting of snow and downed powerlines throughout the region. This caused over 300,000 customers to be without power in the greater Washington/Baltimore area.
February 24, 2007	Winter Storm	0	A low pressure system produced storms that released 5 inches of snow with some locations reporting as much as 11 inches in Northern Virginia. Sleet and freezing rain mixed with snow at times causing icy conditions on roadways. Several schools delayed school openings by two hours due to icy roadways on Monday, February 26th.
March 1, 2009	Winter Storm	0	A low pressure system produced storms releasing averaged snowfall totals of 5 inches across Stafford County and the rest of Northern Virginia.
December 18, 2009	Winter Storm	0	A winter storm produced snowfall amounts between 19 and 23 inches across Stafford County.
January 30, 2010	Winter Storm	0	Snowfall amounts around 5 to 6 inches were reported across Stafford County.
February 2, 2010	Winter Weather	0	Snowfall averaged 3 to 4 inches across the county.
February 5, 2010	Winter Storm	5K	Snowfall amounts between 13 and 17 inches were reported across Stafford County. Power outages were reported due to the weight of the snow on trees and power lines. School closures continued through the following week.

Source: National Climatic Data Center, 2011

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CHAPTER 5 - VULNERABILITY ASSESSMENT

The vulnerability assessment estimates the extent of injury and damages that may result from a hazard. Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In such an instance the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. For those natural hazards not tied to a specific geographical location, such as severe weather, information is available where the potential impacts can be developed or inferred. Past events can also serve as a rough predictor of the future. Where the data was available, rough estimates of annualized damages and the number of hazard events is noted.

The 2012 Update to this Chapter includes a complete reanalysis of the risks associated with each hazard, and the vulnerability of each of the seven jurisdictions. The risk analysis includes total potential loss estimates based on the amount of infrastructure in the jurisdiction, the number of critical facilities that would potentially be affected, loss of business where appropriate, as would be affected by the location, extent, and severity of a potential hazard occurrence. In order to conduct this analysis, the infrastructure, population, and development in each jurisdiction was updated using the best available data.

In the previous section, the MAC identified eight natural hazards as critical, with medium to high hazard potential. These hazards affect either the GWRC region as a whole or have a specific geographical hazard area. Data availability also limits the granularity with which a vulnerability assessment can be performed for any particular hazard. With this in mind, the MAC categorized the hazards as follows:

Regional Vulnerability Assessment

- Drought; and
- Severe Weather, including
  - Extreme temperatures;
  - Northeasters;
  - Thunderstorms;
  - Tornadoes; and
  - Winter Storms.

Community Specific Vulnerability Assessment

- Flooding;
- Hurricanes; and
- Wildfire.

I. Regional Vulnerability Assessment

The two types of natural hazards that were classified as affecting the entire GWRC region were drought and severe weather. For these hazards, the potential impacts are presented below.

A. Drought Regional Vulnerability Assessment

Drought impacts may include physical, bio-physical, social and economic consequences. Physically, there may be a reduction in water supply for drinking, domestic, and irrigation purposes with a subsequent impact of increased pumping costs. The ground water level may be depleted and the flow of

perennial water sources reduced. Bio-physical impacts include damage to crop quantity and quality, damage to wildlife and habitat, an increase in invasive/noxious weeds, and the deterioration of water quality. Economically, there may be a loss in livestock production and increased prices for commodities.

The agricultural industry is the seventeenth largest industry for the GWRC region. In 2002 there were 1011 farms in the Counties of Caroline, King George, Spotsylvania, and Stafford. By, 2007 the number decreased to 997. Logically, the total acreage of farms decreased in the years of 2002-2007 from 173,591 acres to 161,313 acres for the region. The market value of crops in the region for 2007 was $26,237,000 this comes out to an average of $26,315 per farm (The Census of Agriculture, 2007). The market value of 2010 crops exceeded $40million for the region (NASS, 2010). This leaves the potential economic impact of a drought to the region as staggering.

Incidents of drought in the GWRC region have caused significant crop damage. In ten periods of drought from 1986 to 1999 the region saw total crop damages exceeding $1.3 million (all crop and property damages in 2009 dollars unless otherwise noted). This is roughly the equivalent of $100,000 in crop damages occurring annually. The period of drought and excessive heat in the summer of 1995 claimed the lives of seven inhabitants of the region (SHELDUS 2011).

In the summer of 2007 a drought impacted the region causing the USDA to designate Caroline and King George Counties as primary disaster areas. The Secretary of Agriculture also determined Spotsylvania, Stafford, and the aforementioned counties as contiguous disaster areas due to hydrological drought conditions and extreme heat.

The drought in the summer of 2010 placed the counties of King George, Spotsylvania, Stafford, and Caroline under the primary natural disaster area designation.

B. Non-Rotational Wind, Winter Storms, and Tornadoes

The severe weather evaluated as part of this vulnerability assessment included: extreme temperatures, northeasters, thunderstorms, tornadoes, and winter storms. Impacts to the George Washington region as a result of severe weather could include damage to infrastructure, particularly damage to overhead power and communication lines, road closures, and interruption in business and school activities. In the case of tornadoes, severe damages can occur to buildings. Utility outages can impact anything relying on electricity without a redundant power supply (e.g., a generator, solar power, or redistribution plan), and include secondary impacts such as interruption to water and sewage services, heat and refrigeration, fuel supplies, computers and cell phones. If interruption to business occurs for an extended period, economic impacts can be severe. Also of concern would be the impacts on populations with special needs such as the elderly and those requiring the use of electric medical equipment. Although typically short-lived, delays in emergency response services can also be of concern. Depending on the nature of a given storm, all areas within the George Washington region are equally at risk; however, those areas relying on above ground utilities could suffer the greatest damage.

C. Hurricane Regional Vulnerability Assessment

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a wind hazard analysis for the George Washington Region. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of

this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for the George Washington Region. Table 5-1 lists the total dollar value of exposed structures based on occupancy type for the George Washington Region.

Table 5-1. Total Dollar Value of Exposed Structures from HAZUS – GW Region.

Occupancy Type	Total $ Value Exposed Structures
Residential	12,962,651,000
Commercial	1,416,201,000
Industrial	181,449,000
Agricultural	21,895,000
Religion	154,232,000
Government	43,011,000
Education	56,754,000
Total	**14,836,193,000**

Source: HAZUS

The default data set provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the George Washington Region may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high winds.

The two options provided by HAZUS®MH software for wind analysis are the probabilistic and deterministic methods. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyzes hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of “what-if” scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Because residential structures comprise a significantly large percentage of the occupancy classification within the region, these data are presented in Table 5-2 below. Minor damage to a structure is defined as receiving minimal damage and is habitable without repairs. A moderately damage structure is uninhabitable. Minor repairs are necessary to make it habitable. These repairs will take less than 30 days. Severely damaged structures are currently uninhabitable; extensive repairs are necessary to make habitable. These repairs will take more than 30 days. Totally destroyed structures are at a total loss. These structures are not economically feasible to rebuild (VDEM 2007). Figure 5-1 shows the peak wind gusts, ranging from 66mph to 72mph, generated from a hurricane with a 100-year recurrence interval. The total residential loss from a 100-year recurrence interval is displayed in Figure 5-2 below.

Table 5-2. Hurricane Risk – GW Region. Summary of Probability Analysis – Residential Structures.

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	22	0	0	0
50-year	351	10	0	0
100-year	1395	71	5	0
200-year	5976	502	23	8
500-year	15,998	2724	144	14
1000-year	24,074	6674	744	636

Source: HAZUS-MH

D. Severe Storm Regional Vulnerability Assessment

Since 1960 the George Washington region has experienced several severe storms that have caused damage to property and crops from lightning, hail, extreme winds, and flooding. From 1960-2008 these storms have caused over $200,000 in crop damages and over $7 million in property damages. Based on this data, the GW Region can expect to experience roughly $4,167 in crop damages and $145,833 in property damages annually from severe storms.

In that same time period extreme weather from winter storms and ice have caused damages to private and public properties and winter freeze has caused damage to crops within the region. Total damages to properties exceeded $340 million across 67 storms. This works out to roughly $7 million in damages done annually by winter storms. Past data also indicates that on average the number of winter storm events annually is approximately 1.4. Five of those storms caused winter freeze resulting in crop damages exceeding half a million (SHELDUS 2011).

Since 2000, there have been three federally declared disasters related to winter storms events that impacted the region. The total monies divvied out as public assistance grants were $61,513,453.52 for the entire state of Virginia (FEMA, 2011).

Table 5-3. Winter Storm Risk—GW Region.

Locality	Average Snowfall (in) 1958-2010					Likelihood Of Event (%)
	December	January	February	March	Annual	
Caroline	2.51”	4.54”	4.86”	2.43”	15.70”	99.9
Fredericksburg	2.55”	5.20”	4.53”	2.35”	14.47”	96.1
King George	1.91”	3.41”	3.26”	1.67”	10.25”	85.3
Spotsylvania	2.68”	5.72”	4.26”	2.90”	16.34”	93.1
Stafford	3.21”	3.46”	4.11”	2.42”	14.10”	96.3

Source: Southeast Regional Climate Center

E. Tornado Regional Vulnerability Assessment

Based on the available data, the George Washington Region has averaged 0.71 tornado events causing $264,450 in damages annually.

Table 5-4. Summary of Historic Tornado Events – GW Region 1950-2010.

Intensity	Number of Occurrences	Damages ($)
EF0	16	217K
EF1	21	1.1M
EF2	4	14.5M
N/A	2	50K

Source: SVRGIS and NCDC, 2011

F. Flood Regional Vulnerability Assessment

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a flood hazard analysis for the George Washington Region. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 flood analysis was performed to calculate the flood hazard for the George Washington Region. Table 5-5 lists the total dollar value of exposed structures based on occupancy type for the George Washington Region.

Table 5-5. Flood Risk – George Washington Region.

Occupancy Type	Dollar Exposure (replacement value $)
Residential	11,411,621,000
Commercial	1,928,680,000
Industrial	432,039,000
Agricultural	74,802,000
Religion	278,955,000
Government	75,491,000
Education	216,363,000
TOTAL	**14,417,951,000**

Source: HAZUS-MH

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the George Washington Region may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

The three hazard type options provided by HAZUS®MH software for flood analysis are the riverine, coastal, and riverine and coastal scenarios. The necessary scenario for any given situation depends upon the geography of the region. If the area is inland with a stream hydrology, then the riverine scenario should be used. If however, the area is along the coast then either the riverine and coastal, or coastal scenario should be used. The user cannot run any analysis without first defining the scenario. These return periods define the statistical probability that a flood event of a given intensity could occur within any year.

The riverine and coastal flood analysis was chosen because the George Washington Region is situated on the coast (in Stafford and King George Counties) while maintaining an active stream hydrology. This scenario provides the statistical probability for a range of flood events and presents a comparison of those events. The coastal and riverine analysis was used to generate structural loss estimations, agricultural loss estimations, and shelter requirements for flood events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, and 500-year. The recurrence interval is the average interval of time within which the given flood event will be equaled or exceeded once.

Because residential structures comprise a significantly large percentage of the occupancy classification within the region, these data are presented in Figure 5-4 below. Total residential loss from a 100-year flood event is $49,988,000. Figure 5-5 depicts the number of displaced individuals from a 100-year flood event. The total number of displaced individuals from a regional 100-year flood event is 5775 persons. Figure 5-7 shows the 100-year floodplain for the GWRC region with 2010 census blocks that intersect it. The map displays the population (in 2010 Census numbers) that would be affected by a 100-year flood event. The total agricultural losses are listed in Table 5-6 below. Table 5-7 lists the number of critical facilities in the 100-year floodplain for each locality. Figure 5-6 shows the 100-year flood plain and plots the location of the GW Region critical facilities in relation.

Table 5-6. Agricultural Loss – George Washington Region.

Crop Type	Caroline	Fredericksburg	King George	Spotsylvania	Stafford	TOTAL
	Loss ($)					
Corn	817,494.09	N/A	119,654.00	214,915.21	150,813.49	1,302,876.79
Corn Silage	4,025,064.98	N/A	128,691.53	896,703.26	179,339.19	5,229,798.96
Soybeans	581,361.80	N/A	93,049.80	151,766.00	102,142.47	928,320.07
Wheat	N/A	N/A	73,807.52	96,127.05	23,618.65	193,553.22
TOTAL	**5,423,920.87**	**N/A**	**415,202.85**	**1,359,511.52**	**454,913.80**	**7,653,549.04**

Source: HAZUS-MH

Table 5-7. Critical Facilities in 100-year flood plain-GW Region.

Locality	Total at Risk Critical Facilities
Caroline County incl. Towns of Port Royal and Bowling Green	0
City of Fredericksburg	17
King George County	3
Spotsylvania County	11
Stafford County (excl. Quantico)	1
George Washington Region Total	**32**

G. Regional Wildfire Regional Vulnerability Assessment

The individual counties and city that is encompassed by the GW Region provided hardcopy tax parcel information. Caroline County provided a land use suite of layers that delineated the agricultural preservation area and the boundary of Fort A.P. Hill. The agricultural preservation area is defined in the Caroline County Comprehensive Plan as lands designated for agricultural uses and residential densities, and are not to exceed a ratio of one structure per 25 acres. Since these areas contain very low population densities, these areas were removed from the wildfire analysis. The area covered by Fort A.P. Hill was also excluded from the analysis because it is under the jurisdiction of the United States Army.

The Marine Base at Quantico in Stafford County was removed for the same reason. The VDOF Wildfire mapping for the region was plotted at the same scale as the Counties Tax Parcel mapping for all areas not previously indicated and those parcels that intersect the high wildfire hazard boundary were totaled. A map of previous fire incidents over the VDOF's wildfire risk assessment is displayed below in Figure 5-8.

The analysis (seen below in Table 5-8) yielded approximately 95,771 parcels that intersected the high wildfire hazard boundary as delineated by VDOF. The improvement value for these parcels was totaled and resulted in an approximate at risk value of $4.8 billion. Table 5-9 shows that approximately 171 critical facilities in the GW Region are located in high risk wildfire zones.

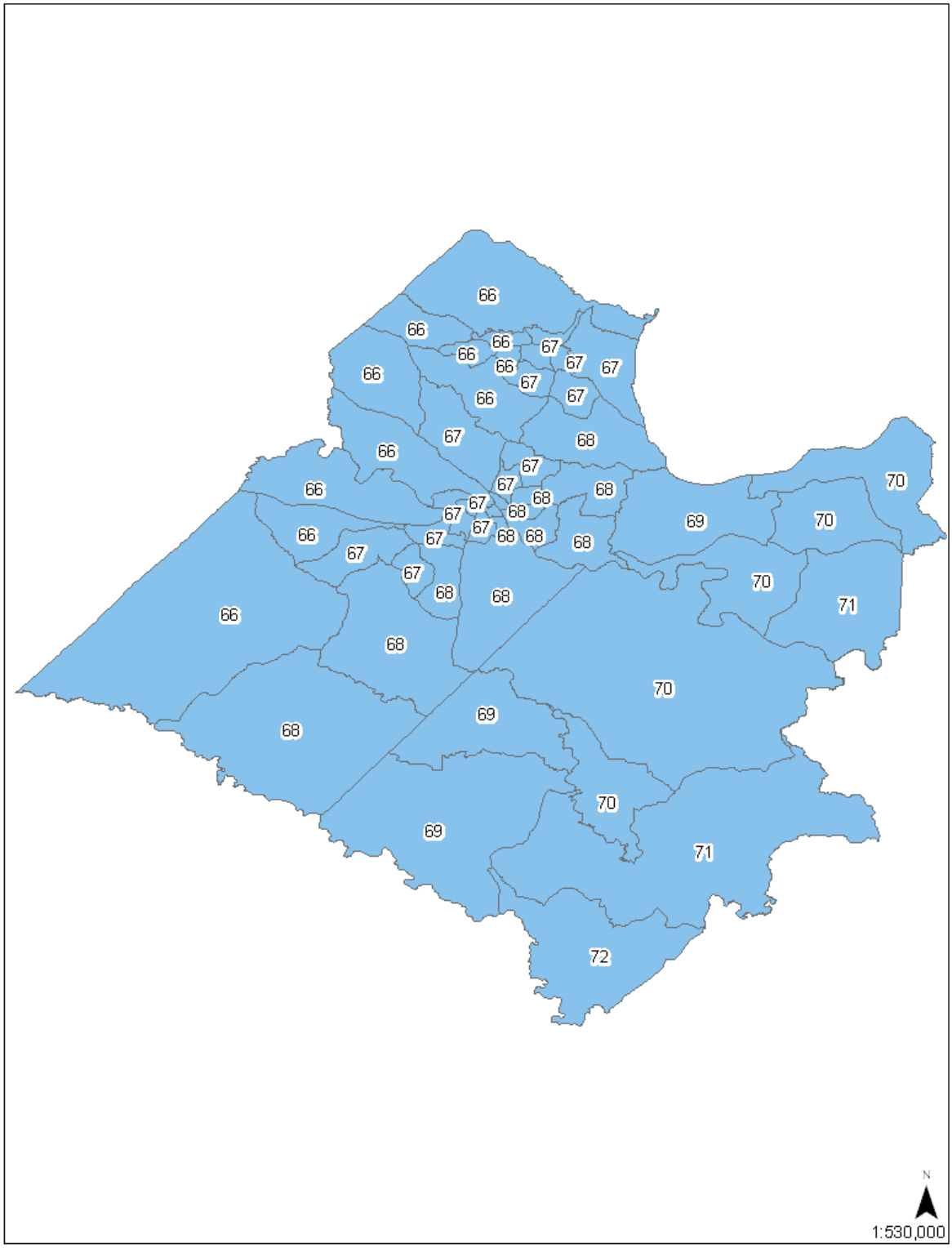
Table 5-8. Wildfire Risk-GW Region.

Locality	Total No. Parcels	No. Parcels in High Wildfire Zone	Estimated at Risk Value
Caroline County incl. Towns of Port Royal and Bowling Green	22,998	11,759	$589,321,400
City of Fredericksburg	8175	1391	$69,712,200
King George County	13,202	6522	$326,860,000
Spotsylvania County	61,506	41,626	$2,086,154,700
Stafford County (excl. Quantico)	52,557	34,473	$1,727,670,400
George Washington Region Total	**158,438**	**95,771**	**$4,799,719,300**

Source: Virginia Department of Forestry

Table 5-9. Wildfire Risk and Critical Facilities-GW Region.

Locality	Total at Risk Critical Facilities
Caroline County incl. Towns of Port Royal and Bowling Green	12
City of Fredericksburg	5
King George County	29
Spotsylvania County	71
Stafford County	54
George Washington Region Total	**171**



Source: HAZUS-MH

Figure 5-1. Peak Wind Gust (mph) 100-yr Distribution.

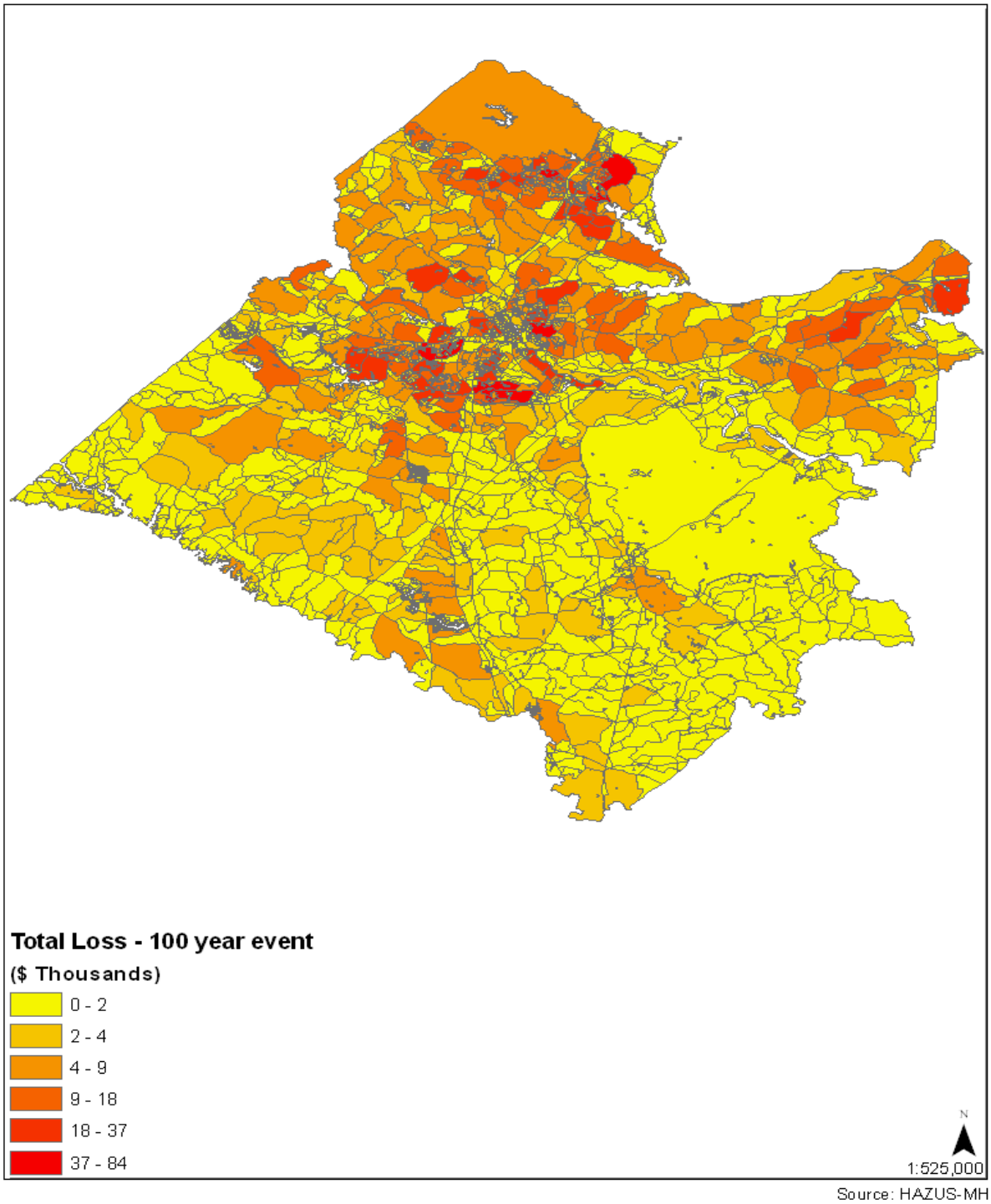


Figure 5-2. Total Residential Loss 100 Year Hurricane- GW Region.

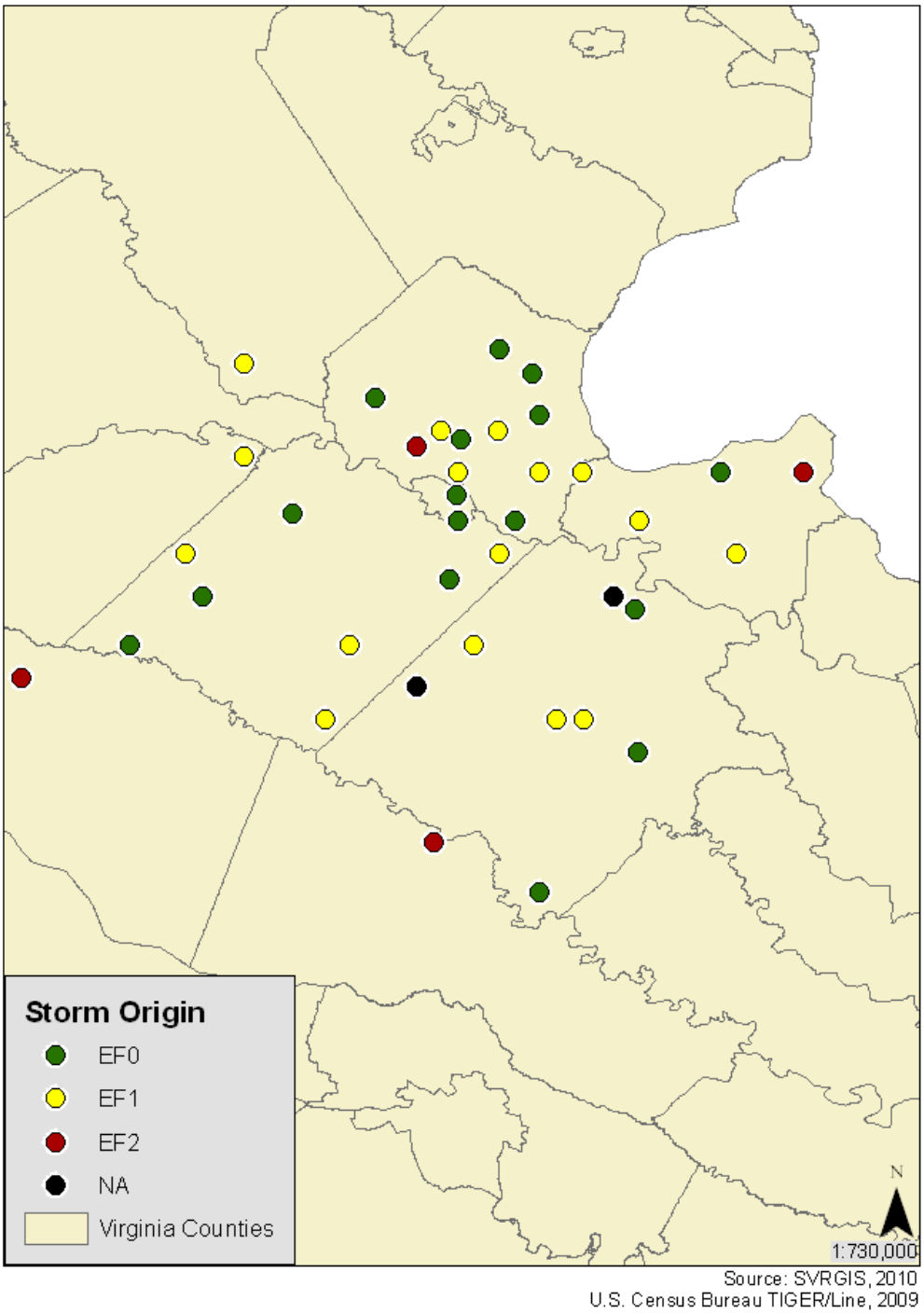


Figure 5-3. Historic Tornado Events.

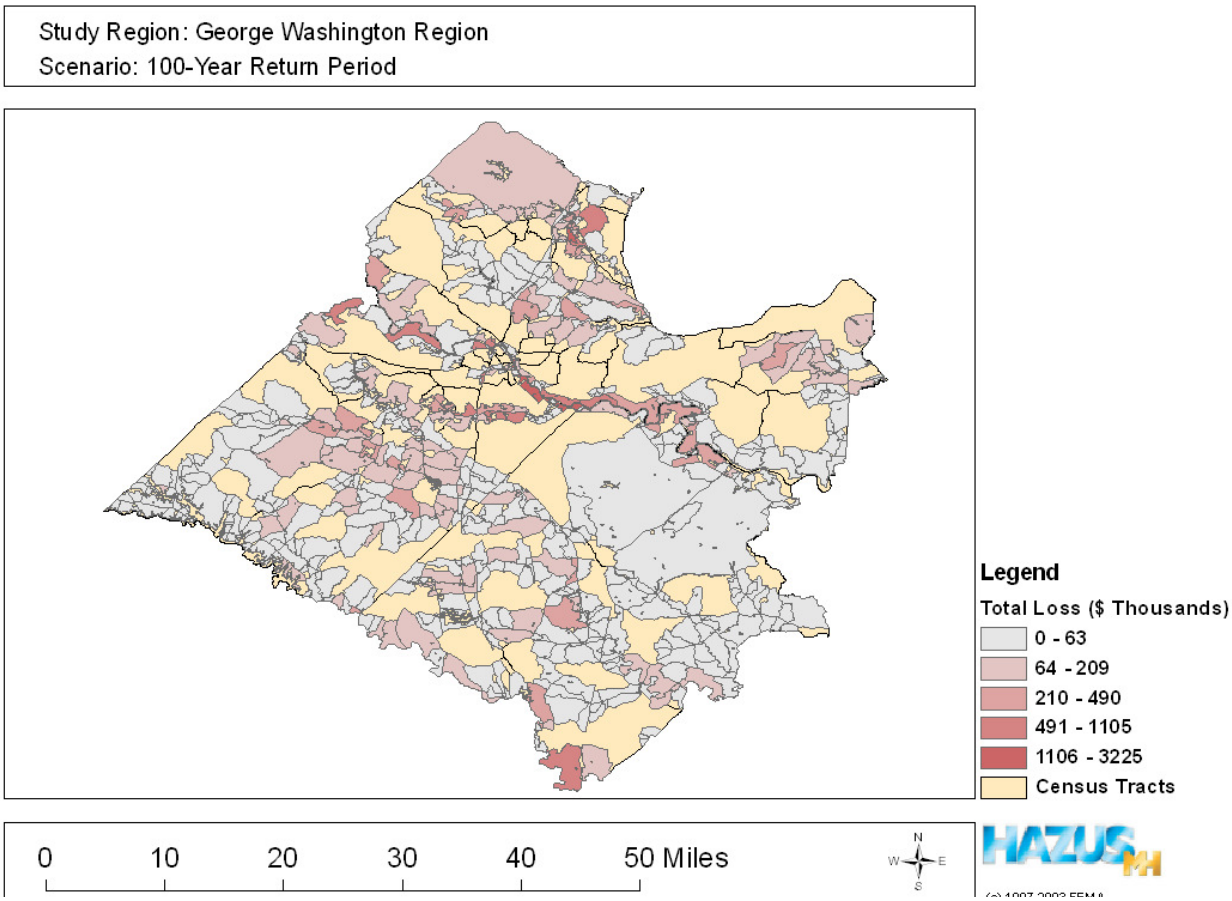


Figure 5-4. Total Residential Loss – GW region.

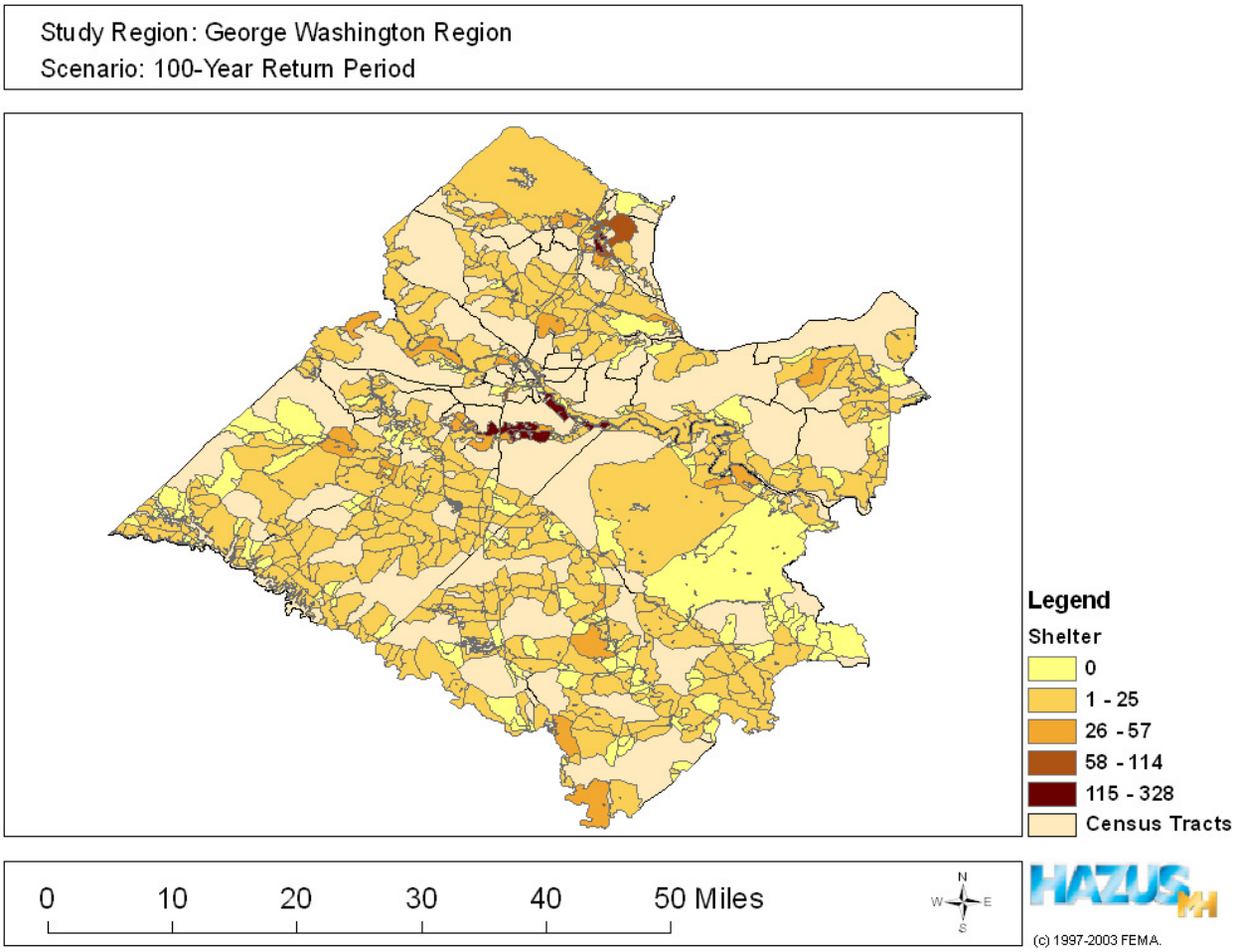


Figure 5-5. Total Displaced Population—GW Region.

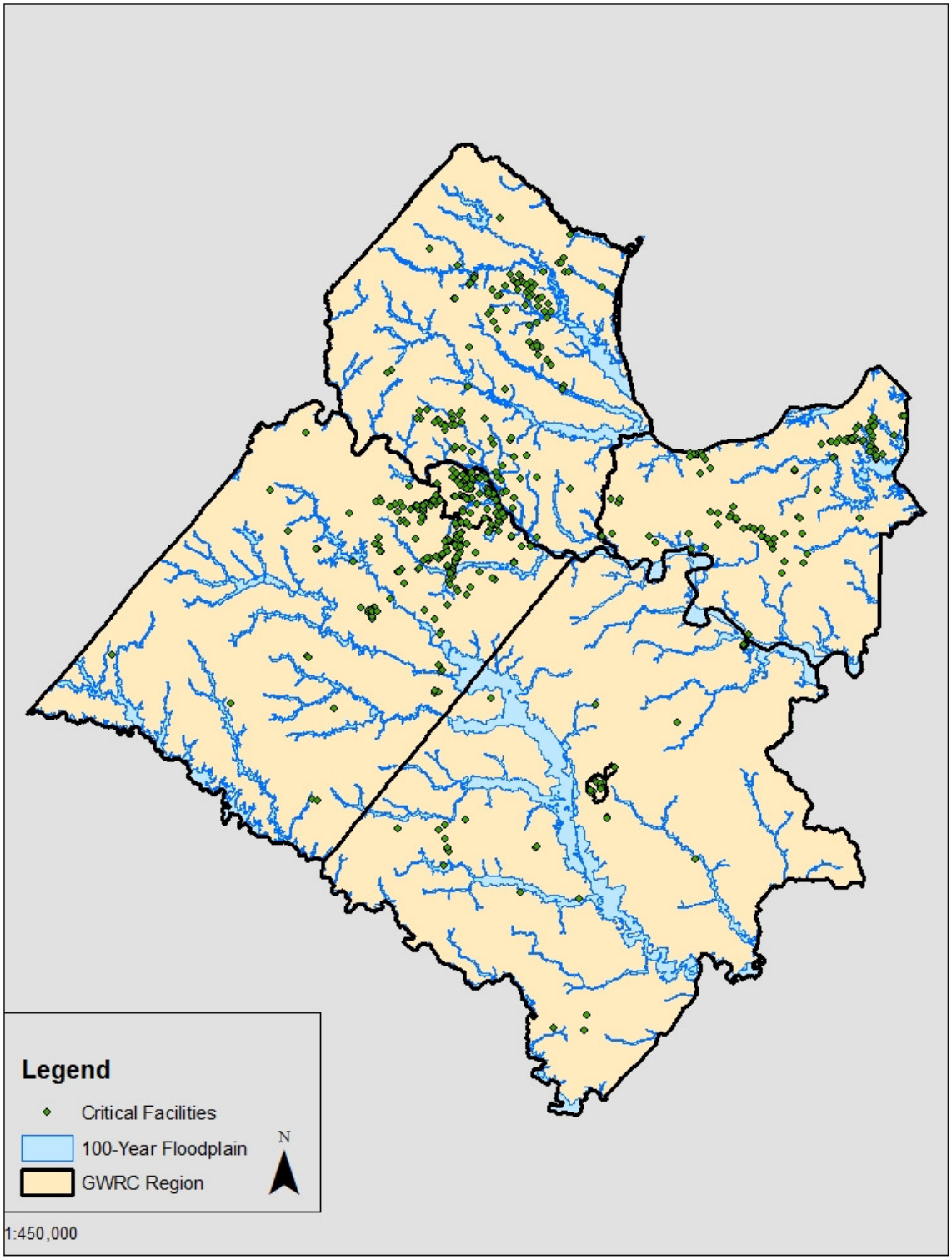


Figure 5-6. Floodplains and Critical Facilities - GW Region.

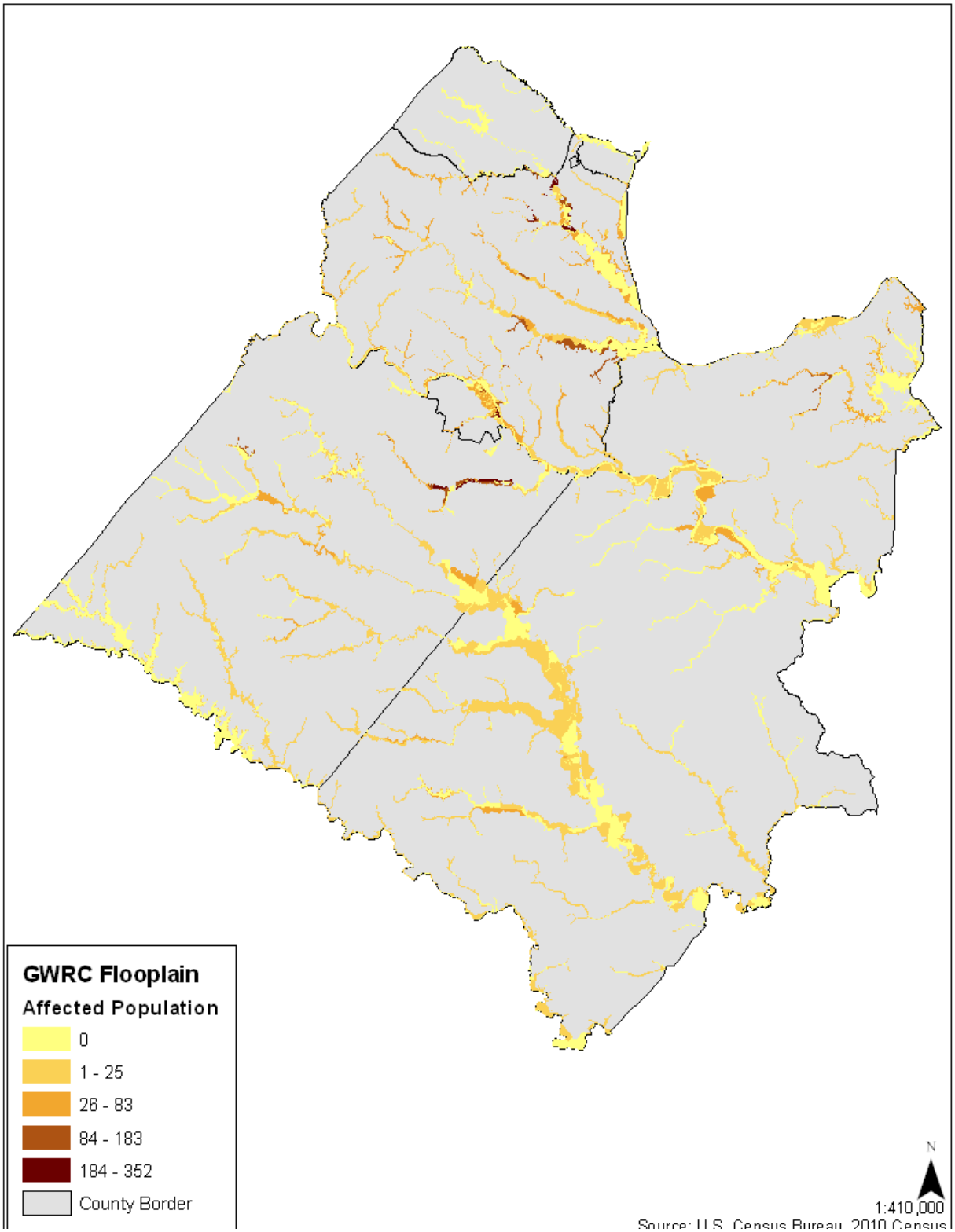


Figure 5-7. Affected Population on 100-Year Floodplain—GW Region.

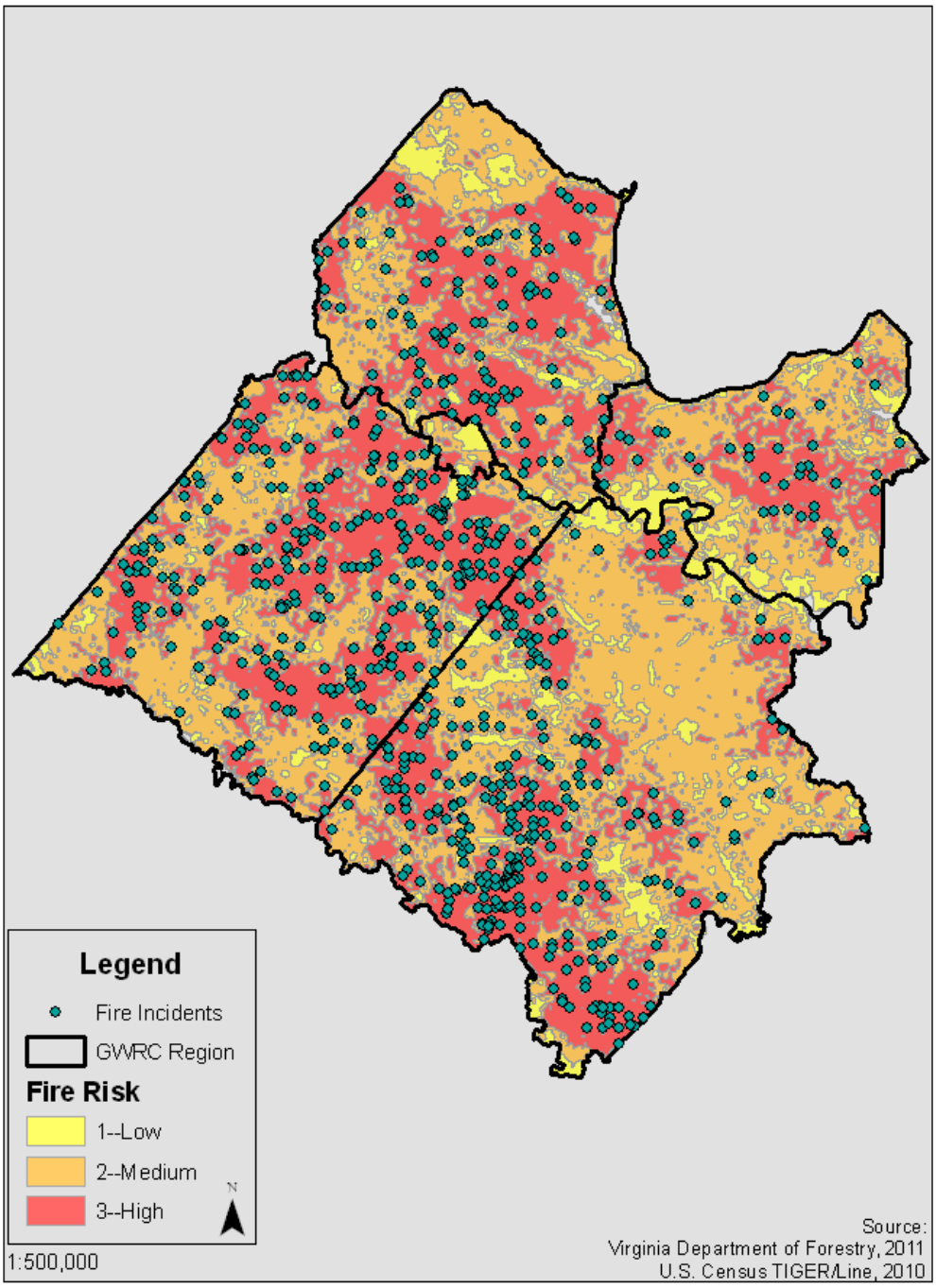


Figure 5-8. Wildfire Risk—GW Region.

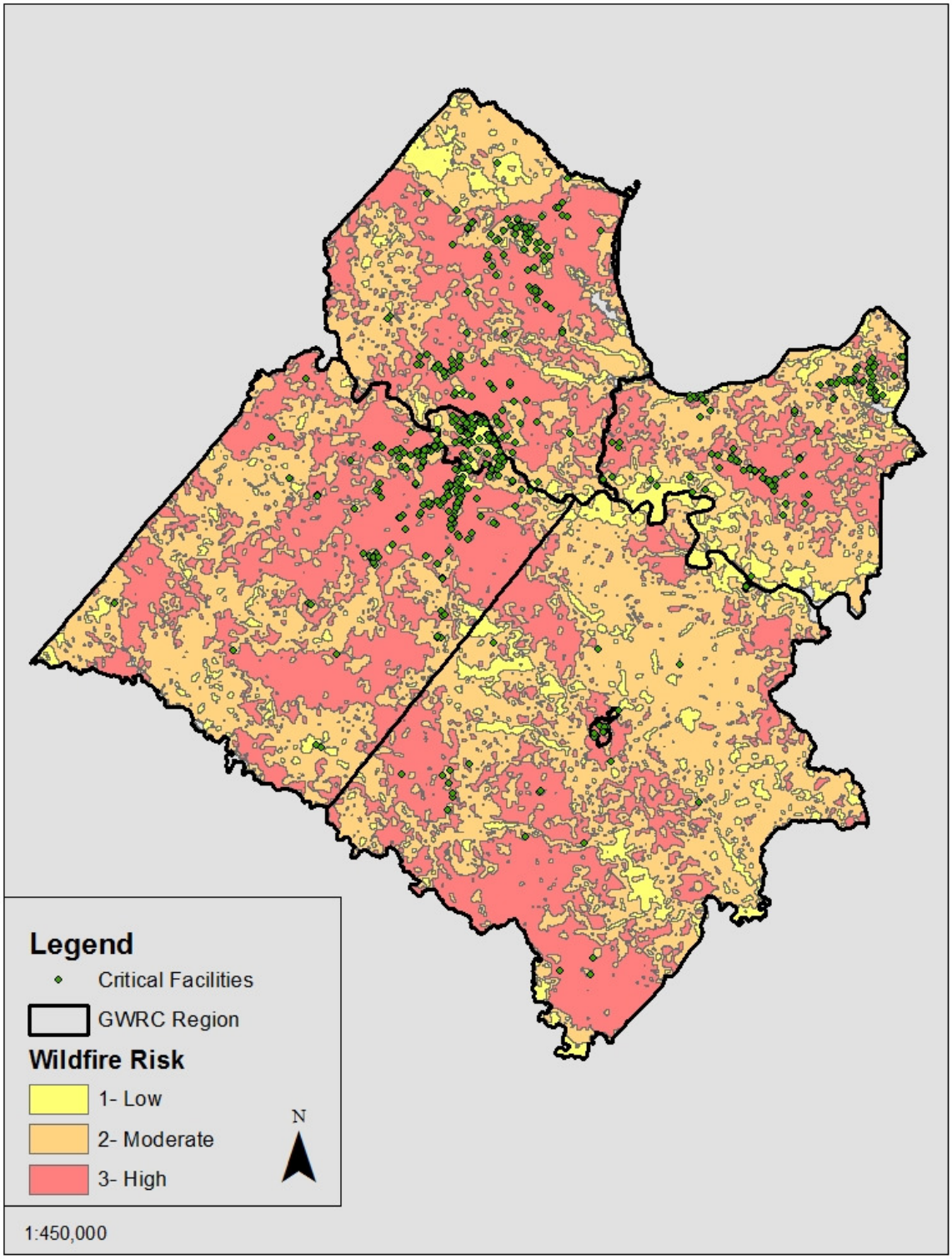


Figure 5-9. Wildfire Risk and Critical Facilities—GW Region.

II. Community Specific Vulnerability Assessment

The MAC identified three hazards to the GWRC region for which specific geographical hazard areas have been defined: flooding, hurricanes, and wildfires. Community vulnerability can be quantified in these instances where there is a known, identified hazard area. The numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Further, information may be collected on the location of critical community facilities (e.g., a fire station), historic structures, and valued natural resources (e.g., an identified wetland or endangered species habitat) that are within the specific hazard area. Past events can also serve as a rough predictor of the future. Where the data was available, rough estimates of annualized damages and the number of hazard events is noted. Together, these values portray the impact, or vulnerability, of that area to that hazard.

However, it is important to note that these values could be refined one step further, with regard to the percent of probable impact. For example, when a flood occurs, the event seldom causes the total destruction of an area. In fact, we know from NFIP insurance claims that a flood with an average depth of 2-feet above the ground is likely to cause approximately 20 percent damage to structures in the aggregate (those with basements, no basements, and second stories). Thus, if the 100-year flood were estimated to be 2-feet deep, a more accurate description of flood vulnerability would be a 1 percent annual chance of incurring a loss of 20 percent of the values tabulated in the 100-year floodplain, not including the additional impacts of damage to infrastructure and economic disruption. This allows a community to measure the cost-effectiveness of alternative mitigation projects under consideration. The benefits of a mitigation project are the future losses avoided, or in this example, that portion of the value of the 1 percent annual chance of 20 percent damage that is protected by the project.

In recent years, FEMA has developed a concept to highlight the impact that repetitively flooded structures have had on the NFIP. The term “repetitive loss,” as applied to the NFIP, refers to any property for which two or more flood insurance claims in excess of $1,000 each in a 10-year period of time have been paid. In 1998, FEMA reported that the NFIP's 75,000 repetitive loss properties have already cost $2.8 billion in flood insurance payments and numerous other flood prone properties continue to remain at high risk in the Nation's floodplains. While these properties make up only 1-2 percent of the flood insurance policies currently in force, they account for 40 percent of the Country's flood insurance claim payments. A report on repetitive loss structures completed by the National Wildlife Federation found that 20 percent of these structures are listed as being outside of the 100-year floodplain (Conrad et al. 1998).

For flooding, hurricane, and wildfire hazards, the MAC has inventoried the following as a means of quantifying vulnerability:

- Development Trends within each jurisdiction;
- Critical Facilities;
- Community Impact; and
- Total Values at Risk (i.e., types, numbers, and value of land and improvements).

Sections II.A through II.E present the vulnerability assessment of each community within the GWRC region to the hazards of flooding, hurricanes, and wildfires.

A. Caroline County and Town of Bowling Green and Town of Port Royal Vulnerability Assessment

Development Trends

The Caroline County Department of Economic Development promotes the goals of business recruitment, job creation, business retention, and marketing in the County. Caroline has a civilian labor force population of 14,313 as of March 2011 and an unemployment rate of 8.5% according to the Virginia Employment Commission. Commercial investment has been successful through the recruitment of the CFC Farmers Market and the move of the Virginia State Fair from Richmond to Caroline.

The Caroline County Strategic Plan promotes education with an increased emphasis on school-to-work, alternative education, and workforce training programs. Over half (51.4%) of Caroline County's workforce consists of management, professional, sales, and office professions. According to the Strategic Plan, "Caroline County will maintain, expand and diversify its economic base by working with existing industries, attracting new industries, promoting tourism, and improving its commercial and retail base in order to provide a wider range of employment, income and services for County residents."

Caroline County's population increased from 19,217 in 1990 to 22,121 in 2000 (15.1% increase). The 2010 Census reported the population in Caroline County at 28,545 persons. This is a 29% increase from 2000. A population projection for 2015 is 32,300 in Caroline County, this is an increase 13.2% from 2010. (U.S. Census Bureau, American FactFinder, 2011.)

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the MAC and the consulting team conducted an inventory of the residential and non-residential structures within Caroline County and identified critical facilities (Table 5-10). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. MAC member representatives from Caroline County provided the inventory of critical facilities for the county.

Town of Bowling Green

MAC member representatives from Caroline County provided the inventory of critical facilities for the Town of Bowling Green. The listing of critical facilities includes emergency response facilities and public facilities (Table 5-11).

Town of Port Royal

MAC member representatives from Caroline County provided the inventory of critical facilities for the Town of Port Royal. The listing of critical facilities is listed in Table 5-12.

Table 5-10. Critical Facilities – Caroline County.

Facility Name	Location	Facility Type
Dept Fire & Rescue Admin. Emergency Operations Center	Caroline County	Fire-Rescue Admin/EOC
Upper Caroline Fire Dept1	Woodford	Fire Dept
Frog Level VFD.2	Hanover	Fire Dept
Ladysmith VFD. 2	Ladysmith	Fire Dept
Sparta VFD. 2	Sparta	Fire Dept
Port Royal VFD. 2	Port Royal	Fire Dept
Frog Level VRS	Ruther Glen	Rescue Squad
Ladysmith VRS	Ladysmith	Rescue Squad
Rappahannock Elec. Field Ofc.	Caroline County	Power Co. local office
St. Johns Sub-Station	Ruther Glen	Electrical Sub Station
Communications Transmit Tower	Varies	Communications
Communications Receive Towers	Varies	Communications
WWUZ CH 2451		Communications
Cell & Microwave Towers	Varies	Communications
Caroline Co. STP	Ruther Glen	Wastewater
Ladysmith Primary2	Ruther Glen	School / Shelter
Bowling Green Primary2	Milford	School / Shelter
Bowling Green Elem	Caroline County	School / Shelter
Ladysmith Elem2	Ruther Glen	School / Shelter
Caroline Middle2	Milford	School / Shelter
Caroline High School	Milford	School / Shelter
Caroline County Courthouse	Bowling Green	Administration Building
Additional significant structures		
CSX/Amtrak Railway	Varies	Transportation
Plantation gas Pipeline	Varies	Gas
Columbia Gas Pipeline	Varies	Gas
School Board Office	Caroline County	School Board

Facility Name	Location	Facility Type
Pneumansend Regional Jail	Caroline County	Jail
Lake Caroline Dam	Ruther Glen	Office
Lake Land'or Dam	Ruther Glen	Office

[1] Data taken from FEMA HAZUS-MH program
[2] Data provided by GWRC
Source: HAZUS and GWRC.

Table 5-11. Critical Facilities – Town of Bowling Green.

Facility Name	Town	Facility Type
State Police	Bowling Green	Police Departments
Caroline Sheriff Admin.	Bowling Green	Police Departments
Bowling Green Police Dept	Bowling Green	Police Departments
Bowling Green Fire Dept	Bowling Green	Fire Dept
911 Center	Bowling Green	911 Center
Bowling Green Rescue Squad1	Bowling Green	Rescue Squad
Water Main Controls/Ground Storage Well	Bowling Green	Water
Fort AP Hill	Bowling Green	Wastewater
Wastewater Treatment Plant	Bowling Green	Wastewater
Sewer Pump Station	Bowling Green	Sewer
Sewer Pump Station	Bowling Green	Sewer
Town Hall	Bowling Green	Administration Building
Additional significant structures		
Dialysis Center	Bowling Green	Medical
Nursing Home	Bowling Green	Medical

Source: Data provided by the Town of Bowling Green.

Table 5-12. Critical Facilities – Town of Port Royal.

Facility Name	Town	Facility Type
Port Royal V.F.D. 1	Port Royal	Fire Dept
Town Water Storage Tank	Port Royal	Water
Town Hall	Port Royal	Administration

Source: Data provided by the Town of Port Royal.

Non-Rotational Wind Vulnerability

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a wind hazard analysis for Caroline County. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for Caroline County.
Table 5-13 lists the total dollar value of exposed structures based on occupancy type for Caroline County.

The default data set provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in Caroline County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high winds.

Table 5-13. Total Dollar Value of Exposed Structures from HAZUS – Caroline County.

Occupancy Type	Total $ Value Exposed Structures
Residential	1,069,417,000
Commercial	59,405,000
Industrial	6,830,000
Agricultural	2,147,000
Religion	14,336,000
Government	3,150,000
Education	1,504,000
Total	**1,156,789,000**

Source: HAZUS-MH

The two options provided by HAZUS®MH software for wind analysis are the probabilistic and deterministic methods. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyzes hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of “what-if” scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Because residential structures comprise a significantly large percentage of the occupancy classification within Caroline County, these data are presented in below. Figure 5-10 shows the peak wind gusts, ranging from 61mph to 69mph, generated from a hurricane with a 100-year recurrence interval. Figure 5-11 displays the total residential loss by census block for a 100-year recurrence interval.

Table 5-14. Hurricane Risk - Caroline County. Summary of Probabilistic Analysis – Residential Structures.

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	1	0	0	0
50-year	5	0	0	0
100-year	95	2	0	0
200-year	296	14	1	0
500-year	1,691	294	18	14
1000-year	2,307	599	66	56

Source: HAZUS

Severe Storm Vulnerability

Since 1960 Caroline has experienced 75 severe storms (roughly 1.6 annually) that have caused damage to property and crops from lightning, hail, extreme winds, and flooding. From 1960-2008 these storms have caused $22,000 in crop damages and $430,000 in property damages or the equivalent of $458 in crop damages and $8,958 in property damages annually. The storms have taken the lives of 2 residents and injured 13 people.

In that same time period extreme weather from winter storms and ice have caused damages to private and public properties and winter freeze has caused damage to crops within the region. Total damages to properties exceeded $61 million across 54 storms or roughly $1.3 million annually. Four of those storms caused winter freeze resulting in crop damages resulting in damages of approximately $94,000 (SHELDUS 2011). The risk for winter storm events for Caroline County and its independent towns is listed below in Table 5-15.

Table 5-15. Winter Storm Risk - Caroline County and the Towns of Port Royal and Bowling Green.

Locality	Average Snowfall (in) 1958-2010					Likelihood Of Event (%)
	December	January	February	March	Annual	
Caroline	2.51”	4.54”	4.86”	2.43”	15.70”	99.9

Source: Southeast Regional Climate Center

Tornado Vulnerability

Based on the available data, Caroline County has averaged 0.18 tornado events causing $6,117 in damages annually.

Table 5-16. Tornado Risk – Caroline County. Summary of Historic Events 1950-2010.

Intensity	Number of Occurrences	Damages ($)
EF0	3	17K
EF1	5	100K
EF2	1	200K
NA	2	50K

Source: NOAA, 2011

Flood Vulnerability

Repetitive Loss Areas

FEMA has identified 0 properties as repetitive loss properties for Caroline County. The number given does not reflect the total number of houses that have flooded in Caroline County, rather the total number of repetitive losses, as defined by FEMA.

HAZUS Flood Analysis

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a flood hazard analysis for Caroline County. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 flood analysis was performed to calculate the flood hazard for the Caroline County. Table 5-13 lists the total dollar value of exposed structures based on occupancy type for Caroline County.

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the Caroline County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

The three hazard type options provided by HAZUS®MH software for flood analysis are the riverine, coastal, and riverine and coastal scenarios. The necessary scenario for any given situation depends upon the geography of the region. If the area is inland with a stream hydrology, then the riverine scenario should be used. If however, the area is along the coast then either the riverine and coastal, or coastal scenario should be used. The user cannot run any analysis without first defining the scenario.

Table 5-17. Flood Risk – Caroline County and the Towns of Bowling Green and Port Royal.

Occupancy Type	Dollar Exposure (replacement value $)
Residential	889,530,000
Commercial	149,857,000
Industrial	32,928,000
Agricultural	7,758,000
Religion	34,712,000
Government	9,295,000
Education	12,091,000
TOTAL	**1,136,171,000**

Source: HAZUS-MH

The riverine analysis was chosen for Caroline County. This scenario provides the statistical probability for a range of flood events and presents a comparison of those events. The coastal and riverine analysis was used to generate structural loss estimations, agricultural loss estimations, and shelter requirements for flood events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, and 500-year. The recurrence interval is the average interval of time within which the given flood event will be equaled or exceeded once.

Agricultural damage from a 100-year event is listed below in Table 5-18. Because residential structures comprise a significantly large percentage of the occupancy classification within the region, these data are presented in Figure 5-13 below. The total damages to residential structures were $9,832,000. The number of displaced persons from a 100-year event is displayed below in Figure 5-14. The total number of displaced Caroline County residents was 1160 people. Figure 5-15 shows the 100-year floodplain for the Caroline County with 2010 census blocks that intersect it. The map displays the population (in 2010 Census numbers) that would be affected by a 100-year flood event.

Table 5-18. Agricultural Loss – Caroline County and the Towns of Bowling Green and Port Royal.

Crop Type	Loss ($)
Corn	817,494.09
Corn Silage	4,025,064.98
Soybeans	581,361.80
TOTAL	**5,423,920.87**

Source: HAZUS-MH

Wildfire Vulnerability

Caroline County provided hardcopy tax parcel information dated at a scale of 1”=600’. Caroline County also provided a land use suite of layers that delineated the agricultural preservation area and the boundary of Fort A.P. Hill. The agricultural preservation area is defined in the Caroline County Comprehensive Plan as lands designated for agricultural uses and residential densities, and are not to exceed a ratio of one structure per 25 acres. Since these areas contain very low population densities, these areas were removed from the wildfire analysis. The area covered by Fort A.P. Hill was also excluded from the analysis because it is under the jurisdiction of the United States Army. The VDOF

Wildfire mapping for Caroline County was plotted at the same scale as the Caroline County Tax Parcel mapping for all areas not previously indicated and those parcels that intersect the high wildfire hazard boundary were totaled.

The analysis (listed below in Table 5-19) yielded approximately 11,759 parcels that intersected the high wildfire hazard boundary as delineated by VDOF. The improvement value for these parcels was totaled and resulted in an at risk value of $589,321,400 for Caroline County.

Table 5-19. Wildfire Risk—Caroline County.

Total No. Parcels	No. Parcels in High Wildfire Zone	Estimated at Risk Value
22,998	11,759	$589,321,400

Source: Data provided by Caroline County

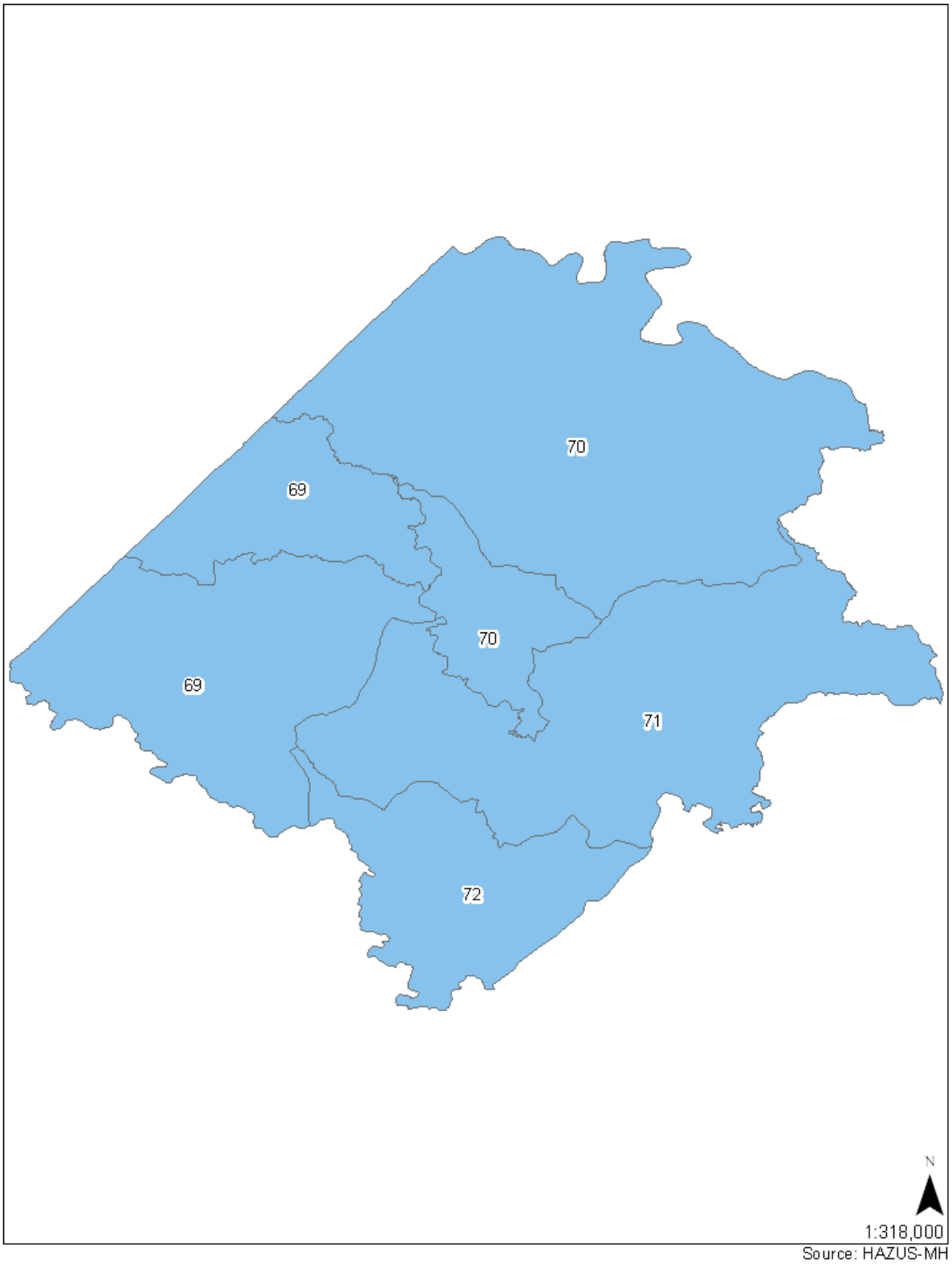


Figure 5-10. Peak Wind Gust (mph) Distribution Caroline County.

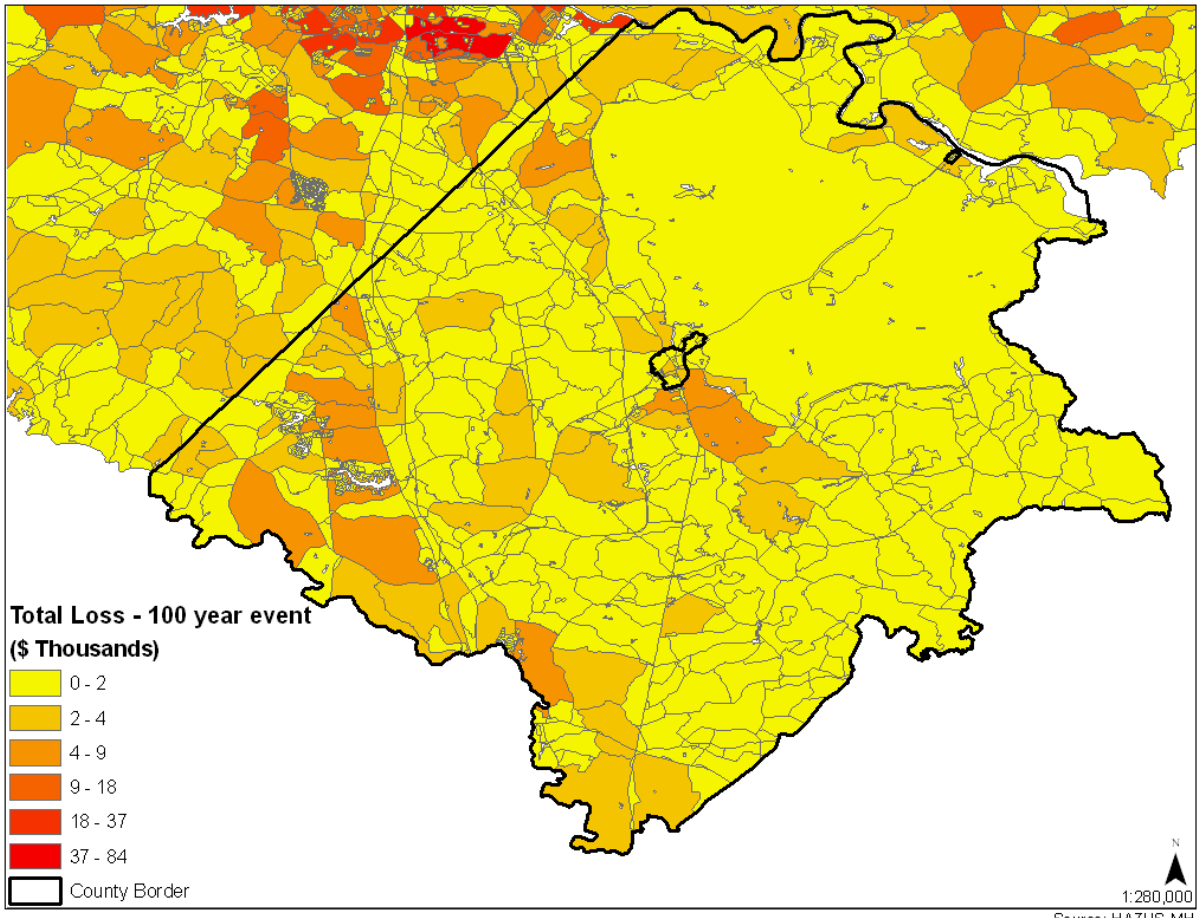
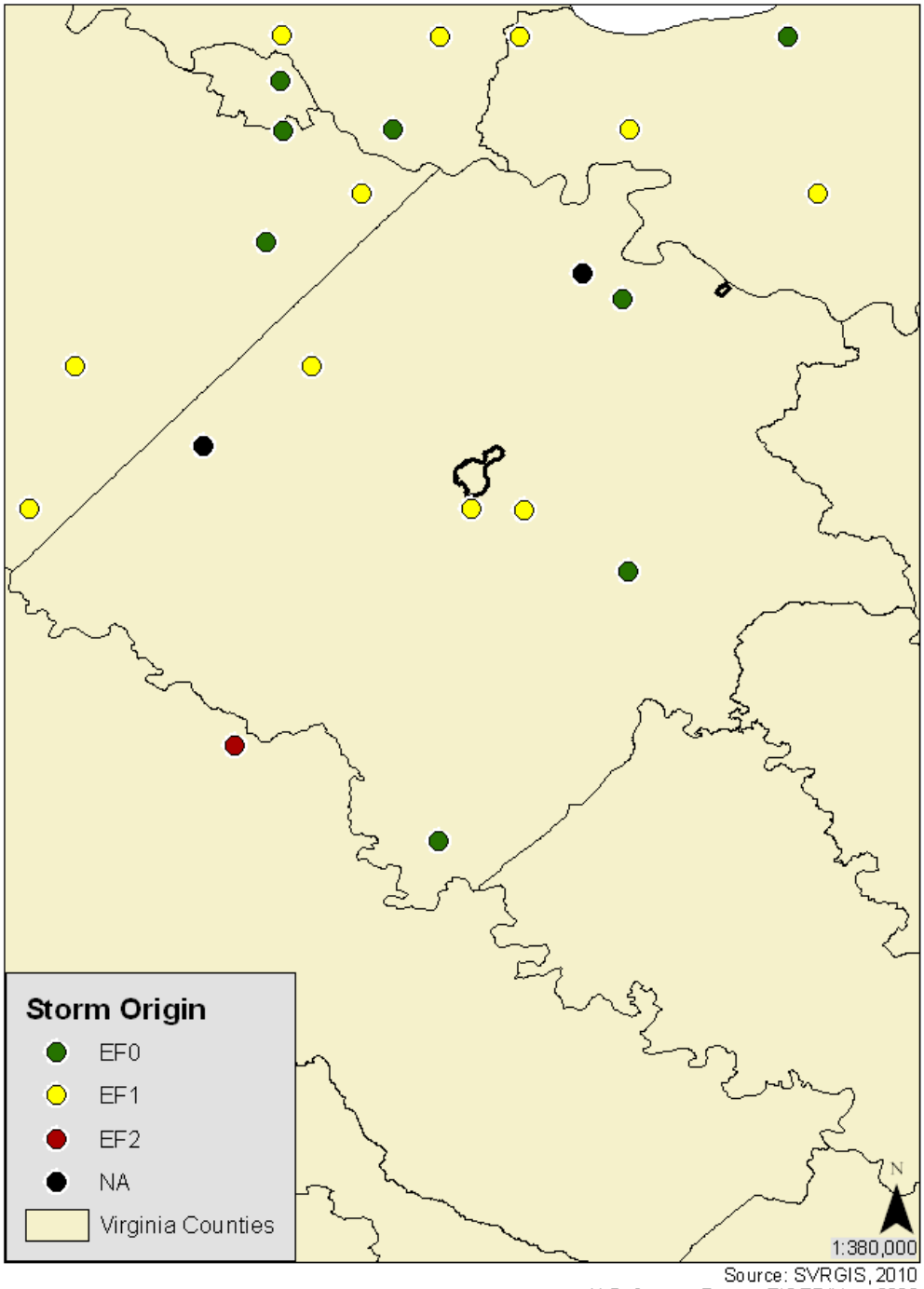


Figure 5-11. Total Residential Loss 100 Year Hurricane - Caroline County .



Source: SVRGIS, 2010
U.S. Census Bureau TIGER/Line, 2009

Figure 5-12. Historic Tornado Events—Touchdown Points for Caroline County.

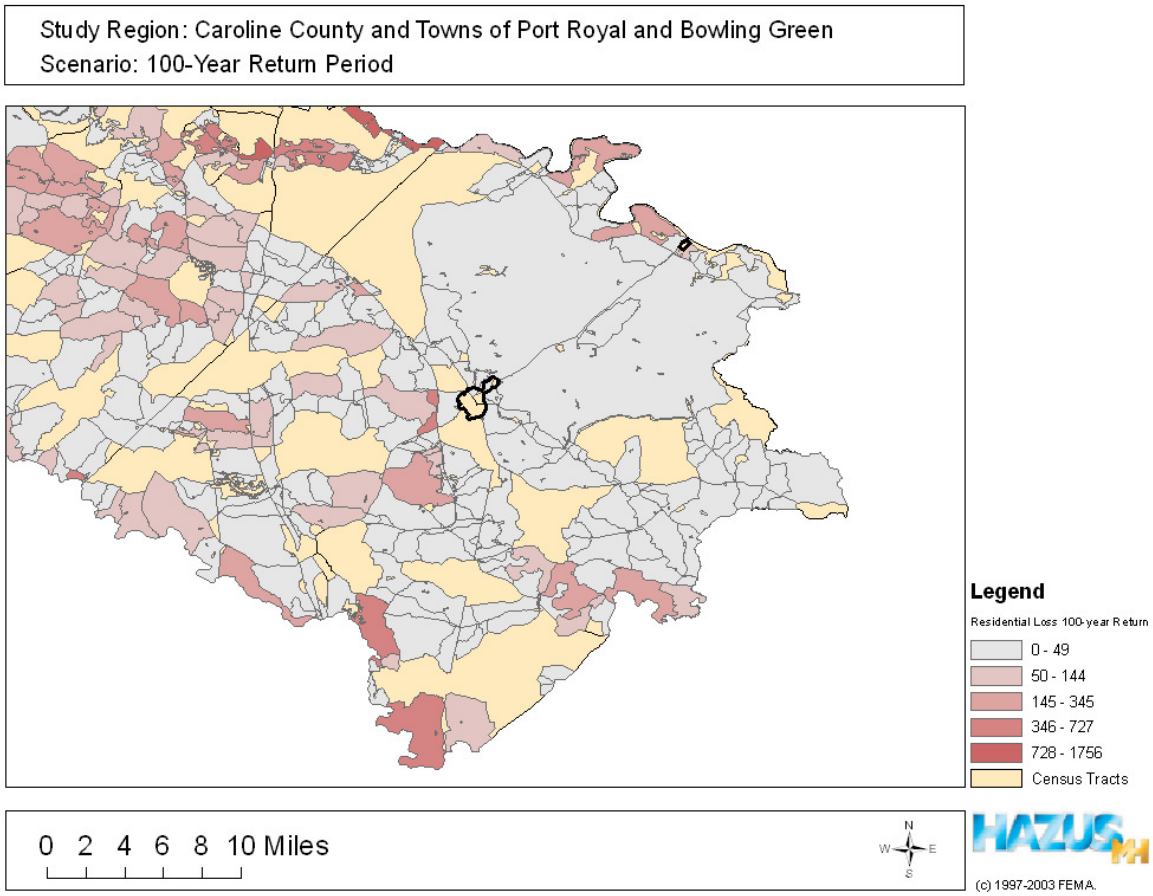


Figure 5-13. Total Residential Loss for Caroline County.

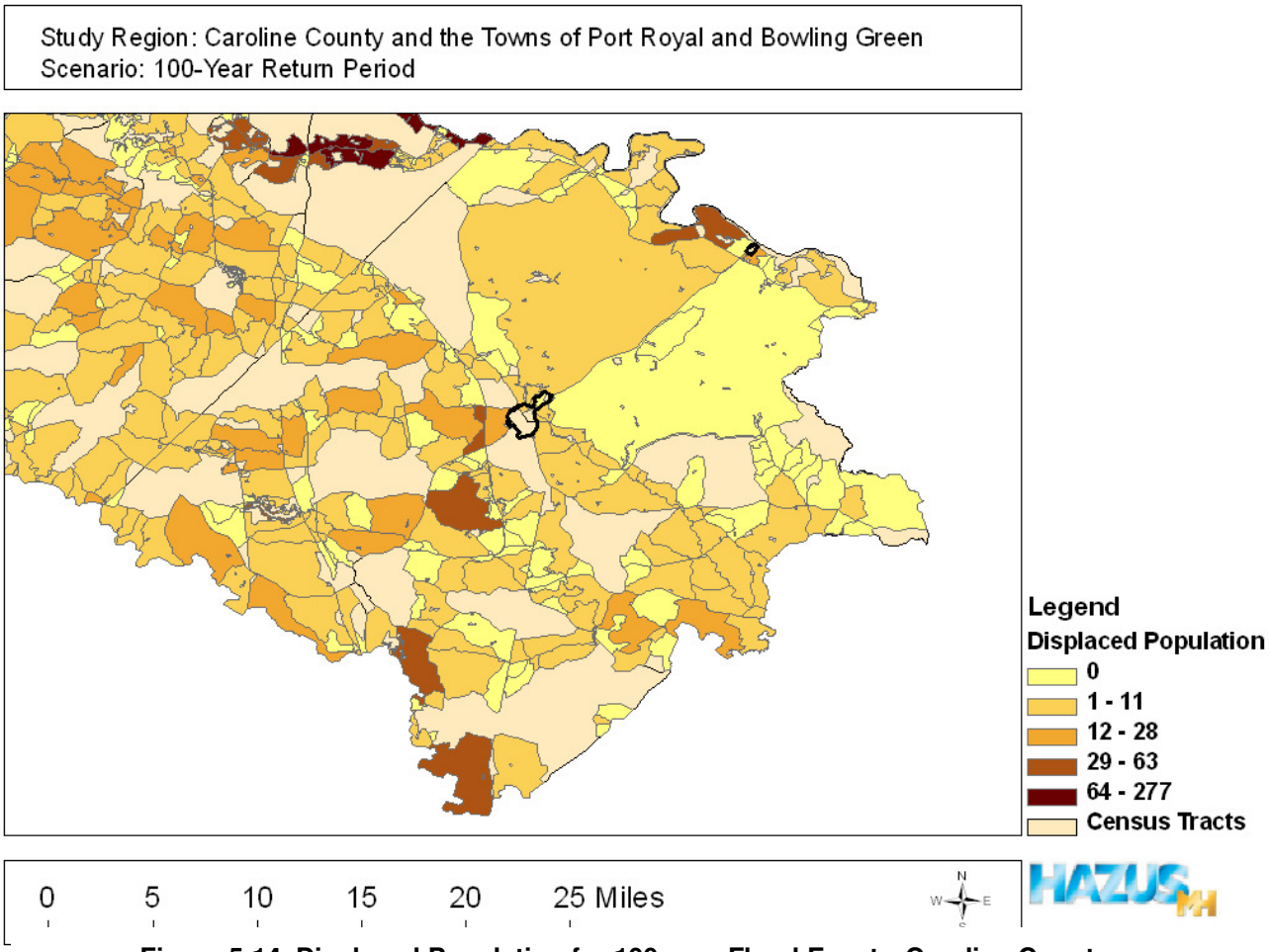


Figure 5-14. Displaced Population for 100-year Flood Event—Caroline County.

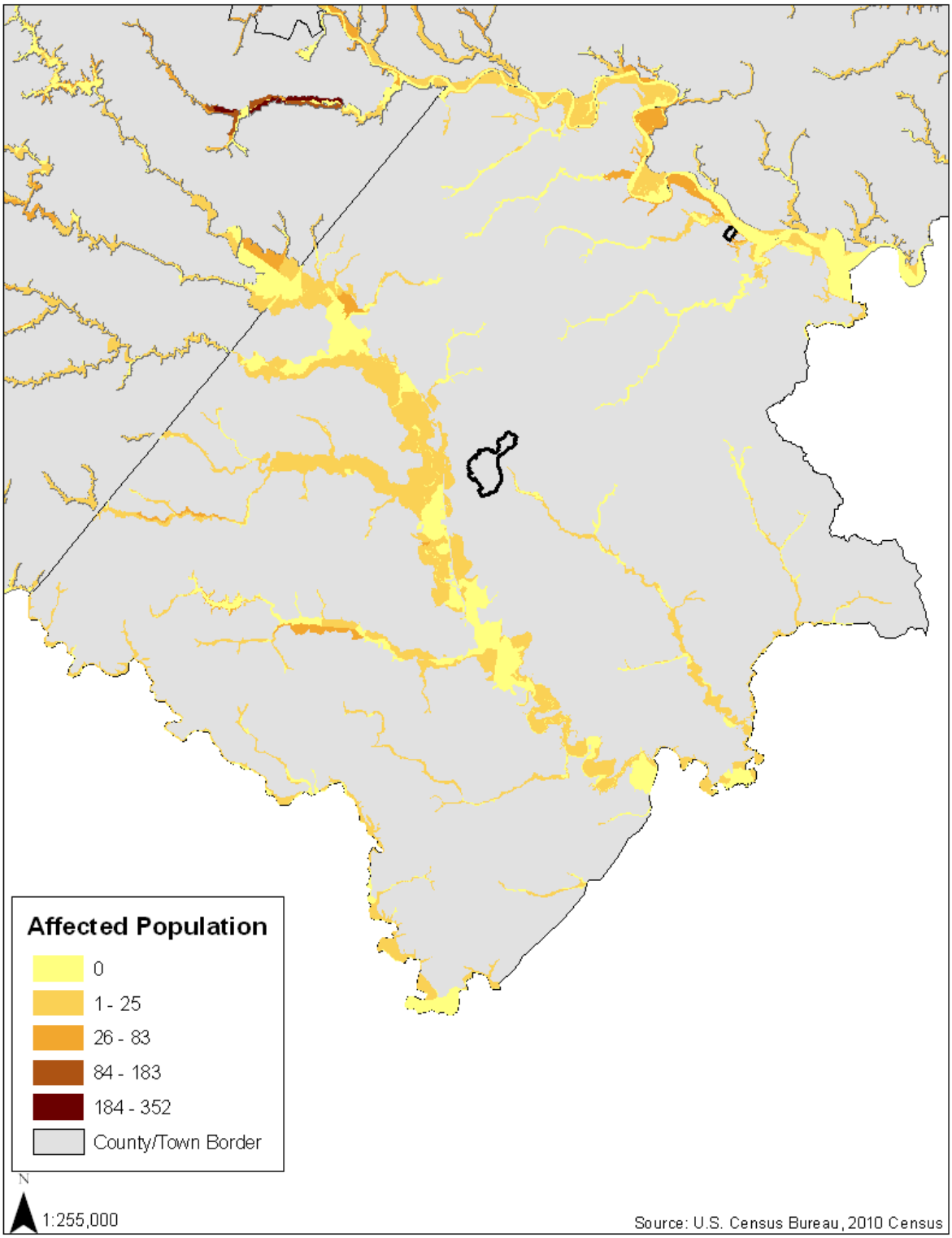


Figure 5-15. At Risk Population for Flood Event—Caroline County.

B. City of Fredericksburg Vulnerability Assessment

Development Trends

The City of Fredericksburg's business development relies heavily upon tourism. The City's Tourism and Business Development Department considers its primary function to be the promotion of tourism to assist development of the local travel industry. As of September 30, 2004, 13,560 jobs were held in the service industry and 4,440 jobs were held in the trade industry. Out of 25,187 employment positions in Fredericksburg, these sectors accounted for 53.8% and 17.8%, respectively (a total of 71.6% of Fredericksburg jobs).

Service-related businesses (food and hotel/motel) made up 20.5% of taxable sales in 2004 with $215,720,808 of Fredericksburg's total of $1,047,573,565 in taxable sales. The largest identifiable business group was the food industry, which had 235 dealers and $199,427,478 in sales during 2004. Sixteen hotel/motel businesses accounted for $16,293,330.

Fredericksburg's population increased from 19,027 in 1990 to 19,279 in 2000 (1.3% increase). 2010 Census data reports that the City of Fredericksburg's population is 24,286 persons. This is a 26% population increase from 2000. A population projection for Fredericksburg's 2015 population is 25,200, an increase of 3.8%. (City of Fredericksburg, Virginia, 2005).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the MAC conducted an inventory of the structures and critical facilities within the City of Fredericksburg (Table 5-20). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. MAC member representatives from the City of Fredericksburg provided the inventory of critical facilities for the county.

Table 5-20. Critical Facilities – City of Fredericksburg.

Facility Name	City	Facility Type
Emergency Operation Center Fredericksburg Fire Dept. Station 2	Fredericksburg	EOC
Executive Plaza Office Building	Fredericksburg	Police and Fire
Fredericksburg Police Hdqrs / E911 Center	Fredericksburg	Police Departments / Communications
Fredericksburg Sheriff	Fredericksburg	Police Departments
Fredericksburg Fire Dept Station 2	Fredericksburg	Fire Dept
Fredericksburg Rescue Squad	Fredericksburg	Fire Dept
Fredericksburg Fire Inspection Station 1	Fredericksburg	Fire Dept
Verizon	Fredericksburg	Communications
Powhatan Site Police #2 Fire and Rescue #1	Fredericksburg	Radio Repeater
Ashby Street Site Police #1	Fredericksburg	Radio Repeater
Police Radio Voter	Fredericksburg	Radio Repeater
Police Radio #3	Fredericksburg	Radio Repeater
Police Radio Voter	Fredericksburg	Radio Repeater
Courtland Water Pumping Station	Fredericksburg	Water Pumping Station
Powhatan Water Pumping Station	Fredericksburg	Water Pumping Station
Lafayette Blvd Pumping Station	Fredericksburg	Water Pumping Station
Motts Run Reservoir Water Treatment Plant	Fredericksburg	Water Treatment Plant
Normandy Village Sewage Pump Station	Fredericksburg	Sewage Pump Station
Bragg Hill Sewage Pump Station	Fredericksburg	Sewage Pump Station
Rts 2 and17 Area Sewage Pump Station	Fredericksburg	Sewage Pump Station
Snowden Sewage Pump Station	Fredericksburg	Sewage Pump Station
Caroline Street Sewage Pumping Station	Fredericksburg	Sewage Pumping Station
Fall Hill Sewage Pumping Station	Fredericksburg	Sewage Pumping Station
City of Fredericksburg Wastewater Treatment	Fredericksburg	Wastewater Treatment Plant
Hugh Mercer Elementary	Fredericksburg	School / Shelter
James Monroe High	Fredericksburg	School / Shelter
Walker-Grant Middle	Fredericksburg	School / Shelter
Lafayette Upper Elementary	Fredericksburg	School/Shelter
City Hall	Fredericksburg	Administration
Additional significant structures		
Mary Washington Hospital	Fredericksburg	Hospital

Facility Name	City	Facility Type
National Guard Army	Fredericksburg	Military
FBI Field Office (local)	Fredericksburg	Federal Government

Source: Data provided by the City of Fredericksburg

Non-Rotational Wind Vulnerability

Hazards U.S. – Multi Hazard (HAZUS-MH) was utilized to perform a wind hazard analysis for the City of Fredericksburg. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for City of Fredericksburg. Table 5-21 lists the total dollar value of exposed structures within the City based on occupancy type.

The default data set provided with the HAZUS-MH software is based on the 2000 census data. It is recognized that the current development trends in the Fredericksburg region make the 2000 census data obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high winds.

Table 5-21. Total Dollar Value of Exposed Structures from HAZUS - City of Fredericksburg.

Occupancy Type	Total $ Value Exposed Structures
Residential	1,113,819,000
Commercial	407,459,000
Industrial	21,365,000
Agricultural	1,439,000
Religion	16,152,000
Government	4,694,000
Education	5,515,000
Total	**1,570,443,000**

Source: HAZUS-MH

HAZUS®MH software provides two options for wind analysis, probabilistic and deterministic. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyzes hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of “what-if” scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Since "residential" comprised a significantly large percentage of the occupancy classification these data are presented in Table 5-22 below. Figure 5-16 shows the peak wind gusts generated from a hurricane with 100-year recurrence interval. Figure 5-17 displays the total loss from a 100-year event.

Table 5-22. Hurricane Risk - City of Fredericksburg. Summary of Probabilistic Analysis – Residential Structures.

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	7	0	0	0
50-year	53	4	0	0
100-year	246	28	2	0
200-year	342	44	2	0
500-year	1,252	388	21	10
1000-year	1,589	704	55	30

Source: HAZUS-MH

Severe Storm Vulnerability

Since 1960 Fredericksburg has experienced 61 severe storms (approximately 1.27 annually) that have caused damage to property and crops from lightning, hail, extreme winds, and flooding. From 1960-2008 these storms have caused $7,400 in crop damages and $487,000 in property damages or the equivalent of $154 in crop damages and $10,146 in property damages annually. The storms have taken the life of 1 resident.

In that same time period extreme weather from winter storms and ice have caused damages to private and public properties and winter freeze has caused damage to crops within the region. Total damages to properties are estimated at $2 million across 56 storms. In annualized terms, this is the equivalent of $41,667 in property damages and 1.17 winter storm events each year. Four of those storms caused winter freeze resulting in crop damages resulting in damages of approximately $44,700 (SHELDUS 2011). The risk for winter storm events for King George County and its independent towns is listed below in Table 5-23.

Table 5-23. Winter Storm Risk—Fredericksburg.

Locality	Average Snowfall (in) 1958-2010					Likelihood Of Event (%)
	December	January	February	March	Annual	
Fredericksburg	2.55"	5.20"	4.53"	2.35"	14.47"	96.1

Source: Southeast Regional Climate Center

Tornado Vulnerability

Based on the available data, Fredericksburg has averaged 0.03 tornado events causing $333 in damages annually.

Table 5-24. Tornado Risk - City of Fredericksburg.

Intensity	Number of Occurrences	Damages ($)
EF0	1	0
EF1	1	20K

Flood Vulnerability

Repetitive Loss Areas

FEMA has identified 4 properties as repetitive loss properties for the City of Fredericksburg. The number given does not reflect the total number of houses that have flooded in City of Fredericksburg, rather the total number of repetitive losses.

HAZUS Flood Analysis

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a flood hazard analysis for the City of Fredericksburg. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 flood analysis was performed to calculate the flood hazard for the Fredericksburg. Table 5-25 lists the total dollar value of exposed structures based on occupancy type for Fredericksburg.

Table 5-25. Flood Risk - City of Fredericksburg .

Occupancy Type	Dollar Exposure (replacement value $)
Residential	114,560,000
Commercial	97,586,000
Industrial	68,641,000
Agricultural	3,197,000
Religion	41,706,000
Government	15,526,000
Education	22,361,000
TOTAL	**363,577,000**

Source: HAZUS-MH

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the Fredericksburg may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

The three hazard type options provided by HAZUS®MH software for flood analysis are the riverine, coastal, and riverine and coastal scenarios. The necessary scenario for any given situation depends upon the geography of the region. If the area is inland with a stream hydrology, then the riverine scenario should be used. If however, the area is along the coast then either the riverine and coastal, or coastal scenario should be used. The user cannot run any analysis without first defining the scenario.

The riverine analysis was chosen. This scenario provides the statistical probability for a range of flood events and presents a comparison of those events. The riverine analysis was used to generate structural loss estimations, agricultural loss estimations, and shelter requirements for flood events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, and 500-year. The recurrence interval is the average interval of time within which the given flood event will be equaled or exceeded once.

Residential structures comprise a significantly large percentage of the occupancy classification within the region. The data displaying the lost damages from residential structures is presented in Figure 5-19 below. Total damages to residential structures in Fredericksburg were $1,088,000. The number of displaced persons from a 100-year event is displayed below in Figure 5-20. The total number of displaced Fredericksburg residents was 225 people. Figure Figure 5-21 shows the 100-year floodplain for the Fredericksburg with 2010 census blocks that intersect it. The map displays the population (in 2010 Census numbers) that would be affected by a 100-year flood event.

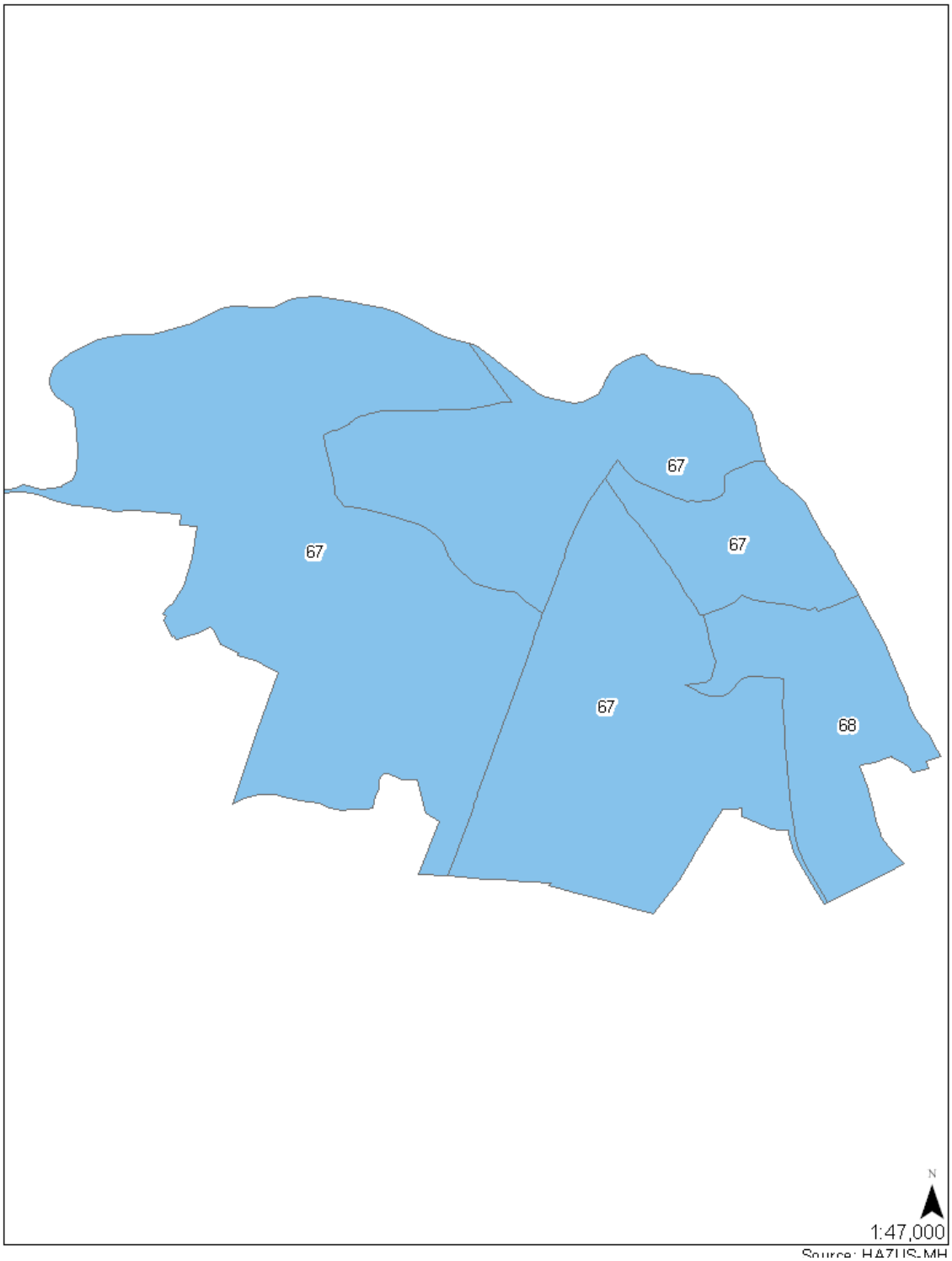


Figure 5-16. Peak Wind Gust (mph) Distribution.

Figure 5.2.2b
Total Residential Loss for
City of Fredericksburg

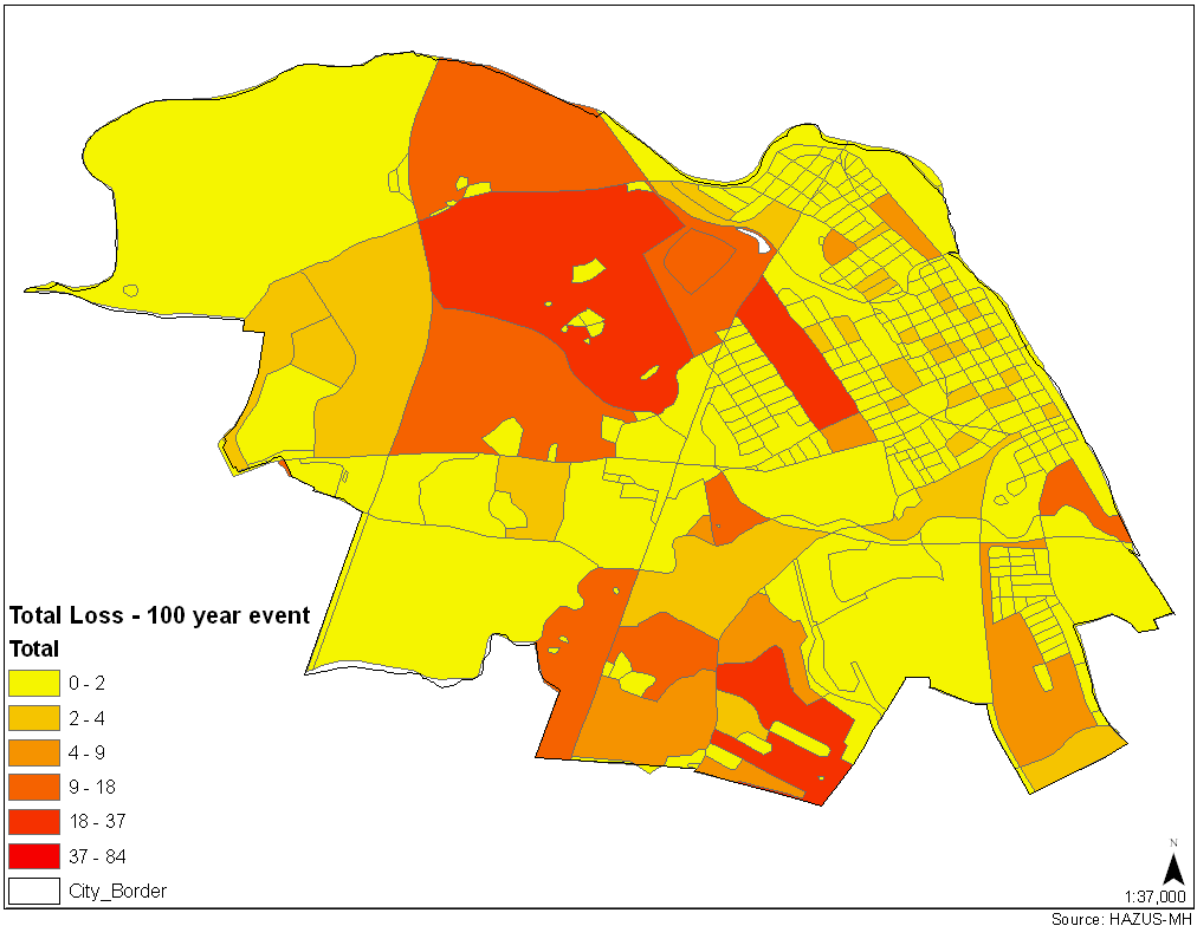


Figure 5-17. Total Residential Loss 100 Year Hurricane - City of Fredericksburg.

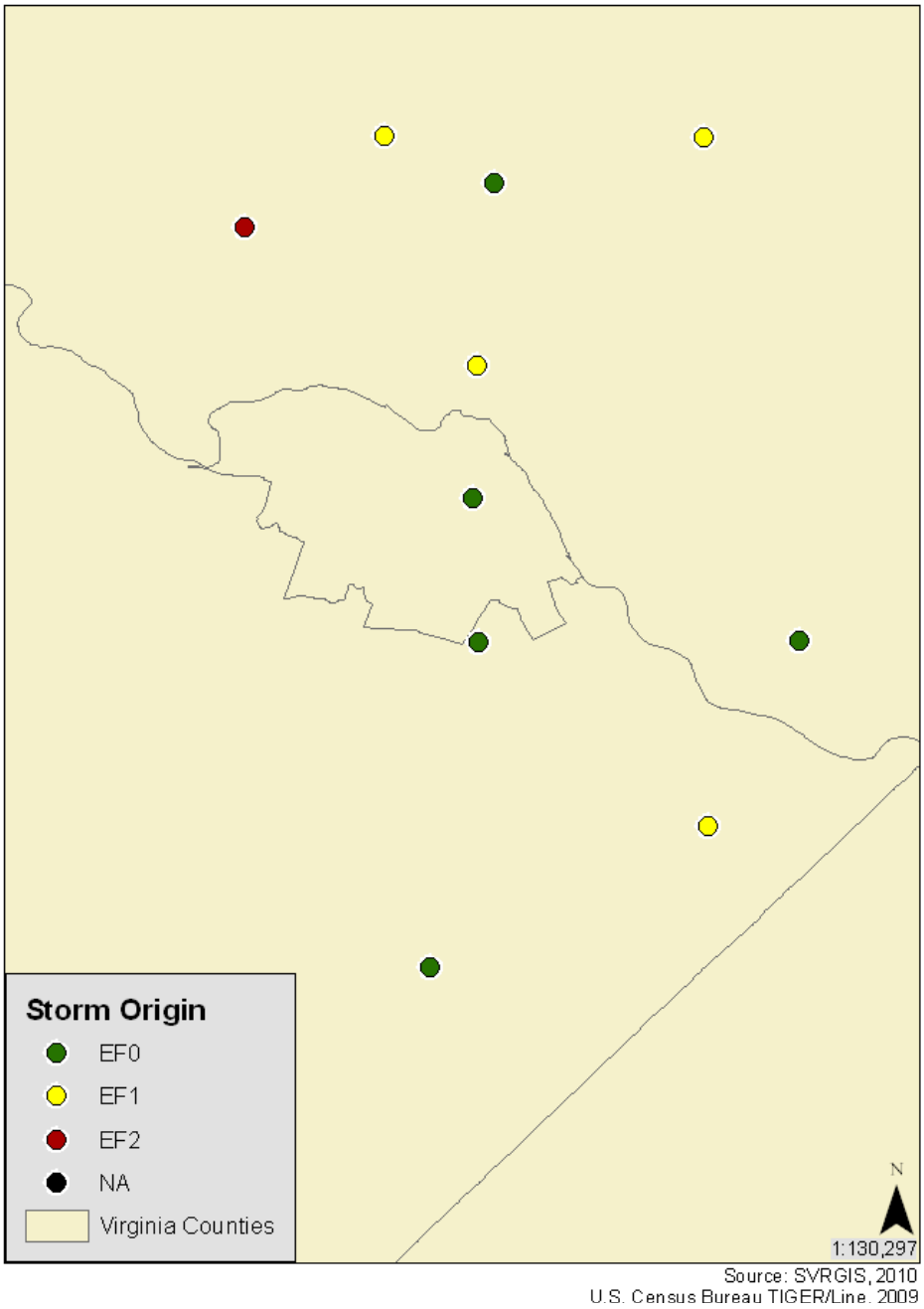


Figure 5-18. Historic Tornado Occurrences (Enhanced Fujita Scale) - City of Fredericksburg 1950-2010.

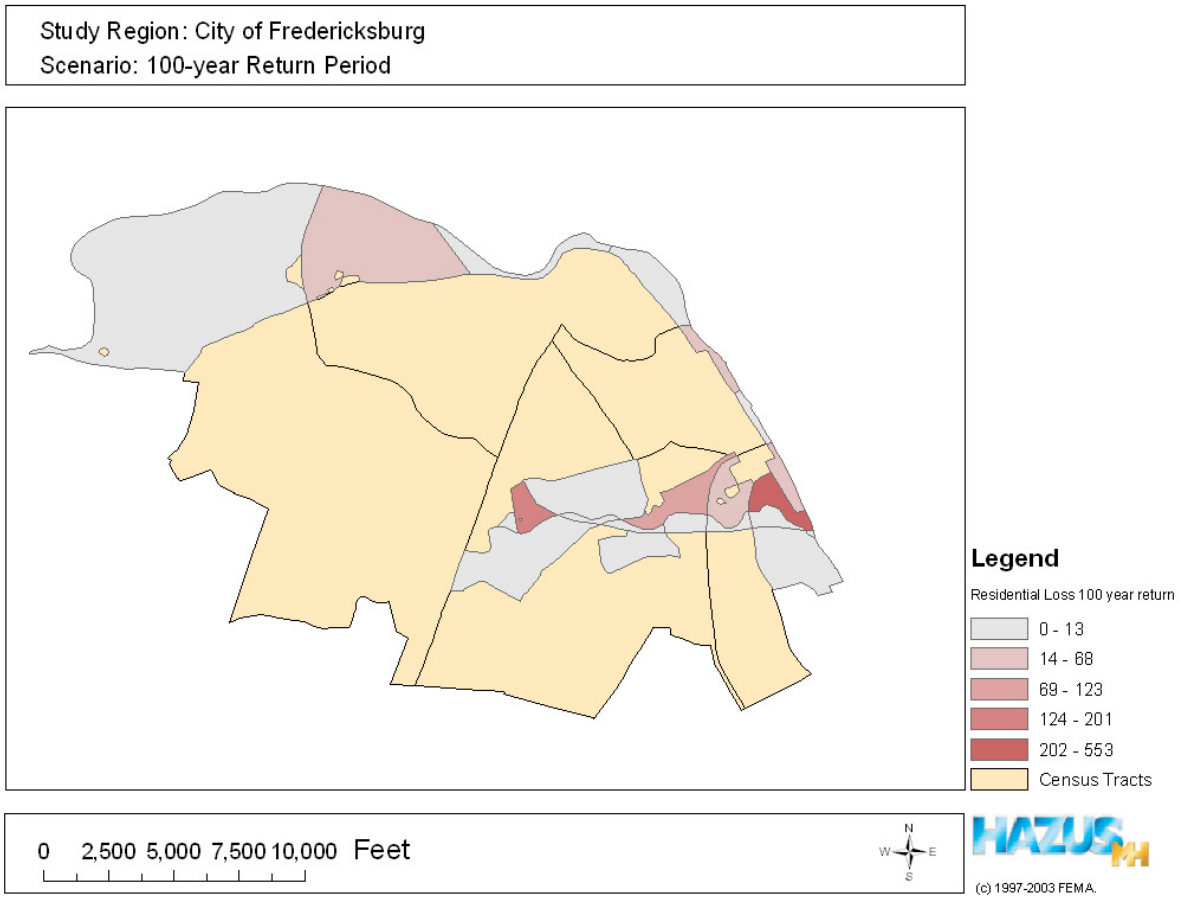


Figure 5-19. Total Residential Loss - City of Fredericksburg.

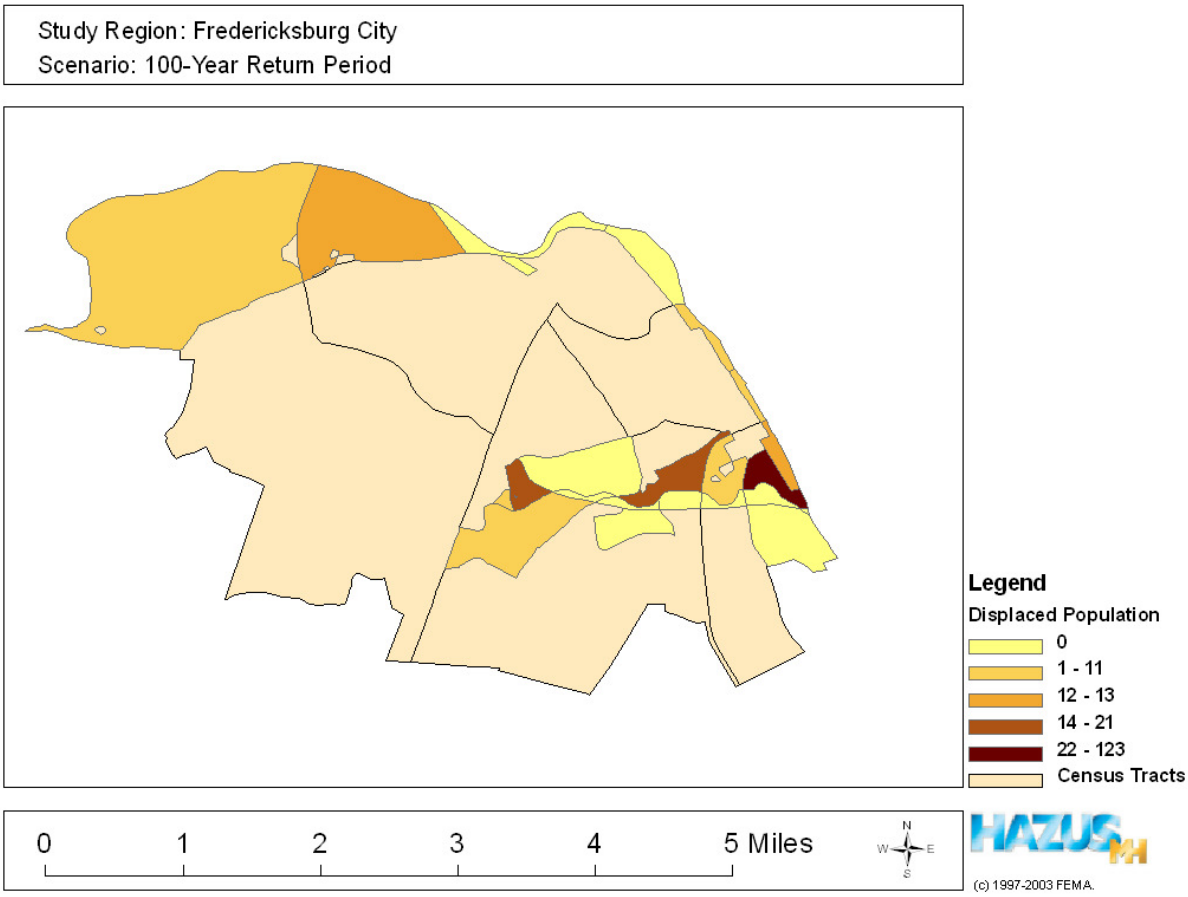


Figure 5-20. Displaced Population for 100-year Flood Event – City of Fredericksburg.

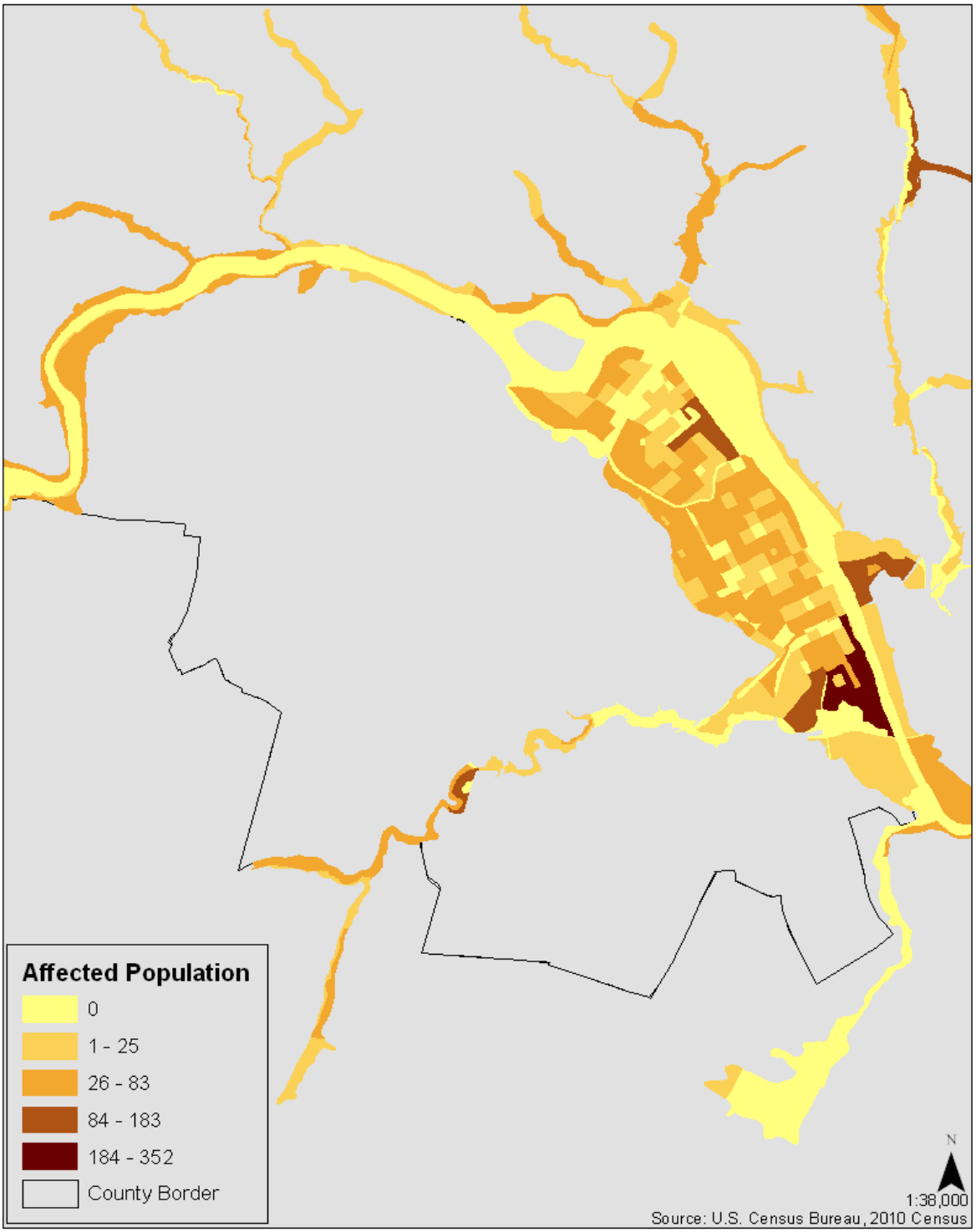


Figure 5-21. At Risk Population for Flood Event - City of Fredericksburg.

C. King George County Vulnerability Assessment

Development Trends

The King George County Comprehensive Plan promotes the goals of business recruitment, job creation, business retention, and marketing in King George County. The second listed commercial implementation strategy of the Plan's Land Use Strategy is to "encourage the creation of an environment to attract businesses and employees for the public and private sectors." King George County has a civilian labor population of 10,569 and an unemployment rate of 8.1% according to the Virginia Economic Development Partnership. The local Business Appreciation Event held May 18, 2011, is used as a tool to attract and retain businesses to King George County. The county's largest employers are U.S. Naval Surface Warfare Center at Dahlgren and Rowe Concrete, LLC. Other large employers include Computer Sciences Corporation and Synetics, Inc. (Source: Virginia Economic Development Partnership).

Over half (61.2%) of King George County's workforce consists of management, professional, sales, and office professions. King George County's population increased from 13,527 in 1990 to 16,803 in 2000 (24.2% increase). 2010 Census data for King George County reported a population of 23,584 persons. This is an increase of 40.4%. The Virginia Economic Development Partnership expects the population to reach 28,700 persons by 2015, an increase of 21.7% from 2010. (King George County, Virginia, 2005).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the MAC conducted an inventory of the structures and critical facilities within King George County (Figure 5-26). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. MAC member representatives from King George County provided the inventory of critical facilities for the County.

Table 5-26. Critical Facilities – King George County.

Facility Name	Location	Facility Type
King Georges Sheriff's Office	King George	EOC
King George Fire Tower & Rescue Inc. Company 1	King George	EOC/Fire Department
King George Fire & Rescue Inc. Company 2	King George	Fire Department
King George Fire & Rescue Inc. Company 3	King George	Fire Department
Dahlgren Rescue Squad Inc. Station 1	King George	Rescue Station
Dahlgren Rescue Squad Inc. Station 2	King George	Rescue Station
EMS Tower	King George	Communications Tower
Owens Tower	King George	Communications Tower
Sheriff's Office Tower	King George	Communications Tower
Accurate Tower	King George	Communications Tower
Sba Towers, Inc	King George	Cell Tower
Stc Three, LLC	King George	Cell Tower
Sba Towers, Inc	King George	Cell Tower
Stc Three, LLC	King George	Cell Tower
Sbc Tower Holdings LLC	King George	Cell Tower
Crown Atlantic Company, LLC	King George	Cell Tower
Sba Towers, Inc	King George	Cell Tower
Sba Towers, Inc	King George	Cell Tower
VA Commonwealth Dept. of State Police	King George	Cell Tower
Sba Towers, Inc	King George	Cell Tower
Sbc Tower Holdings LLC	King George	Cell Tower
Sba Towers, Inc	King George	Cell Tower
Comorn-Northern Neck Electrical Cooperative	King George	Power Substation
Office Hall-Northern Neck Electrical Cooperative	King George	Power Substation
Arnolds Corner Storage Tank	King George	Water Tanks/Wells
Arnolds Corner Well	King George	Water Tanks/Wells
Bayberry Well	King George	Water Tanks/Wells
Bumbrey Well	King George	Water Tanks/Wells
Canterbury #1 Well	King George	Water Tanks/Wells
Canterbury #2 Well	King George	Water Tanks/Wells
Circle #1 Well	King George	Water Tanks/Wells
Circle #2 Well	King George	Water Tanks/Wells
Fairview #2 Well	King George	Water Tanks/Wells
Fairview #3 Well	King George	Water Tanks/Wells
Monmouth 1st Well	King George	Water Tanks/Wells
Monmouth 2nd	King George	Water Tanks/Wells
Ninde Store Well	King George	Water Tanks/Wells

Facility Name	Location	Facility Type
Oakland Park Well	King George	Water Tanks/Wells
Oakland Park Well (Old)	King George	Water Tanks/Wells
Owens Well	King George	Water Tanks/Wells
Peppermill #1 Well	King George	Water Tanks/Wells
Peppermill #2 Well	King George	Water Tanks/Wells
Potomac Landing Well	King George	Water Tanks/Wells
Presidential Lakes Well	King George	Water Tanks/Wells
Rose Dale Water Tower	King George	Water Tanks/Wells
Purkins Corner Well	King George	Water Tanks/Wells
St Paul's Church Well	King George	Water Tanks/Wells
Payne Well	King George	Water Tanks/Wells
Ferry Dock Crossing Pump Station	King George	Water Tanks/Wells
Chatham Village Pump Station	King George	Water Tanks/Wells
Dahlgren WWTP	King George	Water Tanks/Wells
Fairview Beach WWTP	King George	Water Tanks/Wells
Fairview Beach WWTO	King George	Water Tanks/Wells
Fairview Beach Effluent Pump Station	King George	Water Tanks/Wells
Hopyard Farm WWTP	King George	Water Tanks/Wells
Hopyard Farm Well House	King George	Water Tanks/Wells
Hopyard Farm Pump Station	King George	Water Tanks/Wells
LOGICON Pump Station	King George	Water Tanks/Wells
Oakland Park Well Lot Forest Ridge Drive	King George	Water Tanks/Wells
Oakland Park WWTP	King George	Water Tanks/Wells
Project Faith	King George	Water Tanks/Wells
Purkins Corner WWTP	King George	Water Tanks/Wells
SAFT Well	King George	Water Tanks/Wells
Sheetz Pump Station	King George	Water Tanks/Wells
Sealston Pump Station	King George	Water Tanks/Wells
Dahlgren Tech Center	King George	Water Tanks/Wells
Owens Storage Tank	King George	Water Tanks/Wells
10th Street Pump Station	King George	Sewage Pump Station
12th Street Pump Station	King George	Sewage Pump Station
Bayberry Pump Station	King George	Sewage Pump Station
Comfort Inn Pump Station	King George	Sewage Pump Station
Fas Mart Pump station	King George	Sewage Pump Station
Fairview Beach 8th Street Pump Stations	King George	Sewage Pump Station
Fairview Beach Crab House Pump Station	King George	Sewage Pump Station
Fairview Beach Marina Grinder Pump	King George	Sewage Pump Station

Facility Name	Location	Facility Type
Fairview Beach Slick's Grinder Pump	King George	Sewage Pump Station
Ferry Dock Pump Station	King George	Sewage Pump Station
Food Lion/Purkins #3 Pump Stations	King George	Sewage Pump Station
Gordon Drive Pump Stations	King George	Sewage Pump Station
Kings Highway/Purkins Pump Station #1	King George	Sewage Pump Station
Main Pump Station	King George	Sewage Pump Station
McDonalds Pump Station	King George	Sewage Pump Station
Middle School Pump Station	King George	Sewage Pump Station
Monmouth Pump Station	King George	Sewage Pump Station
Oakland Park Pump Station	King George	Sewage Pump Station
Potomac Landing Pump Station	King George	Sewage Pump Station
Pump Station #5	King George	Sewage Pump Station
Pump Station #6	King George	Sewage Pump Station
Purkins Pump Stations #2 RR3-HSL	King George	Sewage Pump Station
Williams Creek Pump Station	King George	Sewage Pump Station
Dahlgren WWTP	King George	Sewer Treatment Facilities/Water Treatment Facilities
Fairview Beach WWTP	King George	Sewer Treatment Facilities/Water Treatment Facilities
Oakland Park WWTP	King George	Sewer Treatment Facilities/Water Treatment Facilities
Purkins Corner WWTP/Auto Dialer	King George	Sewer Treatment Facilities/Water Treatment Facilities
Presidential Lakes WWTP	King George	Sewer Treatment Facilities/Water Treatment Facilities
King George High School	King George	Schools/Shelter Sites
King George Middle School	King George	Schools/Shelter Sites
King George Elementary School	King George	Schools/Shelter Sites
Potomac Elementary School	King George	Schools/Shelter Sites
King George Citizens Center	King George	Schools/Shelter Sites
Sealston Elementary	King George	Schools/Shelter Sites
Administration Center	King George	Administration
King George Courthouse Complex	King George	Administration
Potomac Gateway Welcome Center	King George	Administration
Service Authority Office	King George	Administration
King George Animal Shelter	King George	Administration
King George Sheriff's Office	King George	Administration/Sheriff's Office
King George Library	King George	Administration
Additional significant structures		
VDOT Edgehill Area Maintenance Headquarters	King George	VDOT Maintenance Building

Facility Name	Location	Facility Type
King George County School Bus Garage	King George	School Owned Fuel Station
Harry Nice Memorial Bridge	King George	Bridge
Rappahannock River Bridge	King George	Bridge
Williams Creek Bridge	King George	Bridge
Muddy Creek Bridge	King George	Bridge
Machadoc Creek Bridge	King George	Bridge
Machadoc Creek Bridge	King George	Bridge

Source: Data provided by the King George Office of Emergency Management.

Non-Rotational Wind Vulnerability

Hazards U.S. – Multi Hazard (HAZUS-MH) was utilized to perform a wind hazard analysis for King George County. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for King George County. Table 5-27. Total Dollar Value of Exposed Structures from HAZUS - King George County. lists the total dollar value of exposed structures based on occupancy type for King George County.

The default data set provided with the HAZUS-MH software is based on the 2000 census data. It is recognized that the current development trends in King George County may render the 2000 census data obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high winds.

Table 5-27. Total Dollar Value of Exposed Structures from HAZUS - King George County.

Occupancy Type	Total $ Value Exposed Structures
Residential	858,392,000
Commercial	94,012,000
Industrial	13,357,000
Agricultural	867,000
Religion	10,150,000
Government	16,503,000
Education	6,592,000
Total	**999,873,000**

Source: HAZUS-MH

HAZUS®MH software provides two options for wind analysis, probabilistic and deterministic. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyses hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of "what-if" scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Since the residential data comprised a significantly large percentage of the occupancy classification, these data are presented in Table 5-28. Figure 5-22 shows the peak wind gusts, ranging from 69 mph to 71 mph, generated from a hurricane with 100-year recurrence interval. The total loss to residential structures is displayed in Table 5-28 below.

Table 5-28. Hurricane Risk-King George County - Summary of Probabilistic Analysis – Residential Structures.

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	1	0	0	0
50-year	26	1	0	0
100-year	33	1	0	0
200-year	157	8	1	0
500-year	797	97	5	2
1000-year	1,916	538	52	40

Source: HAZUS-MH

Severe Storm Vulnerability

Since 1960 King George has experienced 61 severe storms (roughly 1.27 annually) that have caused damage to property and crops from lightning, hail, extreme winds, and flooding. From 1960-2008 these storms have caused approximately $8,000 in crop damages and $1,100,000 in property damages, the equivalent of $167 in crop damages and $22,917 in property damages annually.

In that same time period extreme weather from winter storms and ice have caused damages to private and public properties and winter freeze has caused damage to crops within the region. Total damages to properties are estimated at $2,400,000 million across 59 storms. On an annualized basis, this works out to approximately $50,000 in property damage and 1.23 winter storm events per year. Four of those storms caused winter freeze resulting in crop damages resulting in damages of approximately $95,800

(SHELDUS 2011). The risk for winter storm events for King George County and its independent towns is listed below in Table 5-29. Winter Storm Risk - King George..

Table 5-29. Winter Storm Risk - King George.

Locality	Average Snowfall (in) 1958-2010					Likelihood Of Event (%)
	December	January	February	March	Annual	
King George	1.91”	3.41”	3.26”	1.67”	10.25”	85.3

Source: Southeast Regional Climate Center

Tornado Vulnerability

Based on the available data, King George County has averaged 0.10 tornado events causing $12,783 in damages annually.

Table 5-30.Tornado Risk - King George County. Historic Events 1950-2010.

Intensity	Number of Occurrences	Damages ($)
EF0	1	0
EF1	4	517K
EF2	1	250K

Source: SVRGIS

Flooding Vulnerability

The MAC representatives for King George County did not rank flooding as a critical hazard. However, because there is a defined geographic hazard area, vulnerability to flooding was quantified.

Digital floodplain boundaries digitized from the FEMA effective FIRMs and digital tax parcel data were provided by the King George County GIS Department. These two layers were intersected to determine the number of parcels that were at risk to the 100-year flood. Parcels within the 100-Year flood zone that did not have building valuation data in the tax parcel data were assumed to have no structures. Thus, from a total of 10,967 parcels, 6,226 were assumed to have structures.

The analysis showed that 704 buildings were at risk from the 100-yr flood. The improvement value (structure only, not land value) from the tax assessor’s database was used to determine the value of at risk property. A total value of approximately $123,825,500 is at risk from the 100-year flood event. Results of this flood analysis are presented in Table 5-31. Flood Risk - King George County.

Table 5-31. Flood Risk - King George County.

Occupancy Type	Total No. Buildings	No. Buildings in 100-year Flood Zone	Estimated at Risk Value
Residential	1,933	133	30.4 million
Agricultural	3,884	547	82.4 million
Commercial	396	24	11.0 million
Other	13	0	0
TOTAL	**6,226**	**704**	**123.8 million**

Source: Data provided by community

Repetitive Loss Areas

Including flood insurance claims paid as a result of flood damage caused by Hurricane Isabel in 2003, FEMA has identified zero structures as repetitive loss structures for King George County.

HAZUS Flood Analysis

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a flood hazard analysis for King George County to expand on the analysis conducted in 2006 (Table 5-31). HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 flood analysis was performed to calculate the flood hazard for the King George County. Table 5-32 lists the total dollar value of exposed structures based on occupancy type for King George County.

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the King George County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the King George County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

Table 5-32. Flood Risk - King George County.

Occupancy Type	Dollar Exposure (replacement value $)
Residential	792,530,000
Commercial	147,887,000
Industrial	21,914,000
Agricultural	25,030,000
Religion	21,275,000
Government	13,531,000
Education	9,771,000
TOTAL	**1,031,938,000**

Source: HAZUS-MH

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the King George County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

The three hazard type options provided by HAZUS®MH software for flood analysis are the riverine, coastal, and riverine and coastal scenarios. The necessary scenario for any given situation depends upon the geography of the region. If the area is inland with a stream hydrology, then the riverine scenario should be used. If however, the area is along the coast then either the riverine and coastal, or coastal scenario should be used. The user cannot run any analysis without first defining the scenario.

The riverine and coastal analysis was chosen for King George County. This scenario provides the statistical probability for a range of flood events and presents a comparison of those events. The coastal and riverine analysis was used to generate structural loss estimations, agricultural loss estimations, and shelter requirements for flood events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, and 500-year. The recurrence interval is the average interval of time within which the given flood event will be equaled or exceeded once.

Because residential structures comprise a significantly large percentage of the occupancy classification within the region, these data are presented in Figure 5-25 below. The total damages to residential structures were $2,321,000. The number of displaced persons from a 100-year event is displayed below in Figure 5-26. The total number of displaced King George County residents was 228 people. Figure 5-27 shows the 100-year floodplain for the King George County with 2010 census blocks that intersect it. The map displays the population (in 2010 Census numbers) that would be affected by a 100-year flood event.

Table 5-33. Agricultural Loss – King George County.

Crop Type	Loss ($)
Corn	119,654.00
Corn Silage	128,691.53
Soybeans	93,049.80
Wheat	73,807.52
TOTAL	**415,202.85**

Source: HAZUS-MH

Drought Vulnerability

The risk assessment section of this plan identified the threat of droughts and extreme heat as medium-high. The extreme heat and dry conditions that exist during periods of drought cause significant damage to the agricultural industry. According to the 2007 Agriculture Census, the County of King George has 180 farms, an increase of 7% since 2002 (169). The acreage of farms in King George was approximately 36,723 in 2007. The average farm size was 204 acres with crop sales per farm exceeding $24,700.

Of the over 36,000 acres in farmland within King George County, 42% was used as cropland. Another 39% of farmland was used for woodland and 15% as pasture. The five largest crop items in King George were forage (land used for all hay and haylage, grass silage, and greenchop), soybeans, corn for grain, wheat for grain, and vegetables. The top livestock item was cattle and calves (USDA, 2008).

Figure 5-24 depicts drought prone areas in Virginia by displaying the number of drought occurrences in a county's history. King George County has experienced 66-85 droughts in their history, with seven major instances in the last century. These droughts were in 1930-'32, '38-'42, '62-'71, '80-'82, '98-'99, '06-'08, and the summer of 2010. Crop loss estimates were only available for the two droughts of the last decade.

The harvest of 2007 for corn and soybeans was noticeably lower than in previous years. This was due to deteriorated soil moisture conditions from a region-wide drought, according to the USDA. Corn production for the state was sixty percent below the annual percent yield. Land used for forage/pasture was significantly affected by the dry conditions, forcing many farmers to prematurely sell their cattle.

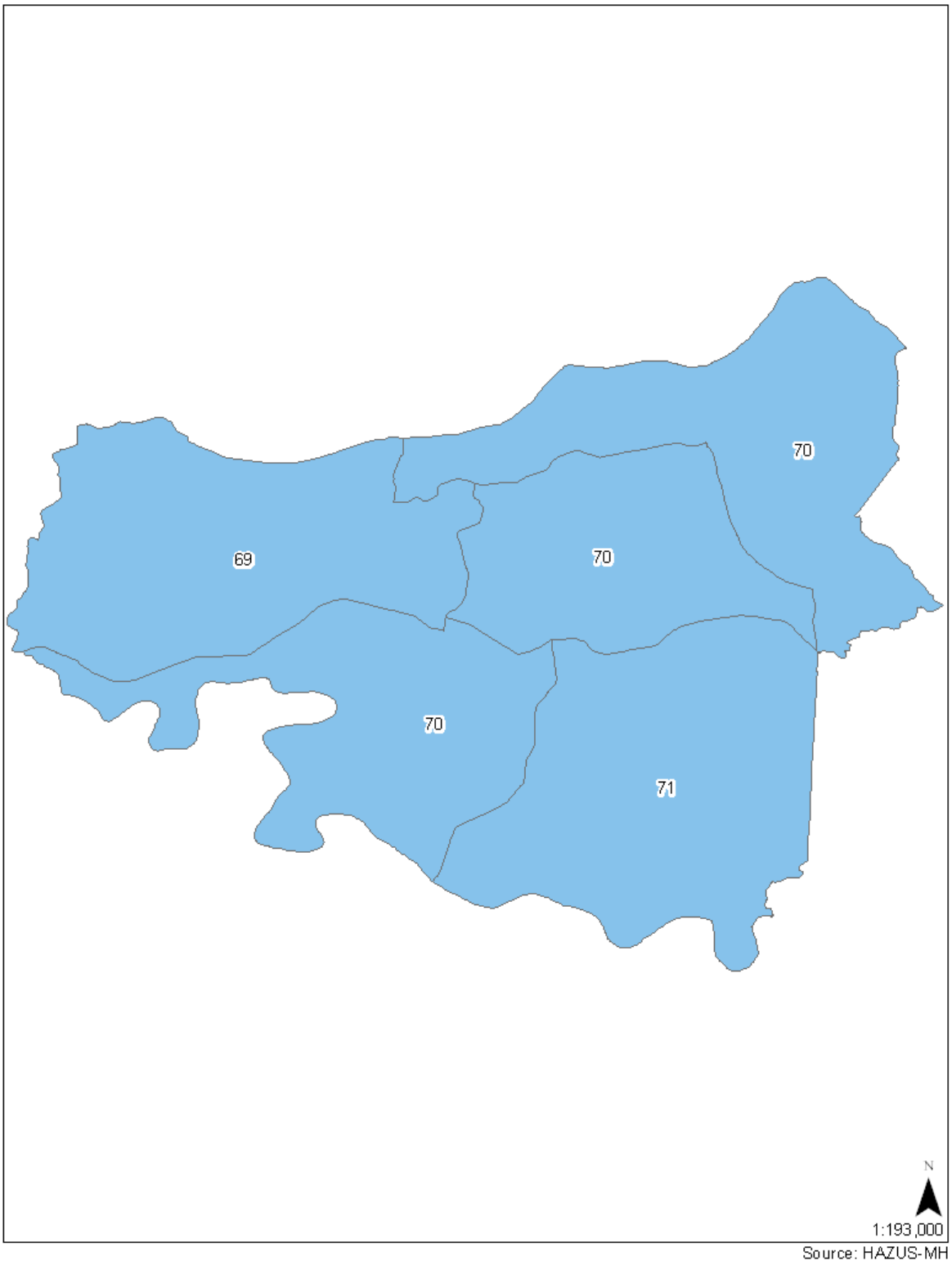


Figure 5-22. Peak Wind Gust (mph) Distribution. King George County.

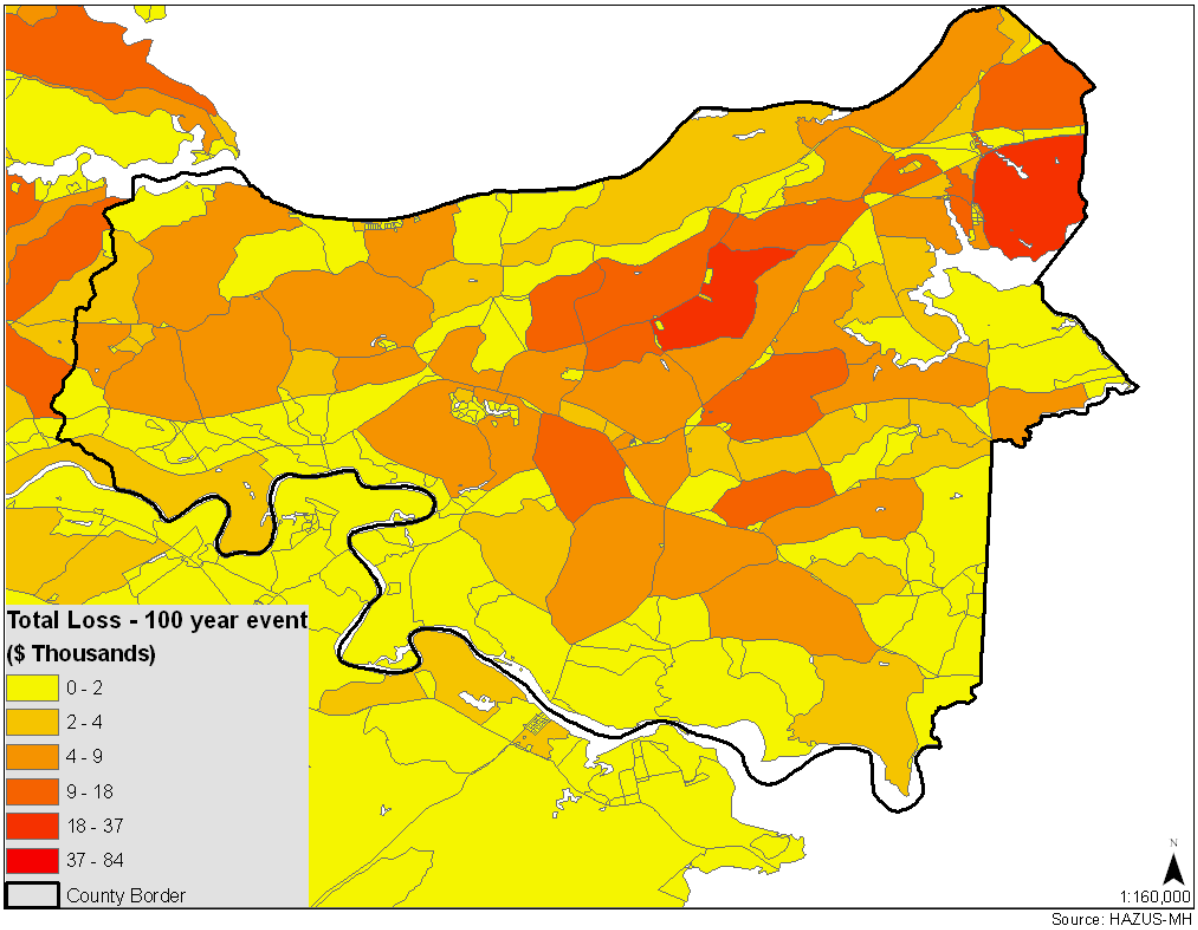


Figure 5-23. Total Residential Loss 100 Year Hurricane - King George County.

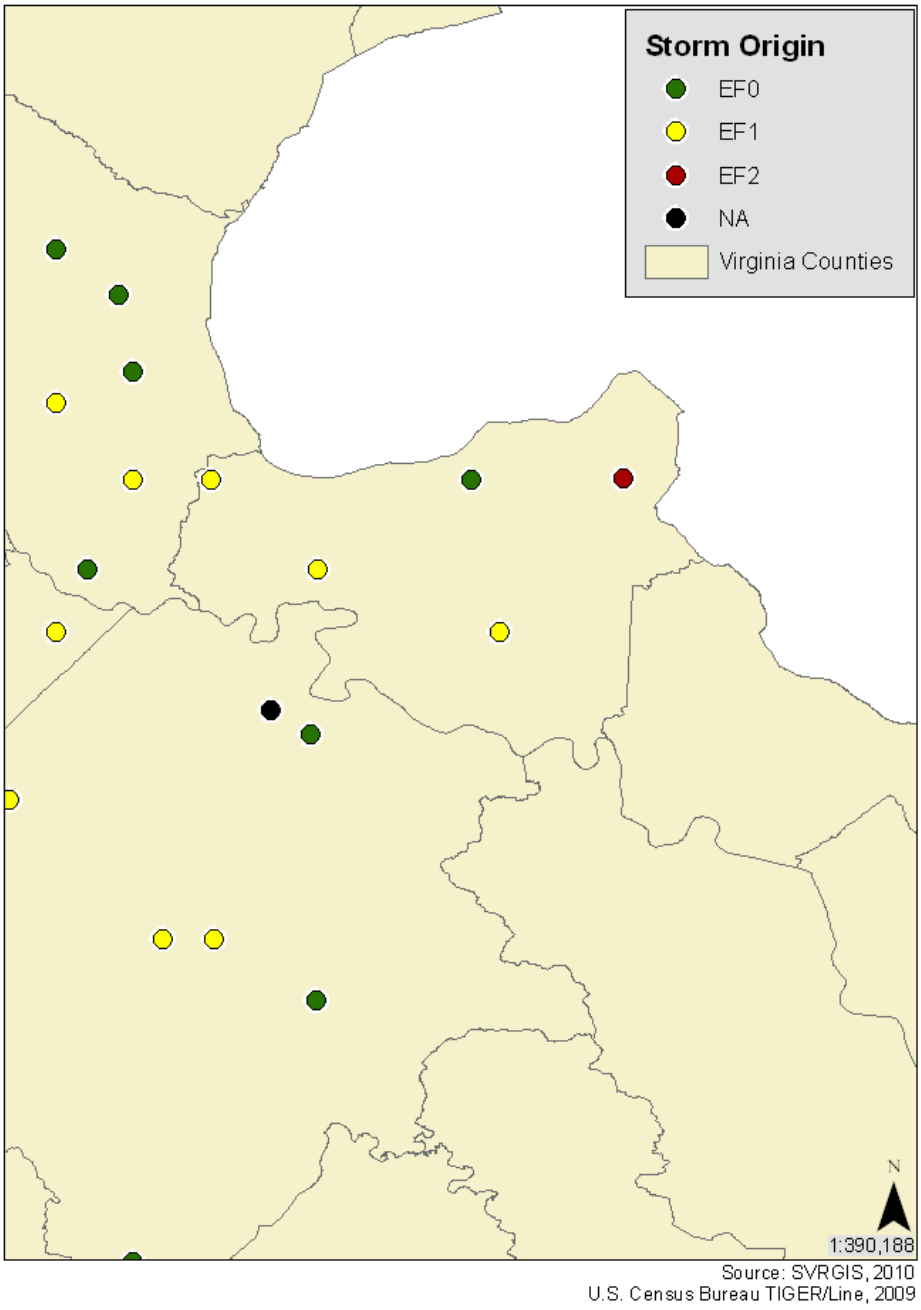


Figure 5-24. Historic Tornado Occurrences (Enhanced Fujita Scale) - King George County 1950-2010.

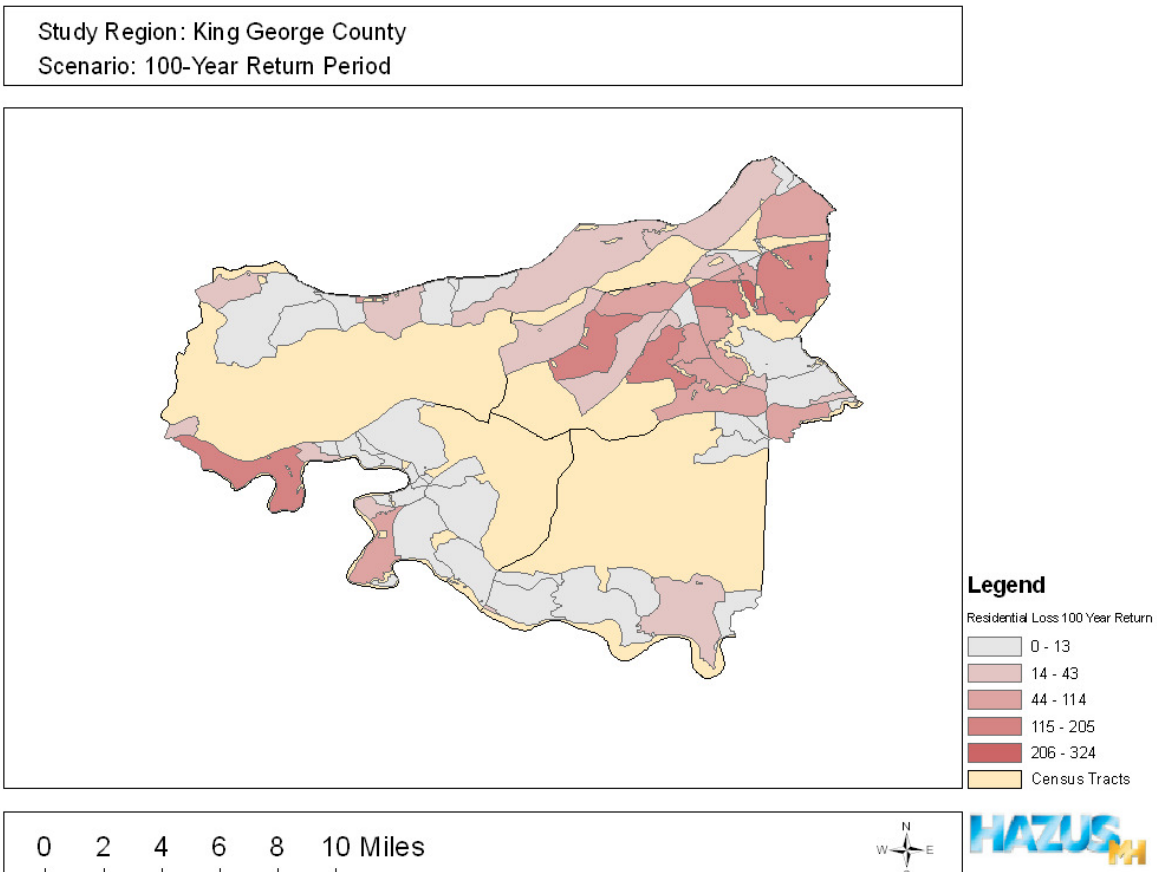


Figure 5-25. Total Residential Loss - King George.

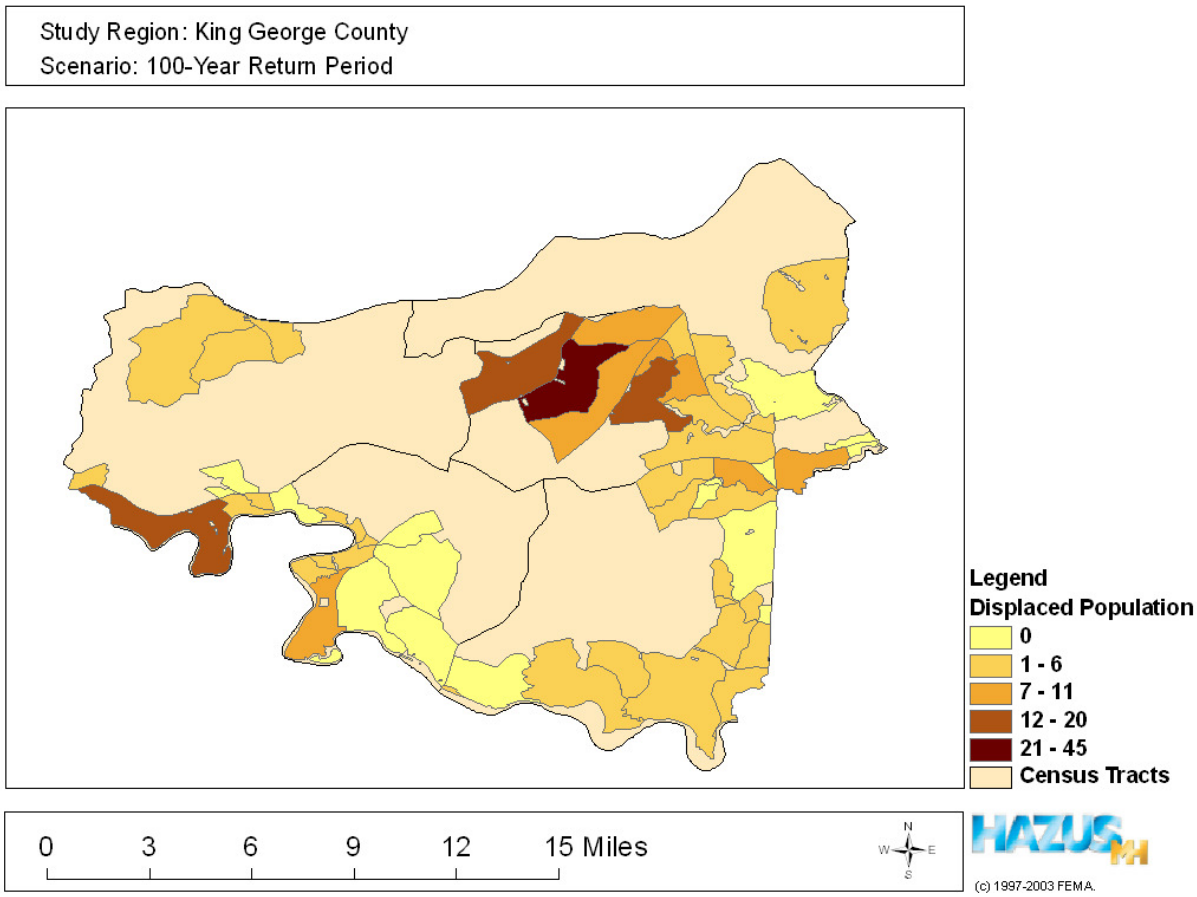


Figure 5-26. Displaced Population for 100-year Flood Event - King George County.

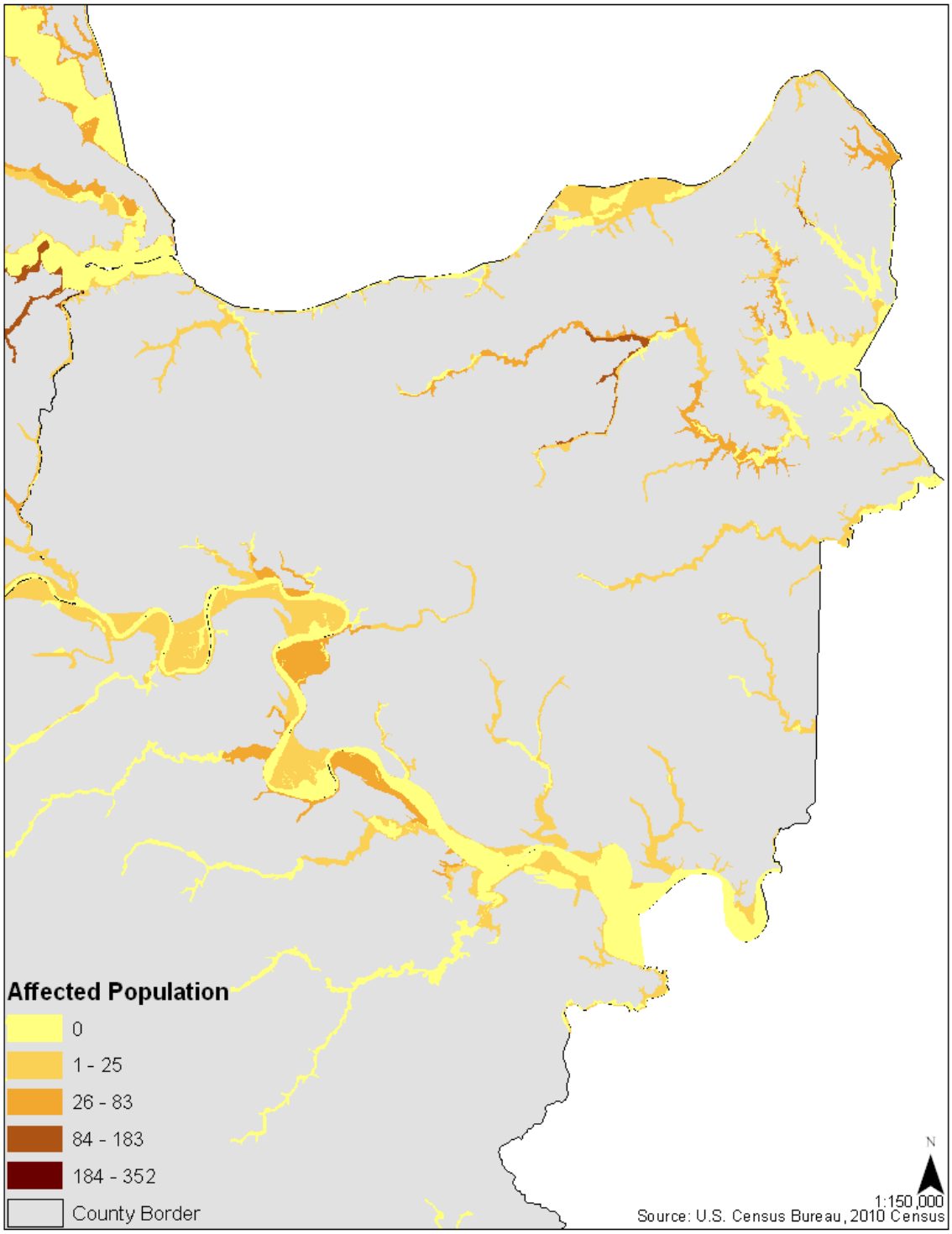


Figure 5-27. At Risk Population for Flood Event - King George .

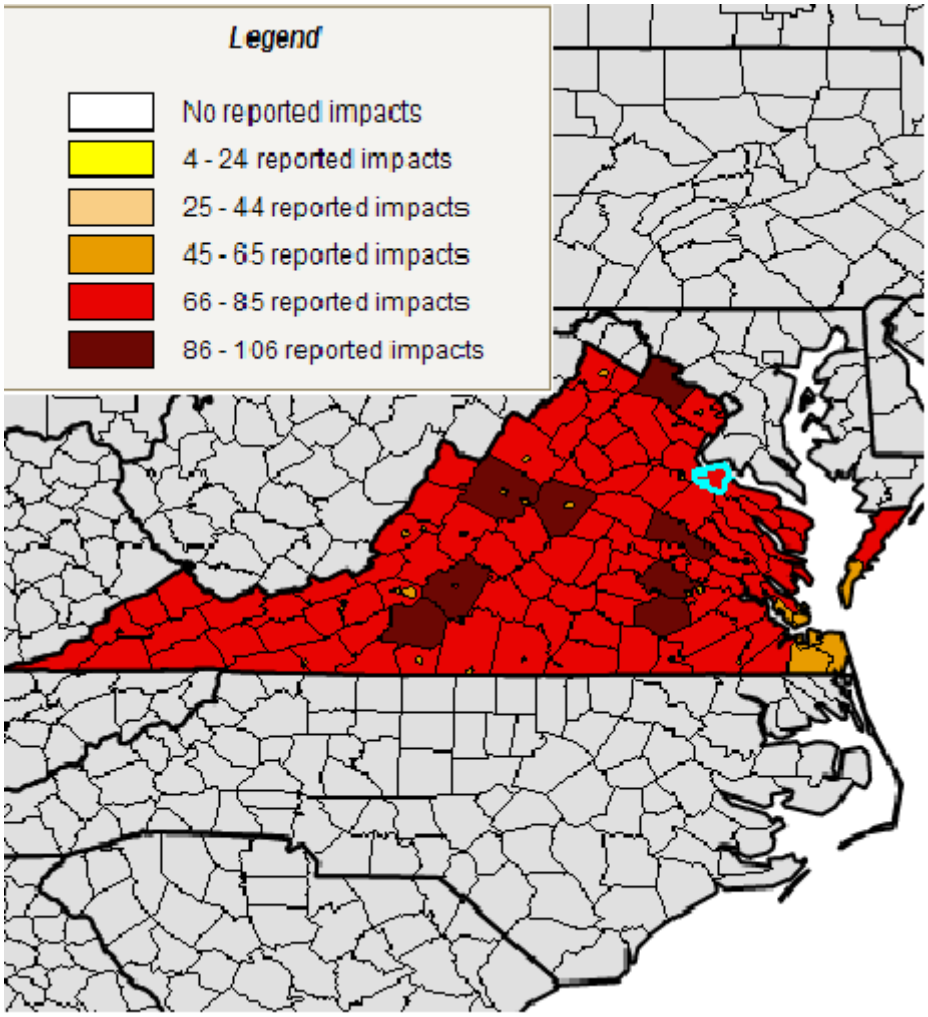


Figure 5-28. Drought Prone Areas in Virginia. By County.
Source: Drought Impact Reporter, National Drought Mitigation Center, 2011

D. Spotsylvania County Vulnerability Assessment

Development Trends

Spotsylvania County's close proximity to Washington, D.C. has given the region a recent dramatic population and business increase. The county's development trend is based on its technology and manufacturing industries and suburban housing for Washington D.C./Northern Virginia commuters. Major employers include CVS Pharmacy (distribution warehouse, 450 employees), and Diversified Mailing Services (commercial mailing service, 300 employees).

Spotsylvania County has a civilian labor force of 66,618 with an unemployment rate of 5.8% according to 2010 data from the Virginia Economic Development Partnership. Demographics Daily ranked Spotsylvania as the #1 small-business sector in the U.S., and the County takes pride in the diversity of small businesses within its borders. Small businesses experienced a 182% growth rate between 1993 and 1998, and the County population has grown 57.5% in the past ten years, from 57,403 in 1990 to 90,395 in 2000. Spotsylvania County holds the rank of 13th fastest growing county in the U.S 2010 Census data reports a population of 122,397 persons. This is an increase of 35.4% from 2000. A population projection for 2015 in Spotsylvania County is 133,400 persons. This is an increase of 9%. (Spotsylvania County, Virginia, 2005).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the MAC conducted an inventory of the structures and critical facilities within Spotsylvania County (Table 5-34). The critical facilities are the community's assets that are the most important or vital to emergency management functions. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. MAC member representatives from Spotsylvania County provided the inventory of critical facilities for the county.

Table 5-34. Critical Facilities – Spotsylvania County.

Facility Name	Location	Facility Type
Brokenburg Fire & Rescue	Spotsylvania	Fire/EMS
Courthouse Fire Company 1	Spotsylvania	Fire
Partlow Fire Company 3	Spotsylvania	Fire
Partlow Rescue Station 3	Spotsylvania	EMS
5-Mile Fork Rescue Station 5	Spotsylvania	EMS
5-Mile Fork Fire Company 5	Spotsylvania	Fire
Salem Church Road Fire Company and Rescue Station 6	Spotsylvania	Fire/EMS
Wilderness Fire Company and Rescue Station 7	Spotsylvania	Fire/EMS
Thornburg Fire Company and Rescue Station 8	Spotsylvania	Fire/EMS
Belmont Fire Company and Rescue Station 9	Spotsylvania	Fire/EMS
Fire Company and Rescue Station 1	Spotsylvania	Fire/EMS
Fire Company and Rescue Station 4	Fredericksburg	Fire/EMS
Salem Fields Fire Company and Rescue Station 10	Fredericksburg	Fire/EMS
Ni River Water Trtmt Plt	Spotsylvania	Potable Treatment
Motts Run Water Treatment Plant	Fredericksburg	Potable Treatment
FMC Wastewater Treatment Plant	Fredericksburg	Water Treatment
Massaponax Wastewater Treatment Plant	Fredericksburg	Water Treatment
Stoneybrook Wastewater Treatment Plant	Fredericksburg	Water Treatment
Thornburg Wastewater Treatment Plant	Woodford	Water Treatment
County Courthouse	Spotsylvania	Administration
Holbert Building	Spotsylvania	Local Government
Marshall Center	Spotsylvania	Local Government
Code Compliance/DSS	Spotsylvania	Local Government
Animal Control Office	Fredericksburg	Local Government
Joint Fleet Maintenance Facility	Spotsylvania	Local Government
Utilities Administration Office	Fredericksburg	Local Government
Voter Registration	Spotsylvania	Local Government
911/EOC/Sheriff/Fire Administration	Spotsylvania	Public Safety Bld/911/EOC
School Transportation Office	Spotsylvania	School/Support Facility
Cedar Forest Elementary	Fredericksburg	School/Shelter Site
Battlefield Elementary	Fredericksburg	School/Shelter Site
Battlefield Middle	Fredericksburg	School/Shelter Site
Berkeley Elementary	Spotsylvania	School/Shelter Site
Brock Road Elementary	Spotsylvania	School/Shelter Site
Career and Technical Center High	Spotsylvania	School/Shelter Site
Chancellor Elementary	Fredericksburg	School/Shelter Site
Chancellor High	Fredericksburg	School/Shelter Site
Chancellor Middle	Fredericksburg	School/Shelter Site
Courthouse Road Elementary	Spotsylvania	School/Shelter Site
Courtland Elementary	Spotsylvania	School/Shelter Site
Courtland High	Spotsylvania	School/Shelter Site

Facility Name	Location	Facility Type
Freedom Middle	Fredericksburg	School/Shelter Site
Harrison Road Elementary	Fredericksburg	School/Shelter Site
Lee Hill Elementary	Fredericksburg	School/Shelter Site
Livingston Elementary	Spotsylvania	School/Shelter Site
Massaponax High	Fredericksburg	School/Shelter Site
Ni River Middle	Spotsylvania	School/Shelter Site
Parkside Elementary	Fredericksburg	School/Shelter Site
Post Oak Middle	Spotsylvania	School/Shelter Site
Riverbend High	Fredericksburg	School/Shelter Site
Riverview Elementary	Spotsylvania	School/Shelter Site
Robert E. Lee Elementary	Spotsylvania	School/Shelter Site
Salem Elementary	Fredericksburg	School/Shelter Site
Smith Station Elementary	Fredericksburg	School/Shelter Site
Spotswood Elementary	Fredericksburg	School/Shelter Site
Spotsylvania High	Spotsylvania	School/Shelter Site
Spotsylvania Middle	Spotsylvania	School/Shelter Site
Thornburg Middle	Spotsylvania	School/Shelter Site
Wilderness Elementary	Spotsylvania	School/Shelter Site

Source: Data provided by the Spotsylvania Fire, Rescue, and Emergency Management

Non-Rotational Wind Vulnerability

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a wind hazard analysis for Spotsylvania County. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for Spotsylvania County. Table 5-35. Dollar Value of Exposed Structures from HAZUS – Spotsylvania County. lists the total dollar value of exposed structures based on occupancy type for Spotsylvania County.

The default data set provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the GWRC region, and particularly in Spotsylvania County, may render the 2000 Census data obsolete. However, this analysis depicts the probability of occurrence and can generally be used estimate potential damages due to high winds.

Table 5-35. Dollar Value of Exposed Structures from HAZUS – Spotsylvania County.

Occupancy Type	Total $ Value Exposed Structures
Residential	4,796,986,000
Commercial	486,242,000
Industrial	69,741,000
Agricultural	5,324,000
Religion	55,793,000
Government	6,195,000
Education	30,123,000
Total	**5,450,404,000**

Source:HAZUS-MH

HAZUS®MH software provides two options for wind analysis, probabilistic and deterministic. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyses hazards associated with a user defined storm event. The user inputs the storm track, forward speed, and wind speed and allows for the creation of "what-if" scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Since residential comprised a significantly large percentage of the occupancy classification these data are presented in Table 5-36 below. Figure 5-29 shows the peak wind gusts, ranging from 66mph to 68mph, generated from a hurricane with 100-year recurrence interval. The total loss to residential structures is displayed in Figure 5-30 below.

Table 5-36. Hurricane Risk - Spotsylvania County. Summary of Probabilistic Analysis - Residential Structures.

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	8	0	0	0
50-year	171	3	0	0
100-year	499	20	0	0
200-year	3,068	287	8	6
500-year	4,820	632	23	17
1000-year	6,839	1,204	61	51

Source: HAZUS-MH

Severe Storm Vulnerability

Since 1960 Spotsylvania has experienced 104 severe storms (approximately 2.17 events annually) that have caused damage to property and crops from lightning, hail, extreme winds, and flooding. From 1960-2008 these storms have caused approximately $6,600 in crop damages and $4,380,000 in property damages, the equivalent of $138 in crop damages and $91,250 in property damages annually.

In that same time period extreme weather from winter storms and ice have caused damages to private and public properties and winter freeze has caused damage to crops within the region. Total damages to properties are estimated at $2,800,000 million across 62 storms. On an annualized basis, this works out to be approximately $58,333 in property damage and 1.29 winter storm events per year. Five of those storms caused winter freeze resulting in crop damages resulting in damages of approximately $50,000 (SHELDUS 2011). The risk for winter storm events for Spotsylvania County and its independent towns is listed below in Table 5-37.

Table 5-37. Winter Storm Risk—Spotsylvania.

Locality	Average Snowfall (in) 1958-2010					Likelihood Of Event (%)
	December	January	February	March	Annual	
Spotsylvania	2.68”	5.72”	4.26”	2.90”	16.34”	93.1

Source: Southeast Regional Climate Center

Tornado Vulnerability

Based on the available data, Spotsylvania County has averaged 0.17 tornado events causing $8,367 in damages annually.

Table 5-38. Tornado Risk - Spotsylvania County Historic Events 1950-2010.

Intensity	Number of Occurrences	Damages ($)
EF0	4	115K
EF1	5	387K
EF2	1	NA

Source:SVRGIS

Flooding Vulnerability

A flood vulnerability assessment analysis was performed for Spotsylvania County using valuation data from the Spotsylvania County tax assessor's database and GIS data including parcel location and 100-Year (or 1% chance) flood zones from Spotsylvania County. The parcel and flood zone layers were analyzed in a GIS environment to determine which parcels were located within the 100-Year flood zone. No specific structure layer was available; therefore, the structure location was estimated to be the parcel centroid. The total value of structures within the flood zone was then calculated by linking the selected parcels to the tax assessor's valuation data via a Property Information Number (PIN). Parcels within the 100-Year flood zone that did not have building valuation data in the tax assessor's database were assumed to have no structures. Thus, from a total of 61,792 parcels, 36,885 were assumed to have structures.

It was determined that there are 410 structures within the 100-Year flood zone in Spotsylvania County. The total value of those structures is estimated to be $106.8 million (Table 5-39).

Table 5-39. Flood Risk – Spotsylvania County.

Occupancy Type	Total No. Buildings	No. Buildings in 100-year Flood Zone	Estimated at Risk Value
Agriculture	14,050	137	$17.9 million
Residential	21,296	246	$49.4 million
Commercial / Industrial	957	24	$39.1 million
Other	582	3	$0.4 million
Total	**36,885**	**410**	**$106.8 million**

Source: Data provided by Spotsylvania County

A regional map of the 100-year floodplains and the jurisdictions' critical facilities is provided in Appendix B, Map B-5.

Repetitive Loss Areas

Including flood insurance claims paid as a result of flood damage caused by Hurricane Isabel in 2003, FEMA has identified zero structures as repetitive loss structures for Spotsylvania County.

HAZUS Flood Analysis

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a flood hazard analysis for Spotsylvania County to expand on the analysis conducted in 2006 (Table 5-39). HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 flood analysis was performed to calculate the flood hazard for the Spotsylvania County. Table 5-40 lists the total dollar value of exposed structures based on occupancy type for Spotsylvania County.

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the Spotsylvania County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the Spotsylvania County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

Table 5-40. Flood Risk - Spotsylvania County.

Occupancy Type	Dollar Exposure (replacement value $)
Residential	4,582,712,000
Commercial	837,154,000
Industrial	167,274,000
Agricultural	14,802,000
Religion	84,021,000
Government	9,485,000
Education	98,242,000
TOTAL	**5,793,690,000**

Source: HAZUS-MH

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the Spotsylvania County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

The three hazard type options provided by HAZUS®MH software for flood analysis are the riverine, coastal, and riverine and coastal scenarios. The necessary scenario for any given situation depends upon the geography of the region. If the area is inland with a stream hydrology, then the riverine scenario

should be used. If however, the area is along the coast then either the riverine and coastal, or coastal scenario should be used. The user cannot run any analysis without first defining the scenario.

The riverine analysis was chosen for Spotsylvania County. This scenario provides the statistical probability for a range of flood events and presents a comparison of those events. The coastal and riverine analysis was used to generate structural loss estimations, agricultural loss estimations, and shelter requirements for flood events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, and 500-year. The recurrence interval is the average interval of time within which the given flood event will be equaled or exceeded once.

Agricultural damage from a 100-year event is listed below in Table 5-41. Because residential structures comprise a significantly large percentage of the occupancy classification within the region, these data are presented in Figure 5-32 below. The total damages to residential structures were $16,162,000. The number of displaced persons from a 100-year event is displayed below in Figure 5-33. The total number of displaced Spotsylvania County residents was 2075 people. Figure 5-34 shows the 100-year floodplain for the Spotsylvania County with 2010 census blocks that intersect it. The map displays the population (in 2010 Census numbers) that would be affected by a 100-year flood event.

Table 5-41. Agricultural Loss – Spotsylvania County.

Crop Type	Loss ($)
Corn	214,915.21
Corn Silage	896,703.26
Soybeans	151,766.00
Wheat	96,127.05
TOTAL	**1,359,511.52**

Source: HAZUS-MH

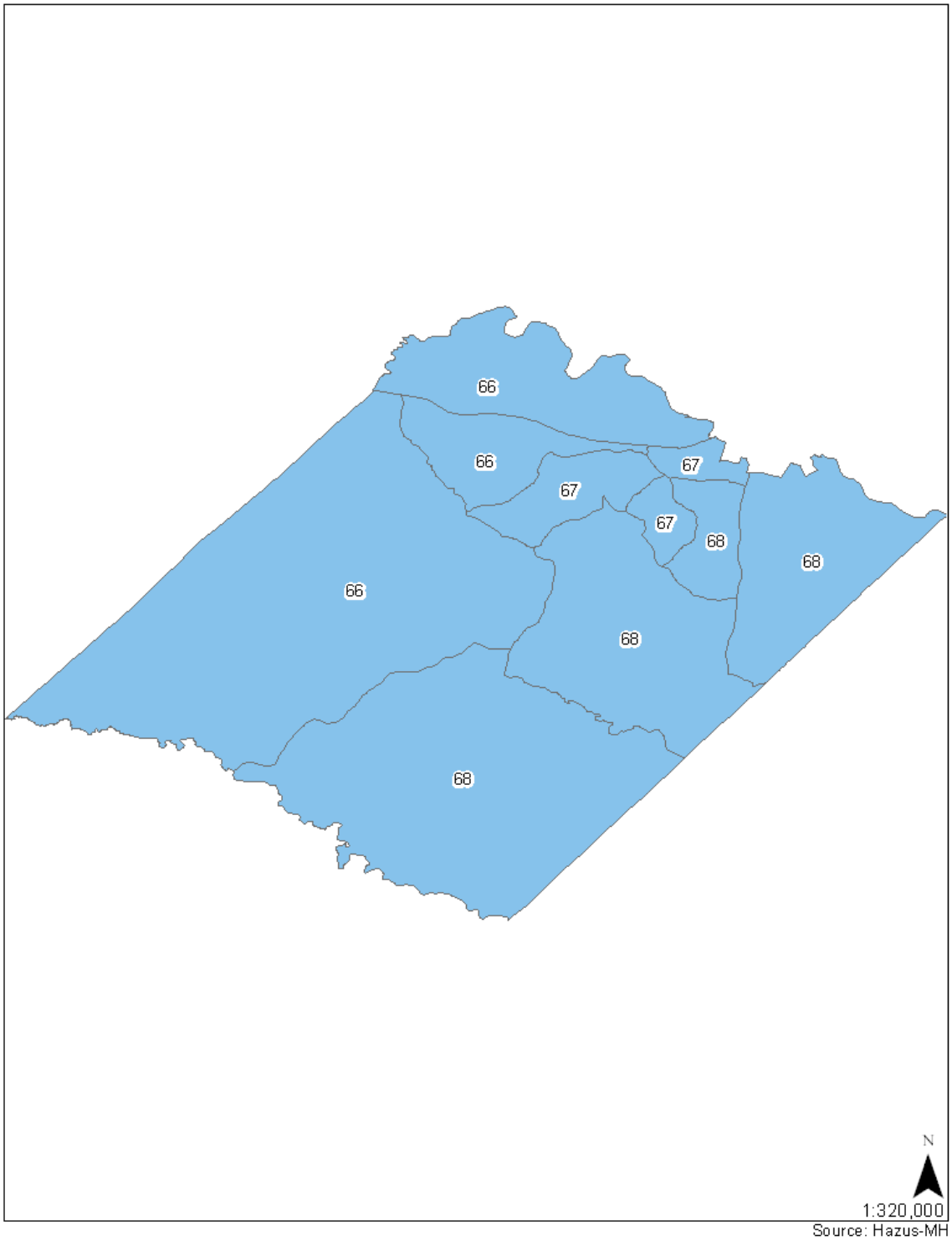


Figure 5-29. Peak Wind Gust (mph) Distribution.

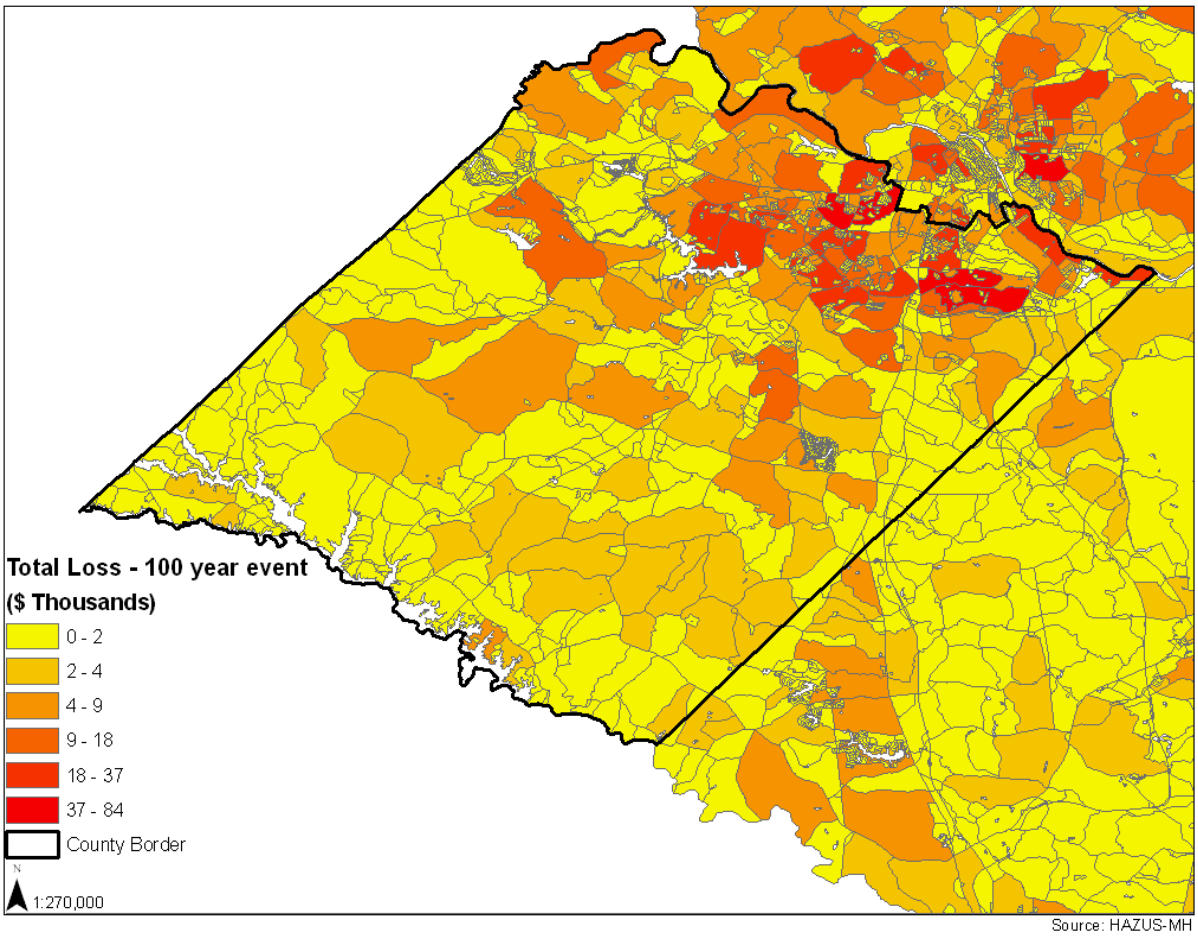


Figure 5-30. Total Residential Loss from 100-Year Hurricane - Spotsylvania County .

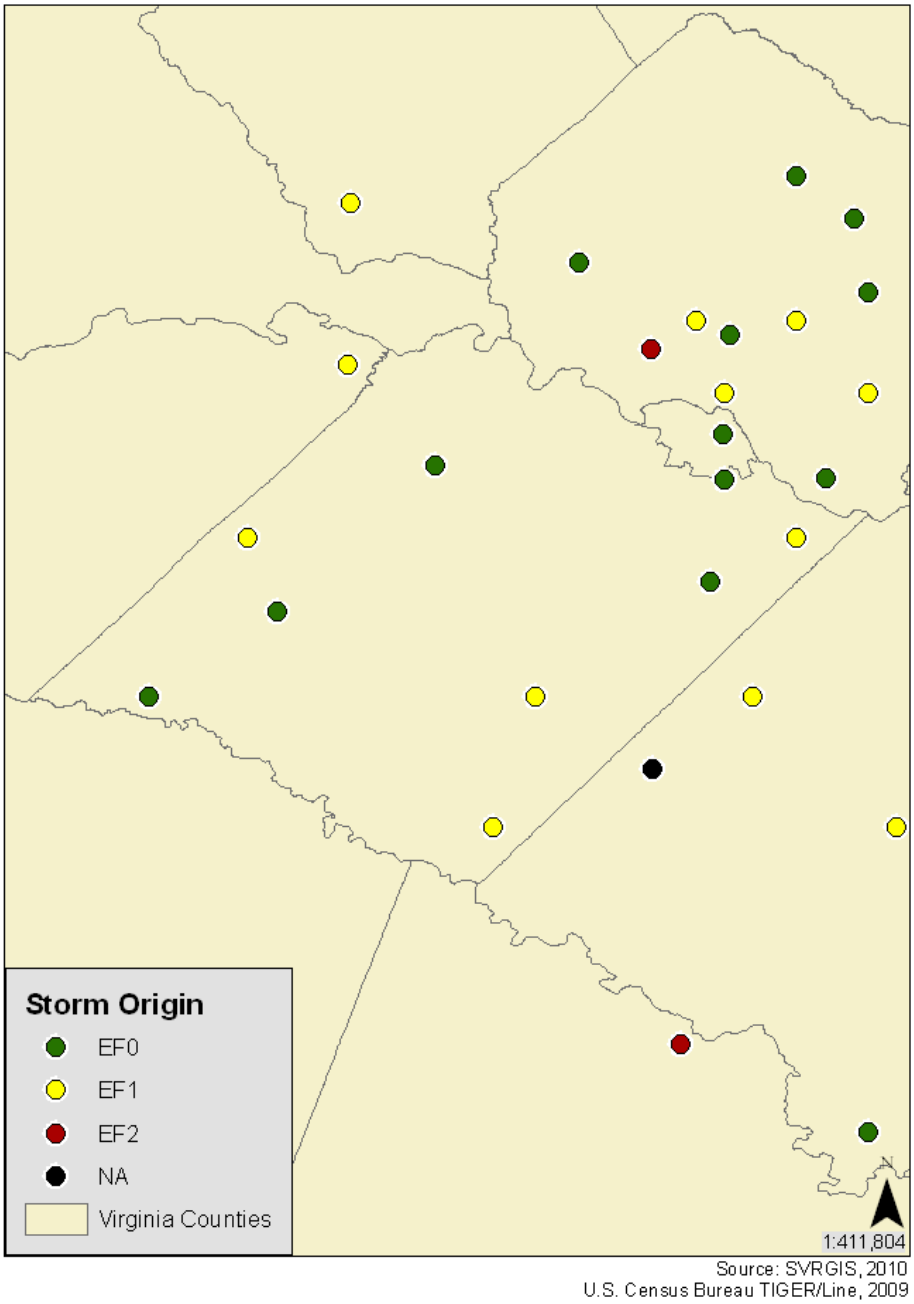


Figure 5-31. Historic Tornado Occurrences (Enhanced Fujita Scale) - Spotsylvania County 1950-2010.

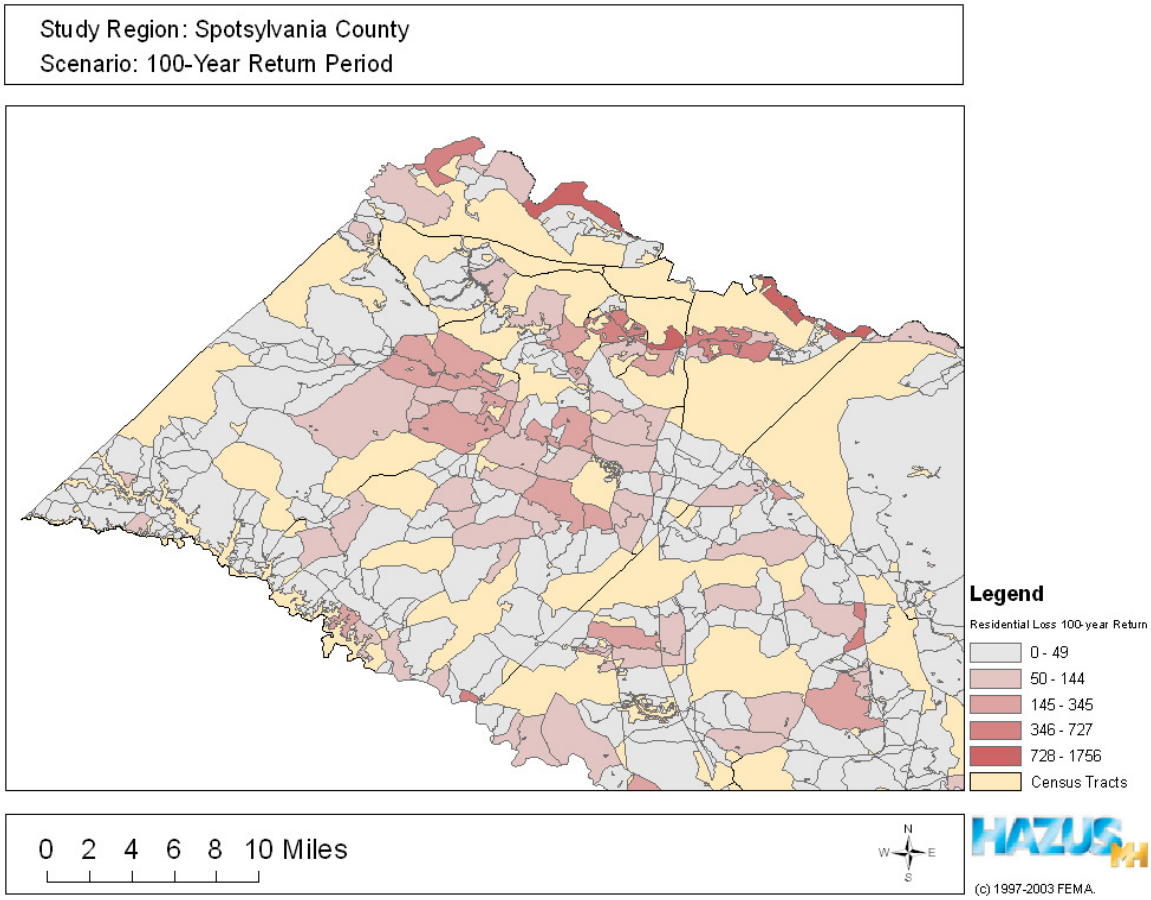


Figure 5-32. Total Residential Loss for Spotsylvania.

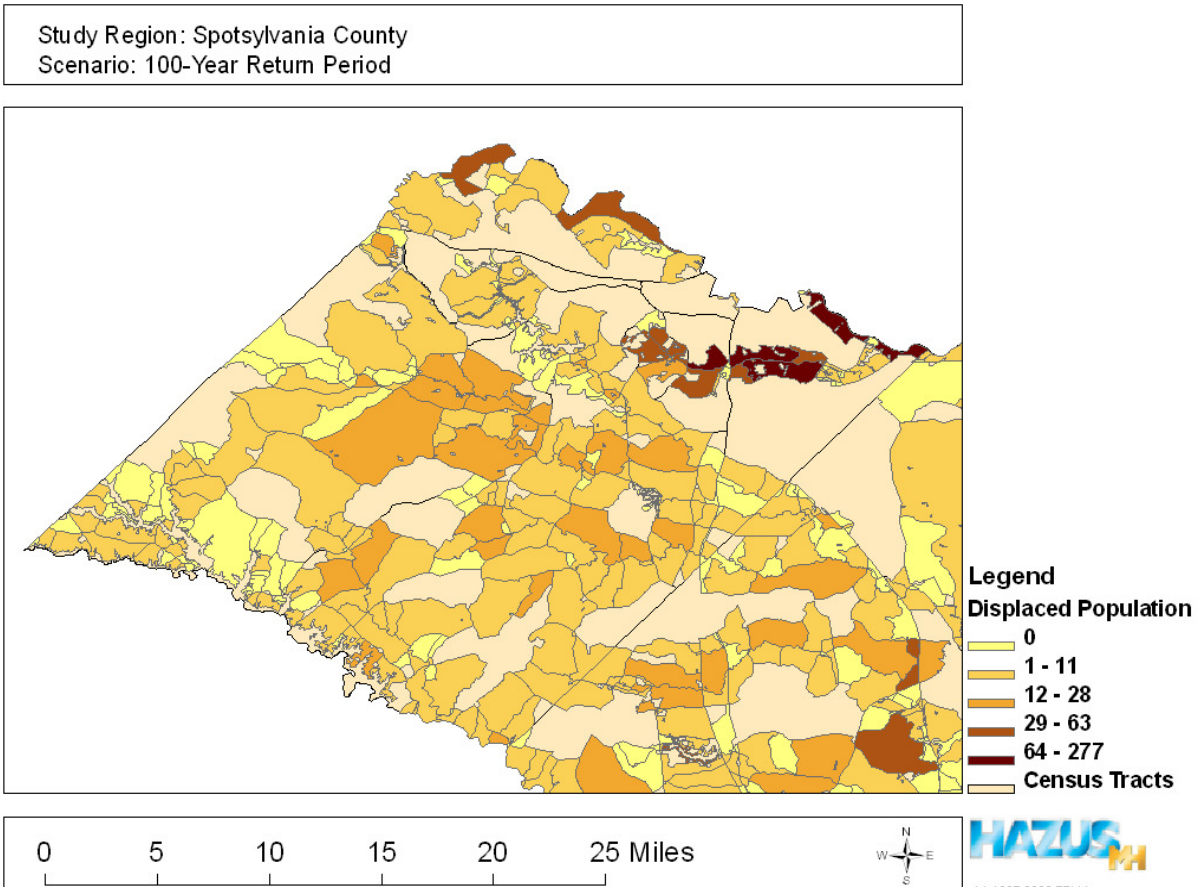


Figure 5-33. Displaced Population for 100-year Flood Event—Spotsylvania County.

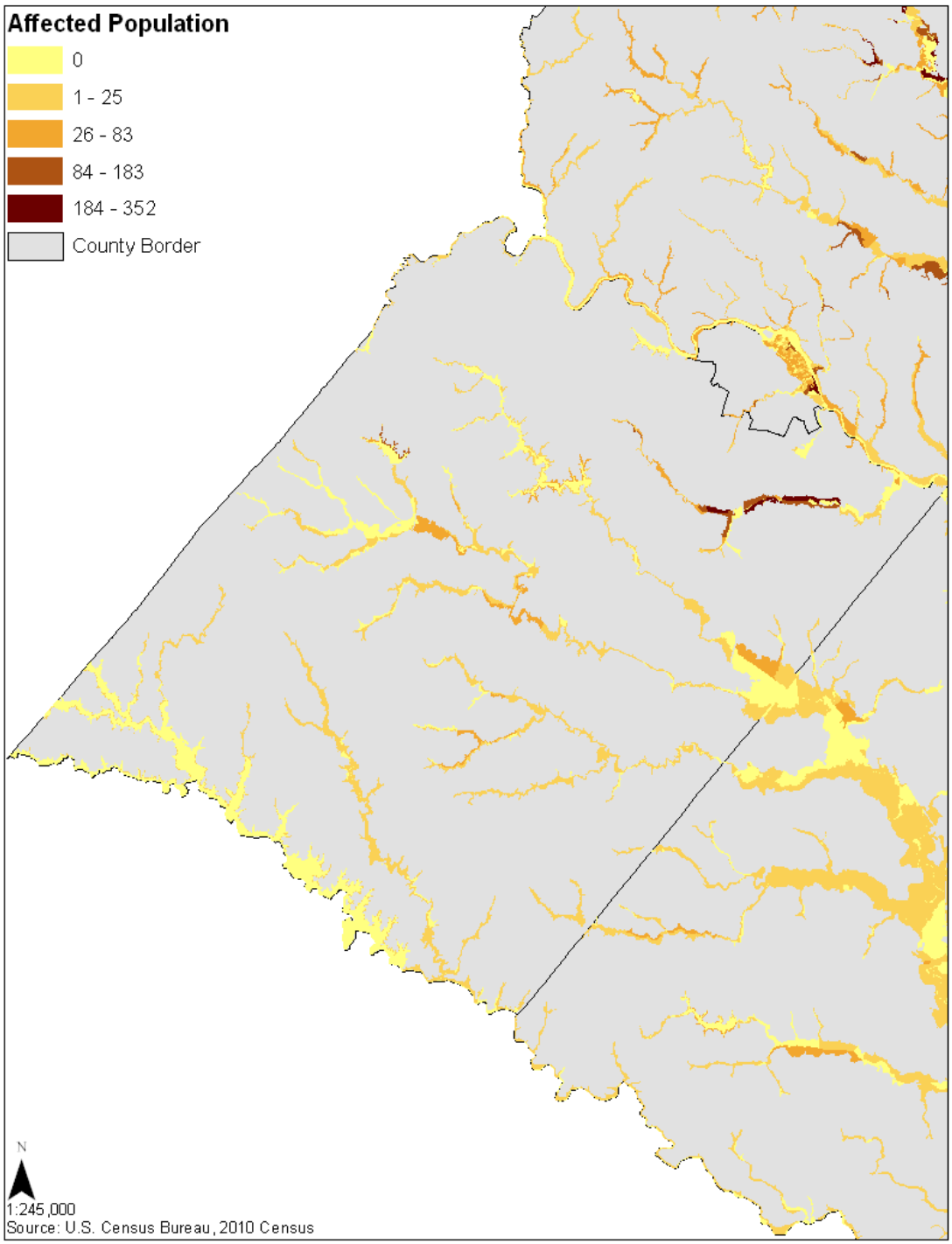


Figure 5-34. At Risk Population for Flood Event—Spotsylvania.

E. Stafford County Vulnerability Assessment

Development Trends

Stafford County's close proximity to Washington, D.C. has allowed its economic base to capitalize on government-related industry and high-tech jobs. Major employers include GEICO Insurance (regional headquarters, 3900 employees), McLane Mid-Atlantic (retail distribution, 850 employees), and Intuit, Inc. (computer services, 600 employees). Northrop Grumman (information technology/engineering) and BAE Systems (weapon systems) employ an additional 585 high-tech professionals. The U.S. Marine Base Quantico occupies 32,753 acres of Stafford County and employs 6,959 civilians ($48 million civilian payroll). The FBI relocated its National Lab to Stafford in 2003 and employs 900 persons, with an additional 900 employees at the FBI Academy and the local FBI office.

New jobs in Stafford County rose 5.6% annually between 1999 and 2004, and as of 2010 the county had a civilian labor force of 67,313 and an unemployment rate of 5.8% according to the Virginia Economic Development Partnership. The number of businesses in Stafford County grew 34% from 1999 to 2004. As of July 8, 2005, Stafford County had 104 active commercial developments claiming an approximate 2.5 million square feet of office space. Stafford County had a population of 92,446 in 2000 and the 2010 Census reports a population of 128,961 persons, an increase of 39.5%. The 2015 population projection for Stafford County is 138,300 an increase of 7.2% from 2010. (Stafford, Virginia, 2005).

Critical Facilities

In order to assess the vulnerability of a community to natural hazards, the MAC conducted an inventory of the structures and critical facilities within Stafford County (
Table 5-42). The critical facilities are the community's assets that are the most important or vital to emergency management. Critical facilities include:

- Emergency Operation Center (EOC);
- Emergency Communications Center (ECC) / 911;
- Law Enforcement Offices;
- Fire / Rescue Stations;
- Emergency Medical Services (EMS);
- Power;
- Communications;
- Water;
- Wastewater Treatment Plants (WWTP);
- Shelters; and
- Administration Buildings / Courthouse.

Critical facilities are those facilities that warrant special attention in preparing for a disaster and/or facilities that are of vital importance to maintaining citizen life, health, and safety during and/or directly after a disaster event. MAC member representatives from Stafford County provided the inventory of critical facilities for the county.

Table 5-42. Critical Facilities – Stafford County.

Facility Name	City	Facility Type
Stafford Sheriff's Office	Stafford	Sheriff/EOC
Aquia Harbor Police	Stafford	Police Dept
Dept. of Fire, Rescue, and Safety	Stafford	Fire/Rescue
Stafford Volunteer Fire Assn	Stafford	Fire Dept
Rock Hill Volunteer Fire Dept	Stafford	Fire Dept
Stafford County Fire Marshall	Stafford	Fire Dept
Falmouth Volunteer Fire Assn	Falmouth	Fire Dept
Widewater Volunteer Fire Assn	Stafford	Fire Dept
Mountain View Volunteer Fire & Safety	Stafford	Fire Dept
Hartwood Volunteer Fire Assn	Hartwood	Fire Dept
White Oak Volunteer Fire	Falmouth	Fire Dept
Berea Fire Station	Stafford	Fire Dept
Aquia Harbour Volunteer Rescue	Stafford	Rescue
White Oak Volunteer Rescue	Falmouth	Rescue
Rock Hill Volunteer Rescue	Stafford	EMS
Stafford Rescue Squad	Stafford	EMS
Brooke Fire House	Stafford	Fire/EMS
Potomac Hills Fire Station	Stafford	Fire/EMS
Smith Lake Water Treatment Facility	Stafford	Potable Water
Abel Lake WTP	Stafford	Potable Water
Aquia Sanitary District	Stafford	Wastewater
Randall Ranny L. STP	Stafford	Wastewater
Richard Schwartz	Stafford	Wastewater
Stafford County Administration Center	Stafford	Administration
Garrisonville Elementary	Stafford	School/Shelter Site
A.G. Wright Middle	Stafford	School/Shelter Site
Widewater Elementary	Stafford	School/Shelter Site
Stafford Middle	Stafford	School/Shelter Site
Conway Elementary	Fredericksburg	School/Shelter Site
Hampton Oaks Elementary	Stafford	School/Shelter Site
Stafford Elementary	Stafford	School/Shelter Site
Kate Walker Barrett Elementary	Stafford	School/Shelter Site
Brooke Point High	Stafford	School/Shelter Site
Ferry Farm Elementary	Stafford	School/Shelter Site
Park Ridge Elementary	Stafford	School/Shelter Site
Margaret Brent Elementary	Stafford	School/Shelter Site
Mountain View High	Stafford	School/Shelter Site
Winding Creek Elementary	Stafford	School/Shelter Site
Rockhill Elementary	Stafford	School/Shelter Site
Grafton Village Elementary	Fredericksburg	School/Shelter Site
Colonial Forge High	Stafford	School/Shelter Site
Anthony Burns Elementary	Stafford	School/Shelter Site
Anne E. Moncure Elementary	Stafford	School/Shelter Site

Facility Name	City	Facility Type
Rodney E. Thompson Middle	Stafford	School/Shelter Site
H.H. Poole Middle	Stafford	School/Shelter Site
North Stafford High	Stafford	School/Shelter Site
Heim Middle School	Stafford	School/Shelter Site

Source: Data provided by the Stafford County Fire and Rescue Department.

Non-Rotational Wind Vulnerability

Hazards U.S. – Multi Hazard (HAZUS-MH) was utilized to perform a wind hazard analysis for Stafford County. HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 wind analysis was performed to calculate the wind hazard for Stafford County.

Table 5-43 lists the total dollar value of exposed structures based on occupancy type for Stafford County.

The default data set provided with the HAZUS-MH software is based on the 2000 census data. It is recognized that the current development trends in Stafford County make the 2000 census data obsolete. However, this analysis depicts the probability of occurrence and can generally be used estimate potential damages due to high winds.

Table 5-43. Total Dollar Value of Exposed Structures from HAZUS – Stafford.

Occupancy Type	Total $ Value Exposed Structures
Residential	5,124,037,000
Commercial	369,083,000
Industrial	70,156,000
Agricultural	12,118,000
Religion	57,801,000
Government	12,469,000
Education	13,020,000
Total	**5,658,684,000**

Source:HAZUS-MH

HAZUS®MH software provides two options for wind analysis, probabilistic and deterministic. The probabilistic scenario is the default option for the software and activates a database of many thousands of storm tracks and intensities. This scenario generates hurricane hazards based on set return periods. These return periods define the statistical probability that a storm of a given size and intensity could occur within any year. The deterministic method analyses hazards associated with a user defined storm event.

The user inputs the storm track, forward speed, and wind speed and allows for the creation of "what-if" scenarios.

The probabilistic wind analysis was chosen because it provides the statistical probability for a range of hurricane events and presents a comparison of these events. The probabilistic analysis was used to generate structural loss estimations for hurricane events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year. The recurrence interval is the average interval of time within which the given hurricane event will be equaled or exceeded once.

Since residential use comprised a significantly large percentage of the occupancy classification these data are presented in Table 5-44. Figure 5-35 shows the peak wind gusts, ranging from 66mph to 68mph, generated from a hurricane with 100-year recurrence interval. Figure 5-36 displays the total loss to residential structures from a 100-year recurrence interval.

Table 5-44. Hurricane Risk - Stafford County. Summary of Probabilistic Analysis – Residential Structures.

Return Period	Residential Building Damage			
	Minor Damage	Moderate Damage	Severe Damage	Total Destruction
10-year	0	0	0	0
20-year	5	0	0	0
50-year	96	2	0	0
100-year	522	20	1	0
200-year	2,113	149	4	1
500-year	7,438	1,313	77	70
1000-year	11,423	3,629	510	459

Source:HAZUS-MH

Severe Storm Vulnerability

Since 1960 Stafford has experienced 99 severe storms (roughly 2 severe storm events annually) that have caused damage to property and crops from lightning, hail, extreme winds, and flooding. From 1960-2008 these storms have caused approximately $7,700 in crop damages and $2,110,000 in property damages, the equivalent of $160 in crop damages and $43,958 in property damages annually. In that same time period extreme weather from winter storms and ice have caused damages to private and public properties and winter freeze has caused damage to crops within the region. Total damages to properties are estimated at $2,300,000 million across 60 storms. On an annualized basis, this works out to be approximately $47,917 in property damage and 1.25 winter storm events per year. Four of those storms caused winter freeze resulting in crop damages resulting in damages of approximately $45,800 (SHELDUS 2011). The risk for winter storm events for Stafford County and its independent towns is listed below in Table 5-45.

Table 5-45. Winter Storm Risk - Stafford.

Locality	Average Snowfall (in) 1958-2010					Likelihood Of Event (%)
	December	January	February	March	Annual	
Stafford	3.21"	3.46'	4.11"	2.42"	14.1"	96.3

Source: Southeast Regional Climate Center

Tornado Vulnerability

Based on the available data, Stafford County has averaged 0.23 tornado events causing $169,417 in damages annually. The calculation of annualized damages is skewed to a considerable extent due to a particularly damaging EF-2 tornado event on May 8, 2008, in Berea that caused $10 million in property damages.

Table 5-46. Tornado Risk—Stafford County: Historic Events 1950-2010.

Intensity	Number of Occurrences	Damages ($)
EF0	7	85K
EF1	6	80K
EF2	1	10.0M

Source: SVRGIS

Flooding Vulnerability

A flood vulnerability assessment analysis was performed for Stafford County using valuation data from the Stafford County tax assessor's database and GIS data including 100-Year flood zone and structure location layers from Stafford County. The structure and flood layers were analyzed in a GIS environment to determine how many structures were located within a 100-Year flood zone. The tax assessor's database and the GIS structure data layer do not have unique matching attributes suitable for attribute joining for all structures. Approximately 62% of the buildings can be linked to the tax assessor's database via the Property Information Number (PIN) – this number is located in both the GIS Building layer and the tax assessor's database. The remaining 38% of the buildings can only be manually matched to the tax assessor's database. The total value of the structures was extrapolated from the 62% of the known values.

It was determined that 1,916 structures are located within the 100-Year flood zone in Stafford County. The total value of those structures is estimated at $339.4 million (Table 5-47. Flood Risk – Stafford County.).

Table 5-47. Flood Risk – Stafford County.

Occupancy Type	Total Buildings	No. Buildings in 100-year Flood Zone	Estimated at Risk Value
Residential	20287	721	$127.7 million
Agricultural	19577	556	$98.5 million
Commercial / Planned Development	924	61	$10.8 million
Other / Unidentified	15116	578	$102.4 million
Total	**55,904**	**1,916**	**$339.4 million**

Source: Data provided by Stafford County

Repetitive Loss Areas

Including flood insurance claims paid as a result of flood damage caused by Hurricane Isabel in 2003, FEMA has identified 10 properties as repetitive loss properties for Stafford County. This number was later revised to nine (9). Six (6) of these properties are situated in an historic district. The numbers given does not reflect the total number of houses that have flooded in Stafford County, rather the total number of repetitive losses.

HAZUS Flood Analysis

Hazards U.S. – Multi Hazard (HAZUS®MH) was utilized to perform a flood hazard analysis for Stafford County (to expand on the analysis conducted in 2006 Table 5-47). HAZUS®MH software is a multi-hazard loss estimation program that was developed under a cooperative agreement between the National Institute of Building Sciences and FEMA. The current version of HAZUS®MH has the ability to calculate earthquake, wind, and flood hazards as well as potential economic losses associated with these hazards. The software is designed with the flexibility to perform loss estimations at three different levels. Level 1 utilizes all default parameters built into the software. Levels 2 and 3 require user defined scenarios and building inventory data. For the purpose of this Plan, a Level 1 flood analysis was performed to calculate the flood hazard for the Stafford County. Table 5-48 lists the total dollar value of exposed structures based on occupancy type for Stafford County.

The default dataset provided with the HAZUS®MH software is based on the 2000 census data. It is recognized that the current development trends in the Stafford County may render the 2000 census data, with which HAZUS®MH is programmed, somewhat obsolete. However, this analysis depicts the probability of occurrence and can generally be used to estimate potential damages due to high surging waters.

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The three hazard type options provided by HAZUS®MH software for flood analysis are the riverine, coastal, and riverine and coastal scenarios. The necessary scenario for any given situation depends upon the geography of the region. If the area is inland with a stream hydrology, then the riverine scenario should be used. If however, the area is along the coast then either the riverine and coastal, or coastal scenario should be used. The user cannot run any analysis without first defining the scenario.

Table 5-48. Flood Risk - Stafford County.

Occupancy Type	Dollar Exposure (replacement value $)
Residential	5,032,289,000
Commercial	696,196,000
Industrial	141,282,000
Agricultural	24,015,000
Religion	97,241,000
Government	27,654,000
Education	73,898,000
TOTAL	**6,092,575,000**

Source: HAZUS-MH

The riverine and coastal analysis was chosen for Stafford County. This scenario provides the statistical probability for a range of flood events and presents a comparison of those events. The coastal and riverine analysis was used to generate structural loss estimations, agricultural loss estimations, and shelter requirements for flood events with specific recurrence intervals; 10-, 20-, 50-, 100-, 200-, and 500-year. The recurrence interval is the average interval of time within which the given flood event will be equaled or exceeded once.

Agricultural damage from a 100-year event is listed below in Table 5-49. Because residential structures comprise a significantly large percentage of the occupancy classification within the region, these data are presented in Figure 5-38 below. The total damages to residential structures were $12,651,000. The number of displaced persons from a 100-year event is displayed below in Figure 5-39. The total number of displaced Stafford County residents was 185 people. Figure 5-40 shows the 100-year floodplain for the Stafford County with 2010 census blocks that intersect it. The map displays the population (in 2010 Census numbers) that would be affected by a 100-year flood event.

Table 5-49. Agricultural Loss – Stafford County.

Crop Type	Loss ($)
Corn	150,813.49
Corn Silage	179,339.19
Soybeans	102,142.47
Wheat	23,618.65
TOTAL	**454,913.80**

Source: HAZUS-MH

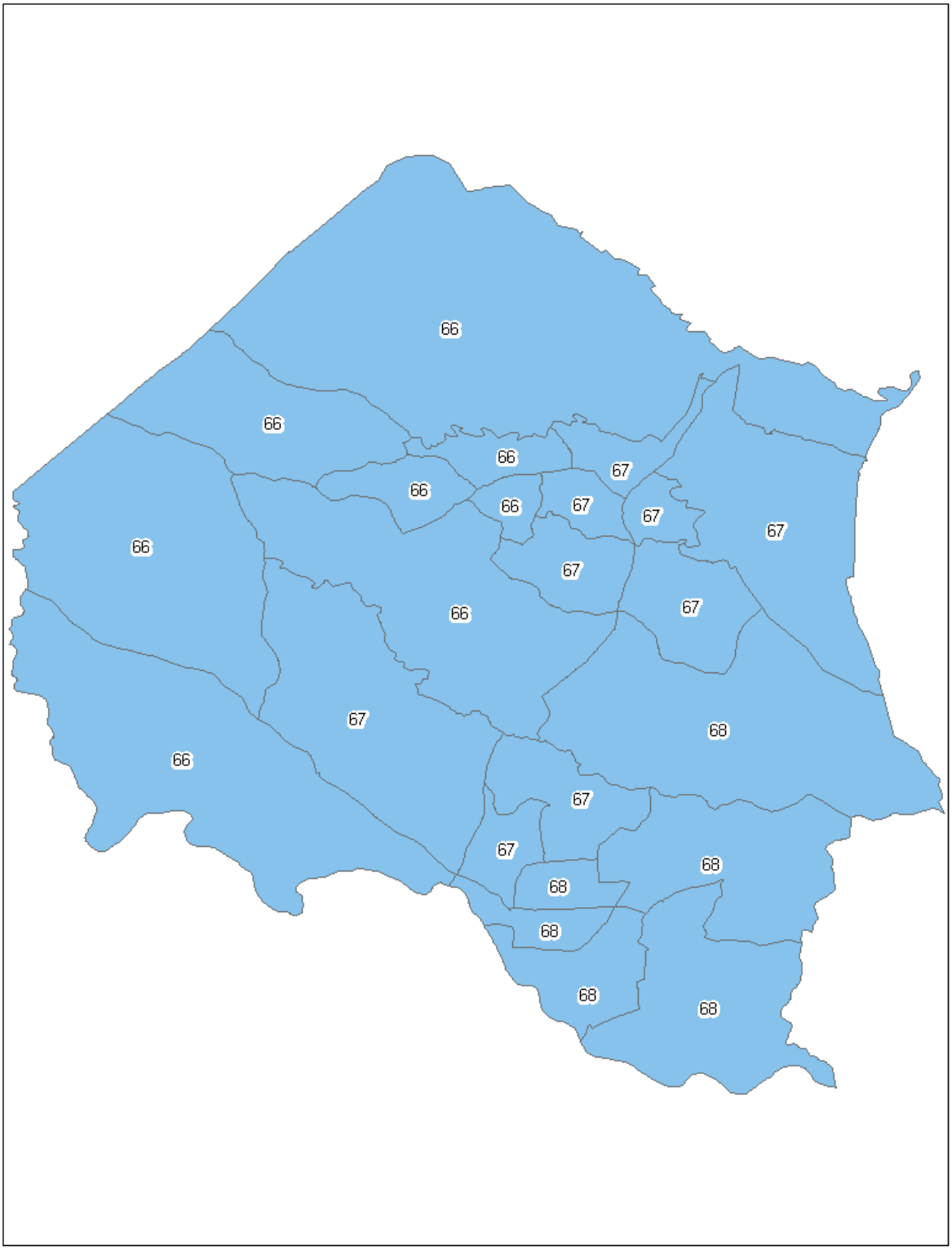

Figure 5-35. Peak Wind Gust (mph) Distribution.

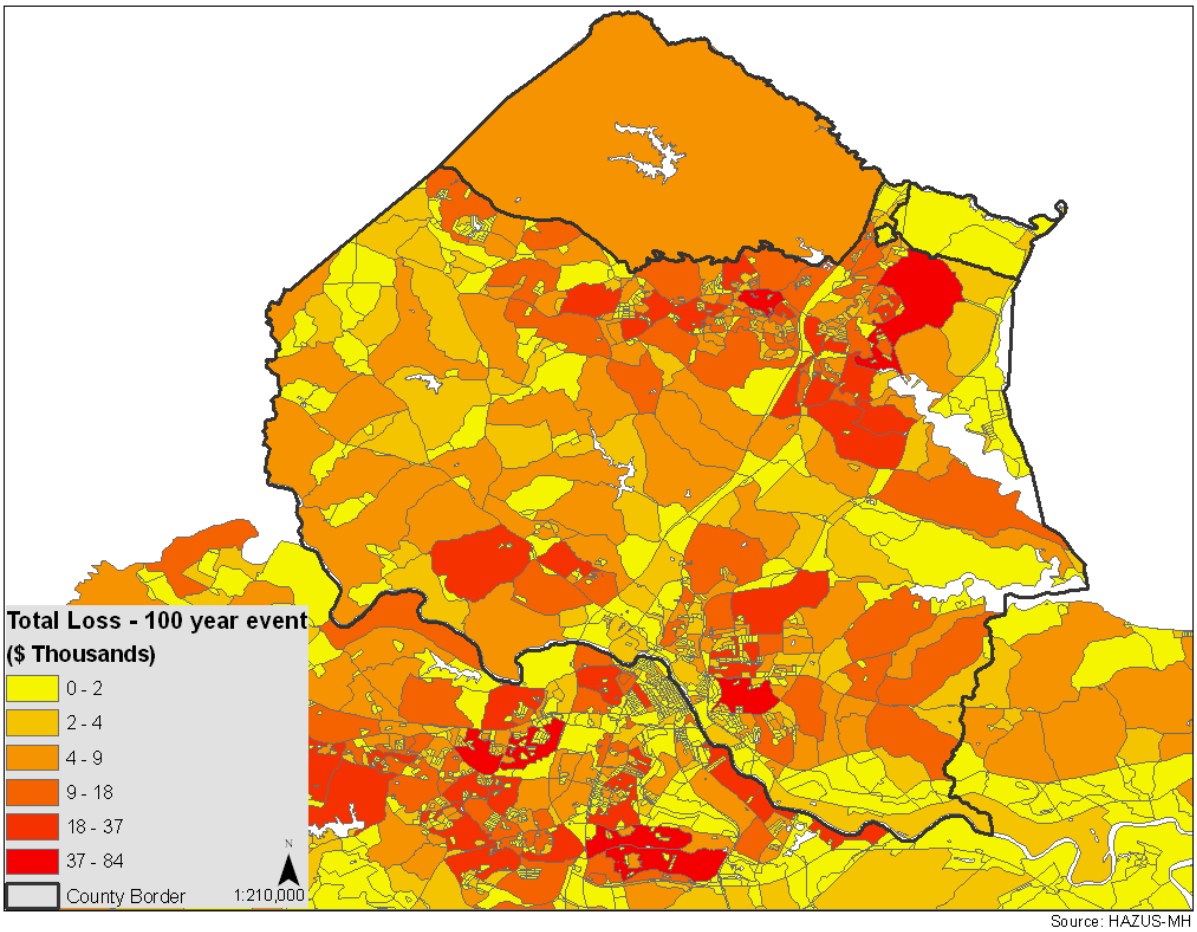

Figure 5-36. Total Residential Loss from 100-Year Hurricane - Stafford County.

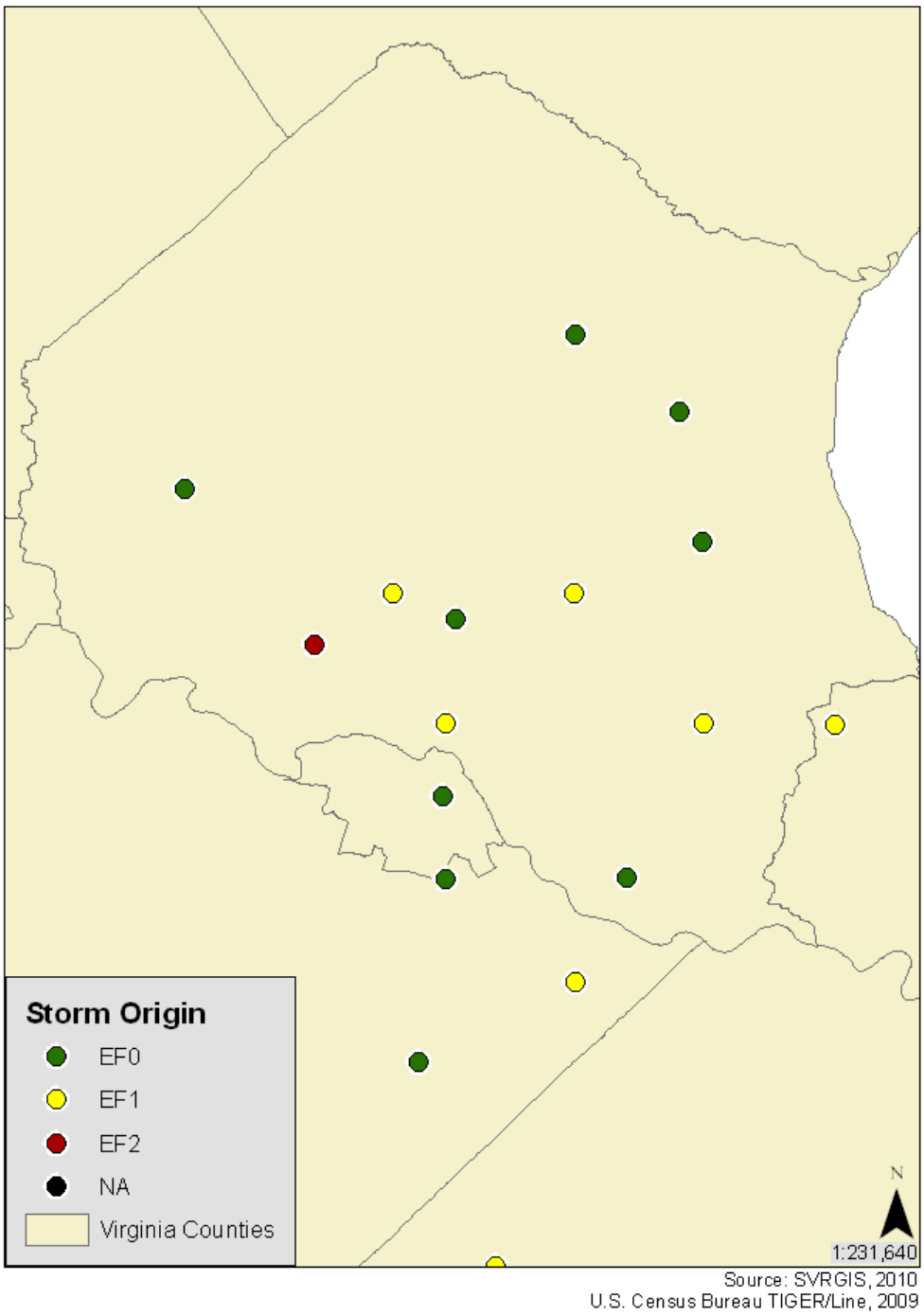

Figure 5-37. Historic Tornado Occurrences (Enhanced Fujita Scale). Stafford County 1950-2010.

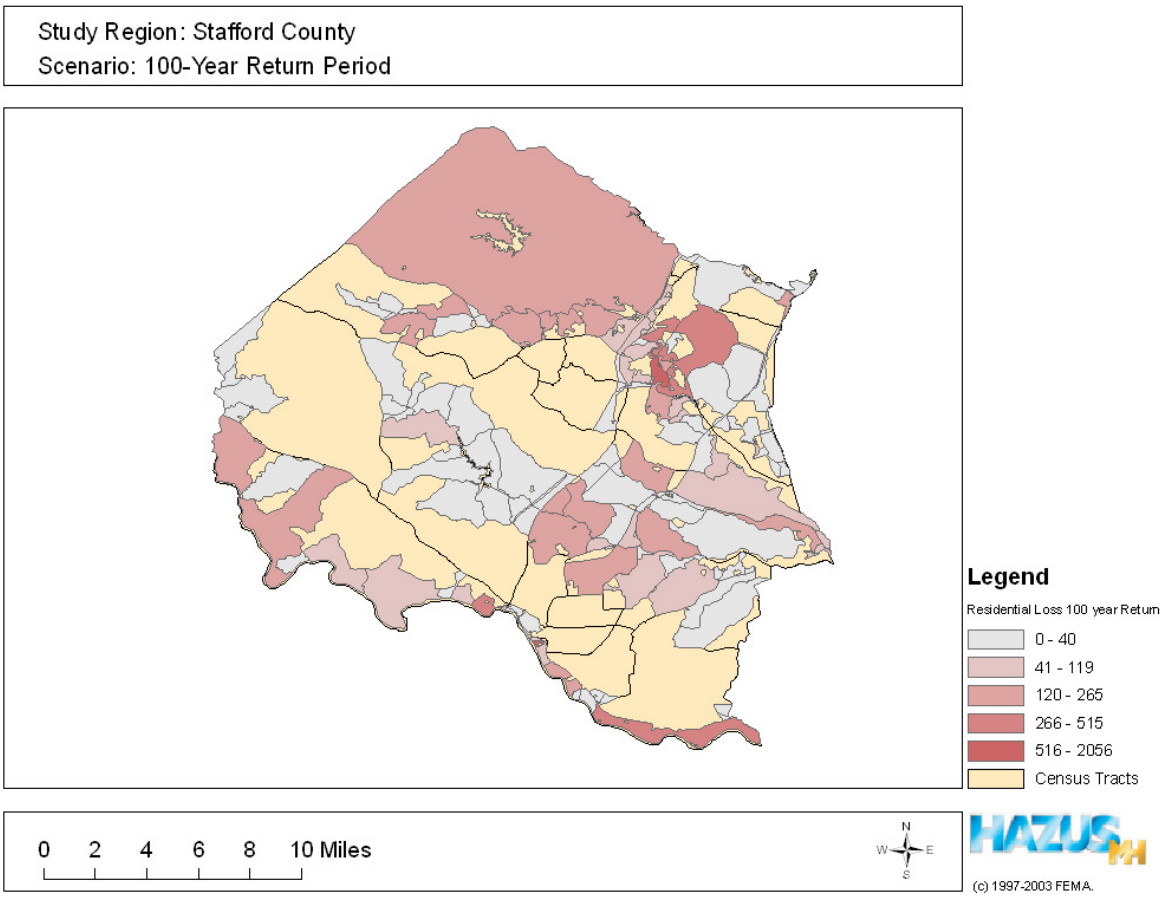

Figure 5-38. Total Residential Loss for Stafford.

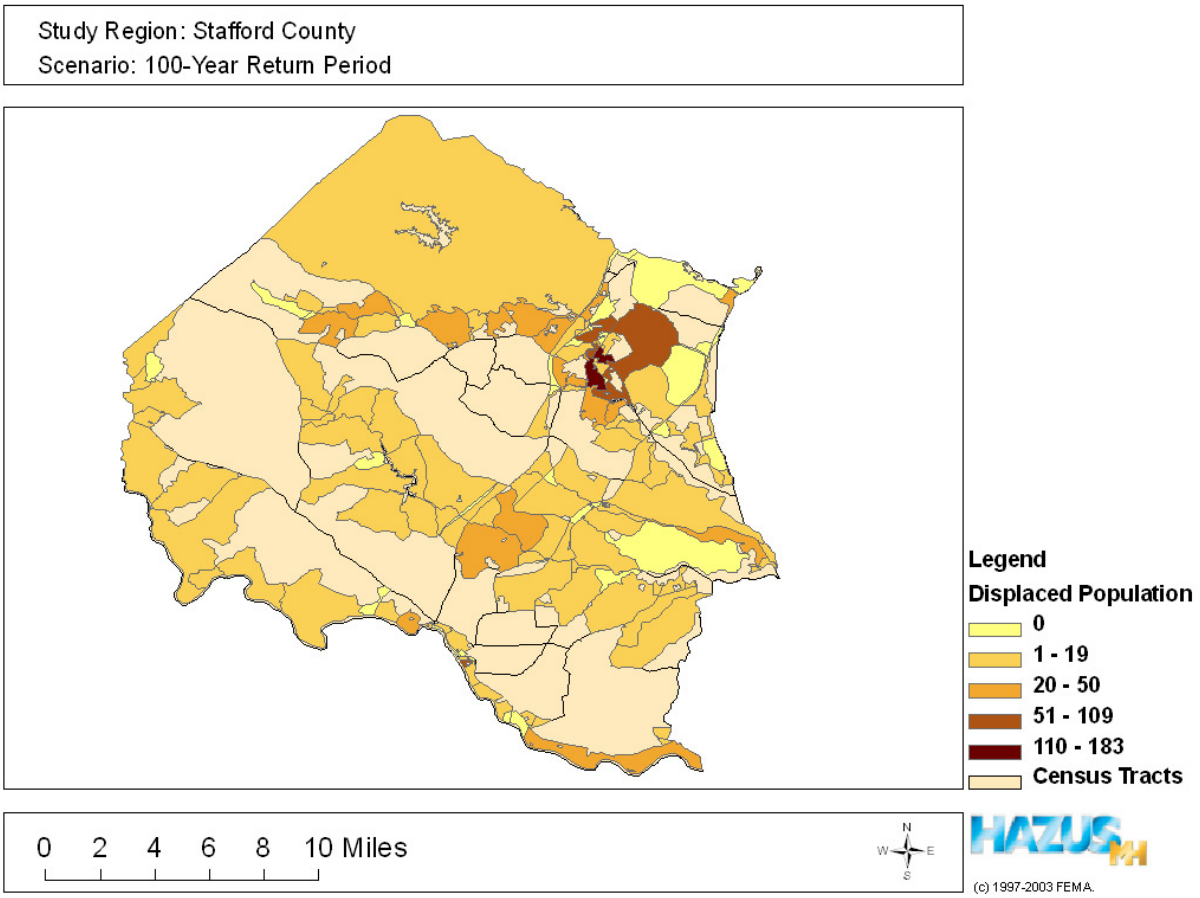

Figure 5-39. Displaced Population for 100-year Flood Event - Stafford County.

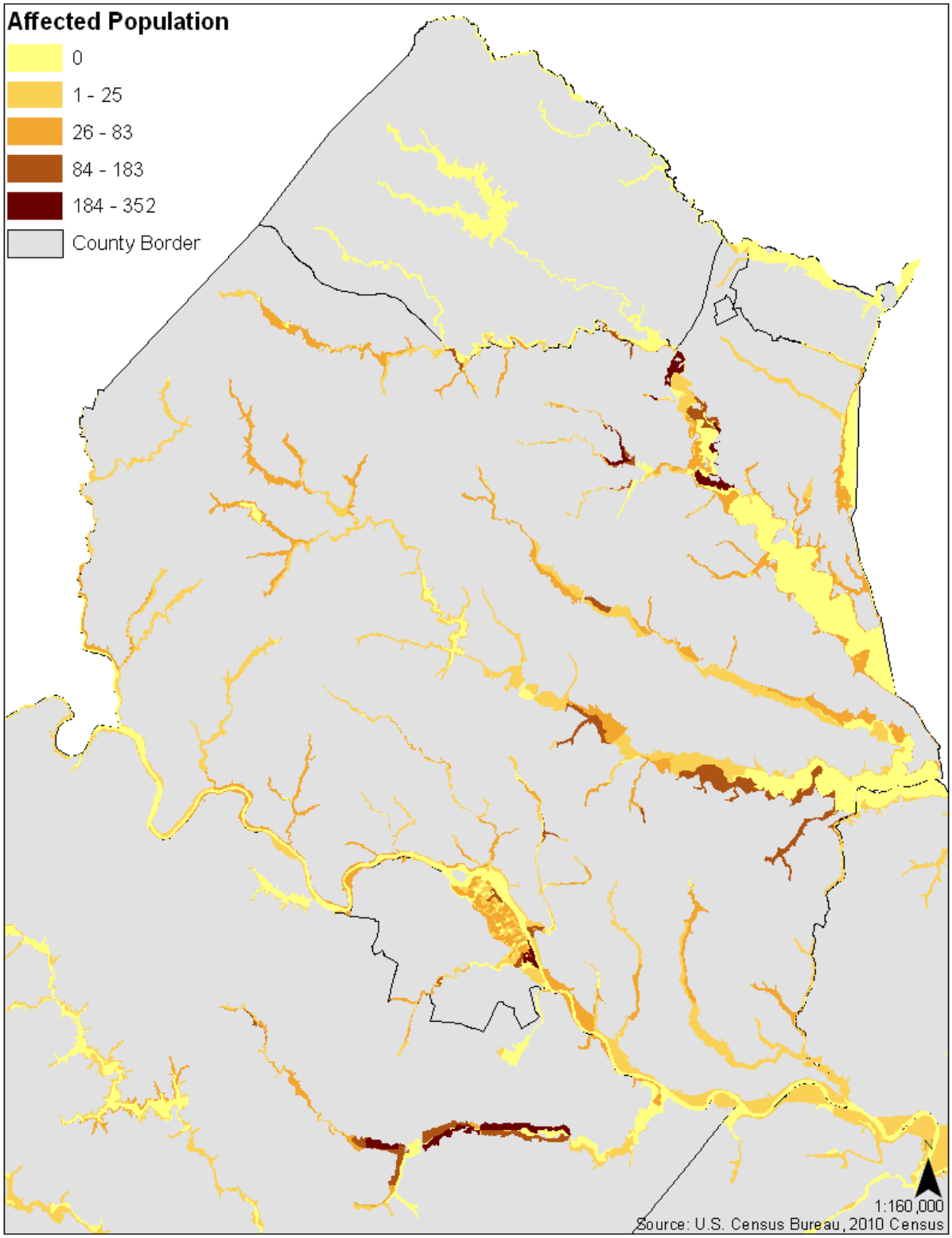

Figure 5-40. At Risk Population for Flood Event - Stafford.

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CHAPTER 6 - CAPABILITY ASSESSMENT

The capability assessment provides each member jurisdiction with a better understanding of its own preparedness levels and its capability to mitigate against natural hazards. This assessment will assist the GWRC communities to more accurately focus the goals, objectives, and proposed actions of this plan.

For the 2012 update, the MAC took two approaches in updating its 2006 capability assessment for its member jurisdictions. First, an inventory/matrix of common mitigation activities from the 2006 plan was updated to identify activities and actions that were either in place, needed improvement, or could be undertaken, if deemed appropriate. Second, the MAC updated information on existing policies, regulations, and plans. These documents were reviewed by the jurisdictions to determine if they still contributed to reducing hazard related losses, or if they, inadvertently, contributed to increasing such losses.

I. Regional Capability Assessment

Federal, State and Regional mitigation capabilities that are common to all communities within the GWRC planning area are presented below. The mitigation capabilities of each community are individually identified and presented in Sections II A-E below.

Table 6-1. Regional Capability Assessment Summary Matrix.

Capability	Caroline County	Bowling Green	Port Royal	King George County	Spotsylvania Co	Stafford County	City of Fredericksburg
Comprehensive Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Land Use Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subdivision Ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Zoning Ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NFIP/FPM Ordinance	Yes	Yes	Yes	Yes	Yes	Yes	Yes
-Effective FIRM Date	08/15/89	N/A	08/15/89	03/16/09	02/18/98	02/04/05	09/19/2007
-Substantial Damage Language	Yes	N/A	Yes	Yes	Yes	Yes	Yes
- Certified Floodplain Manager	No	No	No	No	Yes	Yes	No
- Number of Flood-prone Buildings	2,424	N/A	All	18	410	1,916	300
- Number of NFIP policies	41	N/A	N/A	18	135	288	164
- Maintain Elevation Certificates	No	No	No	Yes	Yes	Yes	Yes
- Number of Repetitive Losses	0	N/A	0	0	0	8	4
CRS Rating	N/A	N/A	N/A	N/A	No	8	N/A
Storm-water Program	Yes	Yes	Yes	No	Yes	Yes	Yes
Building Code Version	Virginia Uniform Statewide Building Code: 2009 Ed. (based on IBC)						
Full-time Building Official	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes
- Conduct "As-built" Inspections	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes
BCEGS Rating	Residential - 3; Commercial - 3			Residential– 4; Commercial - 4	Residential - 4; Commercial - 3	Residential - 4; Commercial - 4	
Local Emergency Operations Plan	Yes	Yes	Through Co.	Yes	Yes	Yes	Yes
Hazard Mitigation Plan	2012 George Washington Regional Commission Hazard Mitigation Plan						
Warning Systems in Place	Poor			Yes	Yes	Yes	Yes
- Storm Ready Certified	No			Yes	No	No	No
- Weather Radio Reception	Fair			Improved coverage from Fredericksburg transmitter	Yes; high coverage	Yes; full coverage	Yes
- Outdoor Warning Sirens	No			No	Yes; 10 mile radius of North Anna Power Station	No	Yes
- Emergency Notification (R-911)	Yes – Caroline Alert System			KGALERT, social media	Yes	Yes	Yes
- other? (e.g., cable over-ride)	No			No	Yes- Roam Secure Emergency Alert System	Yes- Emergency Broadcast System	Yes – Fredericksburg Alert
GIS system	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes
- Hazard Data	No			Yes	Yes	Yes	No
- Building footprints	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes
-Tied to Assessor data	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes
-Land Use designations	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Structural Protection Projects	No	No	No	No	No	No	No
Property Owner Protection Projects	Yes- Acquisition/ Elevation	Through Co.	Through Co.	Yes- Acquisition/ Elevation	No	Yes- Acquisition/ Elevation	No
Critical Facilities Protected	No	No	No	No	No	No	No
Natural Resource Inventory	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cultural Resources Inventory	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Erosion Control Procedures	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes
Sediment Control Procedures	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes
Public Information Program/Outlet	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environmental Education Program	Yes	Through Co.	Through Co.	Yes	Yes	Yes	Yes

A. Federal Capabilities

Federal Emergency Management Agency (FEMA): The Stafford Act

This Act constitutes the statutory authority for most Federal disaster response activities especially as they pertain to FEMA and FEMA programs. Federal assistance for the repair of public roads damaged by a natural disaster not covered by the FHWA's ER program is available through the disaster relief program administered by the Federal Emergency Management Agency under the Stafford Act.

Federal Emergency Management Agency (FEMA): Homeland Security Grant Program: Urban Areas Security Initiative (UASI)

The UASI program addresses the unique planning, organization, equipment, training, and exercise needs of high-threat, high-density urban areas, and assists them in building an enhanced and sustainable capacity to prevent, protect against, mitigate, respond to, and recover from acts of terrorism. The George Washington Region lies between 2 UASI grantee service areas, namely: the National Capital UASI Region (for the Washington DC metropolitan area) and the Central Virginia UASI Region (for the Richmond VA Metropolitan area). Disaster response and evacuation planning between these 2 high-risk areas which would rely on evacuation routes using interstate and primary highway corridors and passenger and commuter train service that bi-sect the Region should be coordinated with regional transportation, hazard mitigation and emergency response planning in the George Washington Planning District; however, no entity in PD 16 is eligible for this program and State Homeland Security officials have offered no involvement for the Region in State and regional UASI grantee planning activities.

The National Flood Insurance Program (NFIP)

Established in 1968, the NFIP provides flood insurance in nearly 20,000 communities across the United States and its territories that agree to regulate new development in identified Special Flood Hazard Areas through the adoption and enforcement of a minimum Flood Damage Prevention Ordinance. The program also requires, as a condition of every federally-backed mortgage within an identified Special Flood Hazard Area, the purchase and maintenance of a flood insurance policy for the life of the loan. Community participation in the NFIP is voluntary. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage is reduced by nearly $1 billion a year through communities implementing sound floodplain management requirements and property owners purchasing of flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80 percent less damage annually than those not built in compliance.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the Nation's floodplains. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed for floodplain management programs and to actuarially rate new construction for flood insurance.

On September 30, 2010, the President signed the National Flood Insurance Program Re-extension Act of 2010, which Congress passed on September 24, 2010. This extends the National Flood Insurance Program until September 30, 2011.

Federal Highway Administration (FHWA): Emergency Transportation Operations (ETO)

FHWA, through the ETO programs, provides tools, guidance, capacity building and good practices that aid local and State DOTs and their partners in their efforts to improve transportation network efficiency and public/responder safety when a non-recurring event either interrupts or overwhelms transportation operations. Non-recurring events may range from traffic incidents to traffic Planning for Special Event (PSE) to disaster or emergency transportation operations (Disaster ETO). Work in ETO program areas focuses on using highway operational tools to enhance mobility and motorist and responder safety. Partnerships in ETO program areas involve non-traditional transportation stakeholders since ETO programs involve transportation, public safety (fire, rescue, emergency medical service [EMS]), law enforcement) and emergency management communities. ETO, as a discipline, spans a full range of activities: from transportation-centric (fender benders) to those where transportation is a critical response component (e.g., hurricane evacuations).

Federal Highway Administration (FHWA): Federal-aid Highway Emergency Relief Program

The Emergency Relief (ER) program - administered by the Federal Highway Administration (FHWA) - is intended to supplement the commitment of resources by States, counties, and cities (or other Federal agencies when appropriate) to help pay for unusually heavy expenses resulting from extraordinary conditions. The Congress has authorized ER funding as part of the FHWA's Federal-aid highway program. ER funds are available for the repair of Federal-aid highways or roads on Federal lands that have been seriously damaged by natural disasters over a wide area or by catastrophic failures from an external cause. Examples of natural disasters include floods, hurricanes, earthquakes, tornadoes, tidal waves, severe storms, or landslides. A bridge suddenly collapsing after being struck by a barge is an example of a catastrophic failure.

State highway agencies, working with local officials, have established the functional classification of all public roads, ranging from high service level arterials to lower service local streets. Federal-aid highways are all the public roads not functionally classified as either local or rural minor collectors. As a result, Federal-aid highways include the more important State, county, and city roads. Based on the functional classifications, about one-quarter of the overall public road mileage has been designated as Federal-aid highways. The FHWA's ER program is limited to the repair of Federal-aid highways (as previously defined) or roads on Federal lands. See the Federal Emergency Management Agency's disaster relief program under the Stafford Act for the repair of public roads not covered by the FHWA's ER program.

U.S. Department of Energy (DOE): Disaster Recovery and Building Reconstruction Program

The U.S. Department of Energy (DOE) is working to encourage cost-effective, durable, and energy-efficient building reconstruction in areas struck by natural disasters. The Building Technologies Program offers information and resources for state and local officials, builders, and consumers, as well as training opportunities on building technologies and designs that can make a long-term difference in areas vulnerable to natural disasters. When applied, these technologies can result in safer, healthier, more economically viable communities that are less susceptible to disaster.

U.S. Fish and Wildlife Service (USFWS): The Coastal Barrier Resources Act (CoBRA)

Established in 1972, the COBRA is environmental legislation administered by the U.S. Fish and Wildlife Service. The legislation provides for the identification and protection of Coastal Barrier Resources. The

Act further prohibits the availability of federally-backed assistance within identified areas, including grants, loans, mortgages and federal flood insurance.

National Oceanic and Atmospheric Administration (NOAA): Coastal Zone Management Act (CZMA)

Established in 1972, and amended by the Coastal Zone Protection Act of 1996, the CZMA defines a national interest in the effective management, beneficial use, protection and development of the coastal zone and identifies the urgent need to protect the natural system from these competing interests.

The Virginia Department of Environmental Quality (DEQ) oversees the Virginia Coastal Resources Management Program, which was established to protect and manage an area known as Virginia's "coastal zone." All seven of the GWRC communities are located in the coastal zone as defined by Virginia's Coastal Resources Management Area. The program has produced a large number of publications and assisted in the development of numerous projects to support their ten primary goals, available online.

In November 2011, GWRC adopted a regional green infrastructure plan developed under a multi-year CZM-funded grant. This plan identifies core areas where high value natural habitats and forested areas are recommended for conservation emphasis, promotes low-impact development and conservation practices to support and encourage voluntary land conservation, water quality pollution reduction and successful Chesapeake Bay watershed total maximum daily load (TMDL) implementation efforts in the Region. Such programs (along with local compliance with and implementation of the State stormwater management regulations) are expected to have an impact on reducing the risk of flooding by increasing the absorption, retention and infiltration of stormwater that feeds rivers and streams in heavy rainfall events.

Environmental Protection Agency's Chesapeake Bay TMDLs

In 1998, major portions of Chesapeake Bay and its tidal tributaries within Virginia were identified as not meeting water quality standards and listed as impaired. Areas of the Bay and tidal rivers within Maryland, Delaware and the District of Columbia are also on the federally approved list of impaired waters. The main pollutants causing these impairments are nitrogen, phosphorus, and sediment. Significant efforts have been taken and resources expended by federal, state, and local governments and other interested parties throughout the entire 64,000 square mile Chesapeake Bay watershed. Despite these efforts the water quality goals under the Clean Water Act have yet to be met.

Because these Bay waters remained impaired in 2008, the six Chesapeake Bay Watershed States (Virginia, Maryland, Delaware, West Virginia, Pennsylvania, and New York), the District of Columbia, and U.S. Environmental Protection Agency agreed that a Total Maximum Daily Load (TMDL) needed to be developed. EPA has assumed primary responsibility for the establishment of the Bay TMDL with assistance from the Bay watershed states. The target date for completing this is December 31, 2010, although under a federal court consent decree EPA must complete the Bay TMDL no later than May 1, 2011.

The Chesapeake Bay TMDL will address all segments of the Bay and its tidal tributaries that are impaired. As with all TMDLs, a maximum aggregate watershed pollutant loading necessary to achieve the Chesapeake Bay's water quality standards will be identified. This aggregate watershed loading will be divided among the Bay states and major tributary basins, as well as by major source categories [wastewater, urban storm water, agriculture, air deposition]. Each community in the watershed will be

required to develop a watershed implementation plan (WIP), demonstrating how the locality will achieve the target pollution reduction goals assigned to them.

Military Installations

Several military installations within the GWRC planning area are not addressed herein: Quantico Marine Corps Base, Fort A.P. Hill, and the Naval Surface Warfare Center Dahlgren Division. Liaisons from these facilities were invited to participate in the MAC and the planning process leading to the creation of this report.

B. State Capabilities

Virginia Department of Emergency Management (VDEM)

VDEM's Strategic Plan 2004-2013

This plan recognizes and prepares for Virginia's changing demographics and increasing threats over the current ten-year period. Goals, strategies and resources are built around the mission statement, which is "to protect the lives and property of Virginia's citizens from emergencies and disasters by coordinating the state's emergency preparedness, mitigation, response, and recovery efforts."

Commonwealth of Virginia Emergency Operations Plan (State EOP), September, 2007:

This plan consists of a Disaster Recovery Plan, a Hazard Mitigation Plan, and five hazard-specific volumes. The mitigation goals and project prioritization criteria from Section 4 of Virginia's Hazard Mitigation Plan are:

- Goal 1 - Structural Mitigation Projects - Maintenance of critical communication, transportation, or supply chain management operations, beneficial impacts for multiple agencies/organizations, feasibility, cost and funding, and multi-hazard mitigation;
- Goal 2 - Policy, Planning and Funding Human health and safety, preparedness, economic recovery, multi-hazard mitigation, and health care and shelter;
- Goal 3 - Information and Data Development - Human health, safety or economic stability, multi-hazard mitigation, beneficial impacts for multiple agencies/organizations, feasibility, and information quality and security; and,
- Goal 4 - Education and Outreach Activities – Number of people and property affected, beneficial impacts for multiple agencies/organization, multi-hazard mitigation, transferability and adaptability, and simplicity and consistency.

Virginia Emergency Alert Systems (EAS) Stations

Virginia is divided into 14 LOCAL AREAS (formerly "operational areas") which coordinate EAS activities under the direction of the Local Emergency Communications Committee (L.E.C.C.). The LECC Chair and Vice-Chair are appointed by the FCC and the State Chair; they are also members of the State Emergency

Communications Committee (S.E.C.C.). The George Washington Region is divided into Area 2 "Fredericksburg Local Area" (including City of Fredericksburg, and Stafford, Spotsylvania, King George, and Fauquier Counties) and part of the "Richmond Extended Local Area" (including Caroline County).

Specific AM/FM radio stations provide updated disaster and directional information to listeners in the Commonwealth. Thirty-seven radio stations cover fourteen regions in Virginia, including: Northern Va.-D.C. (2 AM stations, 2 FM stations), Richmond extended area (2 AM stations, 2 FM stations), and Fredericksburg [1 AM station (WRVA-AM), 2 FM stations (WFLS-FM, WBQB-FM), North Anna Early Warning Siren System], which provide coverage for the GWRC planning area.

2010 Statewide Communication Interoperability Plan

Interoperability is the ability of public safety agencies to talk across disciplines and jurisdictions via radio communications systems, exchanging voice and/or data with one another on demand in real time, when needed, and as authorized. The lack of interoperable communications is not a new public safety problem, but new events continue to remind us of the pressing problem it poses to public safety departments and emergency response agencies. Major events, like September 11, 2001, and Hurricane Katrina in 2005, as well as ongoing day-to-day operations, demonstrate the need for improved communications systems and collaboration and planning among various jurisdictions.

The Virginia SCIP has served as the backbone for regional and local interoperable communications planning. It establishes a future vision for communications interoperability and aligns the Commonwealth's emergency response agencies with that vision and the goals, objectives, and initiatives for achieving that vision. The first Virginia statewide plan was released in FY 2005 and it defined statewide initiatives designed to improve interoperable communications. The 2010 SCIP expands on the previous year's initiatives and ensures compliance with the SAFECOM requirements for statewide planning.

The GWRC Region is divided between two sub-state Regional Preparedness Advisory Committee (RPAC) regions: Region 1 (with Caroline and King George Counties) and Region 2 (with Spotsylvania and Stafford Counties and the City of Fredericksburg). The GWRC Board of Directors has asked GWRC staff to work with local public safety agencies to encourage collaboration and cooperation, leading to potential cost-sharing or other economy-of-scale benefits arising from regional cooperation.

Virginia Department of Conservation and Recreation (VDCR)

Virginia Stormwater Management Act and Regulations

The Virginia stormwater act and VSMP permit regulations (amended in 2011) provide the ability to manage the quantity and quality of stormwater runoff on a construction site, as well as on a regional or watershed basis. Compared with impervious surfaces (such as pavement or rooftops), pervious surfaces (such as meadows and woodlands) absorb and filter rainfall and reduce runoff. When meadows and woodlands are developed, the increase in impervious surfaces increases the amount of runoff that occurs when it rains. This increase in runoff can overwhelm waterways, causing erosion, localized flooding and property damage. Under 2011 revisions, the most significant amendment to the regulations is the flexible adoption of the stormwater components (e.g. the "cafeteria-style" approach) which allows a locality to adopt individual components for local implementation. However, any local SWM program adopted pursuant to the Stormwater Management Law (Title 10.1, Chapter 6, Article 1.1 of the Code of Virginia) must, at a minimum, contain the Flooding component (4VAC3-20-85). This requirement is expected to have an impact on reduced flooding risk in those communities that adopt a local stormwater management program.

Chesapeake Bay Regulations

As part of Virginia's commitment to help preserve and restore the resources of the Chesapeake Bay, the Virginia General Assembly adopted the Chesapeake Bay Preservation Act in 1988. The Chesapeake Bay Preservation Area Designation and Management Regulations were adopted in 1990 and amended in December 2001. The revised regulations took effect in March 2002 and localities had until December 31, 2003 to revise their local ordinances to become consistent with the new language.

The regulations require that communities east of Interstate 95, the "Tidewater" area of Virginia, regulate and enforce the use of Resource Protection Areas (RPAs) and Resource Management Areas (RMAs). The RPA is relevant to floodplain management because new development within the designated area must maintain a 100-foot buffer from the waterline of any perennial stream, as defined by the regulations. This includes all tidal water bodies in coastal areas. Both the GWRC and the VDCR provide technical assistance and guidance to communities in enforcing the regulations.

All 84 local governments subject to the Chesapeake Bay Preservation Act are required to have ordinance provisions addressing land development in Chesapeake Bay Preservation Areas that minimizes impervious cover, minimizes land disturbance and preserves indigenous vegetation. DCR Chesapeake Bay Local Assistance staff members have reviewed local ordinances to identify specific provisions that address these issues and other provisions that protect water quality. To facilitate this effort, the staff is using two checklists that contain example ordinance provisions that address minimization of impervious cover, minimization of land disturbance and maintenance of indigenous vegetation. All seven local governments (including the Towns of Bowling Green and Port Royal in Caroline County) are in compliance with Chesapeake Bay Preservation Act requirements.

Virginia Flood Damage Reduction Act

Virginia's General Assembly enacted the Virginia Flood Damage Reduction Act of 1989. This legislation was the result of several disastrous floods or coastal storms that hit the state between 1969 and 1985. To improve Virginia's flood protection programs and place related programs in one agency, responsibility for coordination of all state floodplain programs was transferred in 1987 from the Water Control Board to DCR. DCR was named manager of the state's floodplain program and designated coordinating agency of the National Flood Insurance Program under the act, §10.1-602, and a governor's memorandum released in July 1997.

Floodplain Management Program staff works with localities to establish and enforce floodplain management zoning. Localities use the program's state model ordinances, in which minimum standards for local regulations are set, to write their own. Local governments can set more restrictive standards to ensure higher levels of protection for residents in flood hazard areas. Also, the state has used the Virginia Uniform Statewide Building Code to set construction standards for structures built in Federal Emergency Management Agency designated flood hazard areas.

Floodplain zoning regulates how development is allowed within floodplains. The program's main goal is to protect people and their property from unwise floodplain development. It also protects society from costs associated with developed floodplains.

Virginia Dam Safety Act

The Virginia Soil and Water Conservation Board established the state's dam safety regulations as a result of the passage of the Virginia Dam Safety Act. The Dam Safety Program's purpose is to provide for safe design, construction, operation and maintenance of dams to protect public safety. The program enforces permit requirements related to the construction and alteration of impounding structures. All dams in Virginia are subject to the Dam Safety Act unless specifically excluded. Inundation mapping is required for all Class I and Class II dams in the Commonwealth. Dam Safety Program officials recommend mapping for all classified dams (VS&WCB, 2005).

The Virginia Dam Safety Act, Article 2, Chapter 6, Title 10.1 (10.1-604 et seq) of the Code of Virginia and Dam Safety Impounding Structure Regulations (Dam Safety Regulations), established and published by the Virginia Soil and Water Conservation Board (VSWCB). New regulations were put into effect Sept. 26, 2008, which regulations require dam break inundation zone mapping in order to identify areas that will be subject to flooding during a dam failure.

Shoreline Erosion Advisory Service (SEAS)

VDCR's Shoreline Erosion Advisory Service promotes environmentally acceptable shoreline and riverbank erosion control measures to protect private property and reduce sediment and nutrient loads to the Chesapeake Bay and other waters of the Commonwealth. In addition, the program promotes research for improved shoreline management techniques to protect and enhance Virginia's shoreline resources.

Since SEAS was created in 1980, VDCR has provided technical advice about tidal shoreline erosion problems to more than 7,000 clients. They include landowners, local governments and environmental agencies. SEAS program activities also help local governments deal with sediment and nutrient loads from shoreline erosion and, of course, address the Commonwealth's obligation to reduce sediment and nutrient loads in the Chesapeake Bay and its tributaries.

Virginia Department of Forestry (VDOF)

The Virginia Department of Forestry (VDOF) is responsible for the protection of 15.8 million acres of forest land from fire, insects and disease. The principle goals of the Forest Protection Program are to prevent injury or loss of human life, minimize property damage and protect resources.

VDOF has a well-defined and organized forest protection team, with every member of the Department having fire responsibilities. The ability to adapt to emergencies enables a small formal fire suppression force to limit annual fire losses to an average of less than 8,200 acres (10-year average). This low average is accomplished through coordination with local fire departments, forest industry, federal agencies, other state agencies and VDOF organized volunteer fire crews.

In 2010, the Department completed a statewide assessment of the state forestry resource ("The State of The Forest – 2010") and a strategic plan ("Strategic Plan: Harnessing the Winds of Change") document, both in response to congressional mandate in the passage of the 2008 Farm bill.

Virginia Marine Resources Commission (VMRC):

The Virginia Marine Resources Commission was established in 1875 as the Virginia Fish Commission. The Virginia Wetlands Act was passed in 1972 and placed under the management of VMRC, as was the 1980 Coastal Primary Sand Dune Protection Act. In 1982, the General Assembly broadened the 1972 Wetlands Act to include non-vegetated wetlands. The Habitat Management Division issues three types of Environmental Permits: subaqueous or bottomlands, tidal wetlands, and coastal primary sand dunes. The division's authority specifically regulates physical encroachment into these valuable resource areas.

The permit process relies on a single Virginia joint local/state/Federal permit application. The review process takes into account various local, state and Federal statutes governing the disturbance or alteration of environmental resources. The Marine Resources Commission plays a central role as an information clearinghouse for all three levels of review. Applications receive independent yet concurrent review by the community's Wetlands Board, the VMRC, the Virginia Department of Environmental Quality, and the U.S. Army Corps of Engineers.

Department of Housing and Community Development

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code (VUSBC), and each county or city is responsible for enforcing the code locally. As of the last quarter of 2010, the VUSBC is based on the 2006 International Building Code, International Plumbing Code, International Mechanical Code, and International Fire Protection Code, and the 1999 National Electrical Code. The 2006 version of the IBC has been incorporated into the VUSBC, and the 2009 version of the IBC is expected to go into effect in the near future. The code contains the building regulations that must be complied with when constructing a new building or structure or an addition to an existing building, maintaining or repairing an existing building, or renovating or changing the use of a building or structure.

Enforcement of the VUSBC is the responsibility of the local government's building inspections department. The VUSBC contains enforcement procedures that must be used by the enforcing agency.

As provided in the Uniform Statewide Building Code Law, Chapter 6 (36-97 et seq.) of Title 36 of the Code of Virginia, the USBC supersedes the building codes and regulations of the counties, municipalities and other political subdivisions and state agencies related to any construction, reconstruction, alterations, conversion, repair or use of buildings and installation of equipment therein. The USBC does not supersede zoning ordinances or other land use controls that do not affect the manner of construction or materials to be used in the construction, alteration, or repair.

C. Regional Capabilities

George Washington Regional Commission (GWRC)

One of 21 Planning District Commissions in the Commonwealth of Virginia, GWRC is a political subdivision representing seven local governments. Planning District Commissions are voluntary associations created pursuant to the Virginia Area Development Act adopted in 1969. The purpose of planning district commissions, as set out in the Code of Virginia, Section 15.2-4207 is "…to encourage and facilitate local government cooperation and state-local cooperation in addressing on a regional basis problems of greater than local significance." GWRC serves as a resource of technical expertise to its member local governments. Specific programs affiliated with GWRC include coastal zone environmental planning, regional all-hazards mitigation planning, transportation, ridesharing, telecommuting, and environmental concerns, which are described below.

Under the recommendation of the 2006 Regional All-Hazards Mitigation Plan, GWRC established a regional clearinghouse of GIS data to support emergency contingency planning. In the summer of 2010, the region received parcel and building footprint data layers from the City of Fredericksburg and Caroline County, completing regional coverage of these important data layers for mitigation planning. Through the regional scenario planning process being implemented by FAMPO and GWRC, every parcel in the region has been coded according to a common land use classification system ("Place Type Pallet"), advancing the region's capacity to look at regional land use problems through a common "lens".

Fredericksburg Area Metropolitan Planning Organization (FAMPO)

Based upon the 1990 Census, the Fredericksburg, VA area was designated an urbanized area (population greater than 50,000). To continue receiving federal funds for transportation improvements, federal law requires all urbanized areas in the United States to conduct the "3-C" (continuing, comprehensive and cooperative) transportation planning process. In response to the Census designation, a "Memorandum of Understanding" was signed in November 1992 between the Commonwealth of Virginia (and its participating agencies), the three jurisdictions (City of Fredericksburg, & Counties of Spotsylvania and Stafford), and the Potomac and Rappahannock Transportation Commission (PRTC) to create the Fredericksburg Area Metropolitan Planning Organization (FAMPO) FAMPO's policy board is the federally-recognized transportation policy board for the "urbanized" portion of Planning District 16, which includes the City of Fredericksburg and Spotsylvania and Stafford counties. FAMPO is responsible for developing a Constrained Long Range Plan (CLRP), managing the regional Transportation Improvement Program (TIP) and developing an annual Unified Planning Work Program (UPWP). In addition, FAMPO also prepares critical regional transportation planning studies. Transportation planning activities in Caroline and King George Counties through the VDOT's Rural Transportation Planning Assistance Program is coordinated with FAMPO's urban transportation planning program. Staffing for FAMPO is provided by the George Washington Regional Commission.

GWRideConnect

GWRideConnect is the ridesharing agency that serves the Region, and promotes ridesharing and transportation demand management (TDM) techniques to assist persons seeking transportation options to their workplaces and other destinations. The program promotes, plans, and establishes transportation alternatives to improve air quality, reduce congestion, and improve the overall quality of life for the citizens in the region.

The GWRideConnect program assists in the creation of new commuter pools (cars, vans, and buses) and works toward keeping these pools successfully operating. The program also acts as an information clearinghouse for persons interested in the benefits, services and options of mass transportation. GWRideConnect distributes match letters and packets containing information on van, car and bus pools, as well as information on the Virginia Railway Express (VRE), Washington Metro System and telecommuting.

GWRideConnect contracts with the Washington Metropolitan Area Transportation Authority to accept Metrocheks (tax free transit subsidies) from area vanpools. GWRideConnect also subsidizes vanpools through the Van Start and Van Save program and, in cooperation with the Virginia Division of Risk Management, established the AdVANtage self-insurance program for vanpool operators. These programs allow GWRideConnect to aid vanpools in the crucial start-up period and to assist existing vanpools that may be in danger of folding.

Fredericksburg Regional Alliance (FRA)

FRA is a public, private economic development marketing partnership created to provide CEOs, presidents, corporate real estate executives, facility planners, and site selection consultants with a single source for comprehensive demographic and economic information on the Fredericksburg Region -- which includes the City of Fredericksburg and the counties of Caroline, King George, Spotsylvania, and Stafford -- while also providing a wide range of services designed to facilitate the site selection process.

By working in cooperation with local economic development offices, the Virginia Employment Commission (VEC), educational institutions, and other regional groups, the Alliance is able to offer a truly comprehensive collection of services and information, including: demographic and economic data; community tours; site, building, and office space inspections; industry-specific wage, workforce, and labor availability information; tax and cost of living comparisons; financing options; and confidential project-specific proposals from localities.

The Rappahannock River Basin Commission (RRBC)

The RRBC's mission and purpose as stated in Section 62.1-69.27 of the Code of Virginia is: "(T)o provide guidance for the stewardship and enhancement of the water quality and natural resources of the Rappahannock River Basin. The Commission shall be a forum in which local governments and citizens can discuss issues affecting the Basin's water quality and quantity and other natural resources." The RRBC's Water Allocation Group was created in the spring of 2000 to facilitate and encourage the planning for water allocation, including water supply and discharge in the Rappahannock. Participants included local and state elected officials, representatives of utilities departments in the basin, local, state and federal environmental agencies and others. The Water Allocation Group was chaired by the Chair of the Rappahannock River Basin Commission. The Water Allocation Group developed many recommendations for the Commission which have in turn been adopted and forwarded to member localities and the Commonwealth of Virginia. A major project of the Water Allocation Group was the development of the Water Supply Planning Model.

According to the US EPA, the Rappahannock River and the Chesapeake Bay are degraded. The nutrient pollution issues in the Rappahannock are driven mostly by non-point sources, such as agriculture, land development, forestry, septic systems and lawn management. Non-point sources are regulated to a far less degree than point sources. This means that more effort must be invested on communication, coordination, cooperation, and incentives to achieve success in addressing the nonpoint source issues than for the point source issues. The projections for success associated with various strategies in the RTS are based on the inputs and outputs of a model. The true measure of success however will be the results found from monitoring the quality of the waters of the Rappahannock basin.
The Non-Point Source Pollution Working Group (NPWG) was formed by the RRBC in 2005. Excess amounts of nutrients and sediment flow into the River and the Bay from the land and from the air (nonpoint source pollution) and from wastewater treatment plants and from industrial facilities (point source pollution). The Rappahannock "Tributary Strategy" (RTS) identified nutrient and sediment reduction goals necessary to achieve water quality and aquatic habitat restoration objectives for the Bay by 2010, in accordance with the Chesapeake Bay Agreement of 2000. Attainment of these goals and objectives will require a major effort on the part of all levels of government, landowners and the public.

A "real world" focus to the implementation of strategies is viewed as important and essential to maximizing the opportunities for achieving the greatest possible return on investments made in addressing nonpoint source pollution. Opportunities to share experiences and to forthrightly discuss practical solutions will aid all stakeholders in avoiding possible pitfalls, unintended consequences and the repetition of mistakes. The Non-Point Working Group has been active in reviewing and commenting on

Chesapeake Bay Preservation Act Phase III compliance review, revisions to the State storm water management regulations and, most recently, the draft Chesapeake Bay Total Maximum Daily Load (TMDL) allocations in the draft State Plan.

To assist in water resource and quality planning the Rappahannock Basin has several documents out to assist the local communities. These documents are Guiding Principles for Water Resource Planning, Planning for Groundwater use in the Rappahannock Basin, and Groundwater Planning: Recommendations by the Water Allocation Group to the Rappahannock River Basin Commission.

II. Jurisdiction Capability Assessment

A. Caroline County, including the Town of Bowling Green and the Town of Port Royal Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the MAC developed a local capability assessment for Caroline County and the Towns of Bowling Green and Port Royal. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the other community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrices presented in Table 6-2 outline the current and planned programming that will impact the ability of Caroline County, the Town of Bowling Green, and the Town of Port Royal, respectively, to plan for and mitigate against natural hazards.

Form of Governance

Caroline County is governed by an elected Board of Supervisors and administered on a day-to-day basis by a County Administrator and departmental staff. The Town of Bowling Green is governed by an elected Town Council and Mayor and administered on a day-to-day basis by a Town Manager. The town of Port Royal has a Council/Manager form of government, which is under the control of a professional manager. The mayor chairs council meetings.

Guiding Community Documents

Caroline County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, suggested facility development standards, utilities plans, capital improvement plans, and emergency management plans. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential planning document to the County is its Comprehensive Plan.

Comprehensive Plan, 2010

- Presents policies and strategies for growth management plan and recognizes the value in preserving the desired rural characteristics of the County
- Ensures responsible stewardship of the County's natural and historic resources, including riparian buffers, floodplains, wetlands, and historic structures and places
- Plans for continued growth and development in designated growth areas, including:
    - Bowling Green/Milford Primary Growth Area
    - Skinker's Neck Growth Area
    - Carmel Church and Ladysmith Sub-areas
    - Secondary Growth Areas – Port Royal, Chilesburg, Dawn, and Cedon
- Plans for necessary transportation enhancements and improvements to service projected growth
- Plans for operation and expansion of public facilities to accommodate expected growth in the County. Facilities include water and sewer service facilities, public libraries, first response emergency services facilities (fire/EMS stations), and parks and recreation facilities.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Most of document recommends policies and standards for new and existing development.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the County is responsible for enforcing locally. The Uniform Statewide Building Code was based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for Caroline County is presented in Table 6-2.

Public Education

Among the public outreach mechanisms available in Caroline County, the County's website provides County residents with pertinent information, provides an on-line complaint form, and answers several Frequently Asked Questions (FAQs). The County also posts most of its guiding documents, including the Comprehensive Plan on this site.

The Town of Bowling green also provides public outreach through its website. It, too, provides residents and visitors with timely information and guidance.

Emergency Preparedness

Caroline County utilizes a SMS and email notification system, Twitter, and the County's website to notify residents of emergency and non-emergency information. The Town of Bowling Green also utilizes a cable access channel to notify residents of information which may include emergency preparedness.

The tables below represent the identified capabilities of the Towns and Caroline County. All data was provided by a representative of that jurisdiction.

Table 6-2. Capability Matrix - Caroline County

Capability	Caroline County
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes

Capability	Caroline County
-Effective FIRM Date	15-August-89
-Substantial Damage Language	Yes
- Certified Floodplain Manager	No
- # of Floodprone Parcels	2,424
- # of NFIP policies	41
- Maintain Elevation Certificates	No
- # of Repetitive Losses	0
CRS Rating	N/A
Stormwater Program	Yes
Building Code Version Full-time Building Official	VA USBC 2009 Edition (based on IBC)
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential - 3; Commercial - 3
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	Yes
Warning Systems in Place	Poor
- Storm Ready Certified	No
- Weather Radio Reception	Fair
- Outdoor Warning Sirens	No
-Emergency Notification (SMS Text)	Yes – Caroline Alert System
-other? (e.g., cable over-ride)	No
GIS system	No
-Hazard Data	No
-Building footprints	No
-Tied to Assessor data	No
-Land Use designations	No
Structural Protection Projects	No
Property Owner Protection Projects	Yes-Acquisition/Elevation
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by Community.

Table 6-3. Capability Matrix - Town of Bowling Green

Capability	Town of Bowling Green
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	N/A
-Substantial Damage Language	N/A
- Certified Floodplain Manager	No
- # of Floodprone Buildings	N/A
- # of NFIP policies	N/A
- Maintain Elevation Certificates	No
- # of Repetitive Losses	N/A
CRS Rating	N/A
Stormwater Program	Yes
Building Code Version Full-time Building Official	VA USBC 2009 Edition (based on IBC)
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential – 3; Commercial – 3
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	Yes
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	No
-other (e.g., cable over-ride)	Yes-Cable-Emergency Alert System
GIS system	Yes
-Hazard Data	N/A
-Building footprints	N/A
-Tied to Assessor data	N/A
-Land Use designations	N/A
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes

Capability	Town of Bowling Green
Public Information Program/Outlet	Yes
Environmental Education Program	No

Source: Data provided by Community.

Table 6-4. Capability Matrix – Town of Port Royal

Capability	Town of Port Royal
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	2010
-Substantial Damage Language	N/A
- Certified Floodplain Manager	No
- # of Floodprone Buildings	0
- # of NFIP policies	N/A
- Maintain Elevation Certificates	No
- # of Repetitive Losses	0
CRS Rating	N/A
Stormwater Program	No
Building Code Version Full-time Building Official	VA USBC 2009 Edition (based on IBC)
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential – 3; Commercial – 3
Local Emergency Operations Plan	No
Hazard Mitigation Plan	Yes
Warning Systems in Place	Yes – Fire House
- Storm Ready Certified	No
- Weather Radio Reception	Yes; Fire House
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	No
-other (e.g., cable over-ride)	No
GIS system	No
-Hazard Data	N/A
-Building footprints	N/A
-Tied to Assessor data	N/A
-Land Use designations	N/A

Capability	Town of Port Royal
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	Fire House
Natural Resource Inventory	No
Cultural Resources Inventory	Yes
Erosion Control Procedures	Chesapeake Bay Act
Sediment Control Procedures	Chesapeake Bay Act
Public Information Program/Outlet	No
Environmental Education Program	No

Source: Data provided by Town of Port Royal, Alex Long ; 01/01/2012

B. City of Fredericksburg Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the MAC developed a local capability assessment for the City of Fredericksburg. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6-5 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

A six-member City Council and a Mayor govern the City of Fredericksburg. The Mayor and two Council members are elected at large while the remaining four Council members are elected from the City's four wards. The City Manager and the various departments under the City Manager's authority carry out the day-to-day administration of the City's services and programming.

Guiding Community Documents

The City of Fredericksburg has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, public works, and public utilities plans, capital improvement plans, and emergency management plans. The City uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the jurisdiction guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, 2007

- Presents policies and strategies for growth management plan and recognize the value in preserving the desired rural characteristics of the City.
- Recognizes the value of the City's considerable natural, cultural, and historic resources.
- Recognizes the impacts of regional facilities, transportation corridors, and hospital facilities
- Ensures that development is done in an environmentally sensitive, planned manner that serves to preserve environmentally sensitive features such as floodplains, wetlands and natural topography.
- Develops a well planned, efficient, effective and safe transportation system that meets local, regional and interstate transportation needs.
- Preserves the City's historic resources that provide valuable information about the proud history of the City and its residents.
- Recognizes State and federal flood and other water resource regulations, including the Chesapeake Bay Preservation Act.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Recommends policies and standards for new and existing development.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the City is responsible for enforcing locally. As of October of 2003, the Uniform Statewide Building Code is based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for the City of Fredericksburg is presented in Table 6-5.

Public Education

Among the readily available public outreach mechanisms available in the City of Fredericksburg, the City's website provides City residents with pertinent information, including local events and information on the City's rich cultural history, and answers several Frequently Asked Questions (FAQs). The City also posts most of its guiding documents, including the Comprehensive Plan on this site.

Emergency Preparedness

The City of Fredericksburg utilizes a cable access channel, Reverse 911, and Fredericksburg Alert (email and text message capability) to notify residents of information which may include emergency preparedness.

Table 6-5.Capability Matrix - City of Fredericksburg

Capability	City of Fredericksburg
Comp Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	19-September- 2007
-Substantial Damage Language	Yes
- Certified Floodplain Manager	No
- # of Floodprone Buildings	300
- # of NFIP policies	164
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	4
CRS Rating	N/A
Stormwater Program	Yes

Building Code Version Full-time Building Official	VA USBC 2009 Edition (based on IBC)
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential - 4; Commercial - 4
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	Yes
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes, Poor
- Outdoor Warning Sirens	No
-Emergency Notification (R-911, Fredericksburg Alert)	Yes
-other? (e.g., cable over-ride)	Yes - Emergency Alert System
GIS system	No
-Digital Hazard Data	No
-Digital Building footprints	No
-Tied to Assessor data	No
-Land Use designations	No
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by Community.

C. King George County Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the MAC developed a local capability assessment for King George County. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6-6 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

The County is governed by an elected five member Board of Supervisors and administered on a day-to-day basis by a County Administrator and departmental staff.

Guiding Community Documents

King George County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, subdivision ordinance, zoning ordinance, capital improvement plans, and emergency management plans. In addition, the King George County Service Authority administers the standards and specifications governing water and sewer utility service. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the jurisdiction guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, adopted May 25, 2000

The County's current Comprehensive Plan outlines the County's future planning goals, including:

- Preserve the Rural Characteristics of King George County;
- Encourage land use patterns that sustain and enhance the health, safety, morals, order, convenience, prosperity and general welfare of the residents of King George County;
- Promote a healthy, diversified economy in the County;
- Encourage protection of critical environmental resources and maintain renewable natural resources for future generations;
- Encourage a balance of residential zoning classifications to meet the needs of all county residents while concentrating and guiding growth in and around service districts as designated in this Plan;
- Seek to manage through-traffic flow on principal roads in such a manner as to minimize the impact on local-traffic flow;
- Protect water supplies and assure an adequate quality and quantity of water; and
- Encourage the construction and control of central sewage facilities in designated areas.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Provides policies and standards for new and existing development as allowed by the Code of Virginia.

Subdivision ordinance, adopted December 17, 2002

The purpose of this ordinance is to establish standards for the subdivision of land and development procedures for King George County.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the County is responsible for enforcing locally. The 2009 edition of the Uniform Statewide Building Code took effect 3/1/2011, which is based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for King George County is presented in Table 6-6.

Public Education

Among the readily available public outreach mechanisms available in King George County, the County's website provides County residents with pertinent information, provides an on-line complaint form, and answers several Frequently Asked Questions (FAQs). The County posts most of its guiding documents, including the Comprehensive Plan on this site. KGALERT also serves as a source of public education through the availability and presentation of disaster and emergency preparedness information. Public information is also provided through articles published I the local weekly newspaper, The Journal, and the daily regional newspaper, The Free Lance Star. King George County Department of Fire, Rescue and Emergency Services will launch their own department website in the spring 2011. The Emergency Management Division will provide timely preparedness and disaster information on this website.

Emergency Preparedness

The County is served by Metrocast Cable, which provides cable services for County residents. King George County does not have access to override the cable channel for emergency information purposes; there is no EAS Activation capability. The County does have access to the public access channel for posting information. Emergency notifications are provided to citizens and businesses through KGALERT, CityWatch (Reverse 911) local radio station announcements, and Twitter (kgva_firerescue) postings.

Table 6-6. Capability Matrix - King George County.

Capability	King George County
Comprehensive Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes

Capability	King George County
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	March 16, 2009
-Substantial Damage Language	Yes
- Certified Floodplain Manager	No
- # of Floodprone Buildings	18
- # of NFIP policies	18
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	0
CRS Rating	N/A
Stormwater Program	No
Building Code Version Full-time Building Official	VA USBC 2009 Edition (based on IBC)
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential – 4; Commercial - 4
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	Yes
Warning Systems in Place	Yes
- Storm Ready Certified	Yes
- Weather Radio Reception	Improved coverage due to Fredericksburg transmitter
-Emergency Notification (R-911)	Yes
-other? (e.g., cable over-ride)	KGALERT, social media
GIS system	Yes
-Hazard Data	Yes
-Building footprints	Yes
-Tied to Assessor data	Yes
-Land Use designations	Yes
Structural Protection Projects	Yes
Property Owner Protection Projects	No
Critical Facilities Protected	Minimal
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by Community.

D. Spotsylvania County Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the MAC developed a local capability assessment for Spotsylvania County. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6-7 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

The County is governed by an elected Board of Supervisors and administered on a day-to-day basis by a County Administrator and subsequent departmental staff.

Guiding Community Documents

Spotsylvania County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, public works, and public utilities plans, capital improvement plans, and emergency management plans. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the jurisdiction guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, adopted November 2008

- Presents policies and strategies for growth management and recognizes the value in preserving the desired rural characteristics of the County.
- Strategizes to preserve the natural environment, "open space" and areas deserving special attention while providing sufficient designated growth areas to accommodate expected demand for business and residential growth.
- Strategizes regulating open burning, and considers eliminating open burning for land clearing. Statewide fire prevention code adopted.
- Ensures that development is done in an environmentally sensitive, planned manner that serves to preserve environmentally sensitive features such as floodplains, wetlands and natural topography.
- Develops a well planned, efficient, effective and safe transportation system that meets local, regional and interstate transportation needs.
- Preserves the County's historic resources that provide valuable information about the proud history of the County and its residents.
- Improves planning information resources by completing, performing and maintaining surveys of existing resources, land uses, and facilities.
- Recognizes State and Federal flood regulations.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Contains standards for development and redevelopment.

Building Codes

The Virginia Uniform Statewide Building Code (USBC) is a state regulation promulgated by the Virginia Board of Housing and Community Development, a Governor-appointed board, for the purpose of establishing minimum regulations to govern the construction and maintenance of buildings and structures. The international codes are adopted by reference in the USBC. The USBC supersede the building codes and regulations of the counties. Enforcement of the provisions of the USBC for construction and rehabilitation shall be the responsibility of the local building department. The 2009 edition became effective 3/1/2011.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for Spotsylvania County is presented in Table 6-7.

Public Education

Among the readily available public outreach mechanisms available in Spotsylvania County, the County's website provides County residents with pertinent information, provides updates on County programming and events, and answers several Frequently Asked Questions (FAQs). The County also posts most of its guiding documents, including the Comprehensive Plan on this site. The County's cable station airs information and updates 24 hours a day and includes links to information sources.

Emergency Preparedness

Spotslyvania County utilizes a Roam Secure Public Notification System to notify residents of important information. The County does have access to override all cable channels for EAS activation. Additionally, the Department of Fire, Rescue, and Emergency Management website has links to multiple websites providing information on emergency preparedness.

Table 6-7. Capability Matrix - Spotsylvania County

Capability	Spotsylvania County
Comp Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	18-February-98
-Substantial Damage Language	Yes
- Certified Floodplain Manager	Yes
- # of Floodprone Buildings	410
- # of NFIP policies	135

Capability	Spotsylvania County
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	0
CRS Rating	No
Stormwater Program	Yes
Building Code Version	USBC 2009 Edition (based on IBC)
Full-time Building Official	Yes
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential - 4; Commercial - 3
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	Yes
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes; high coverage
- Outdoor Warning Sirens	Yes; 10 mile radius around the North Anna Power Station
-Emergency Notification (R-911)	Yes
-other (e.g., cable over-ride)	Yes- Roam Secure Emergency Alert System
GIS system	Yes
-Hazard Data	Yes
-Building footprints	Yes
-Tied to Assessor data	Yes
-Land Use designations	Yes
Structural Protection Projects	No
Property Owner Protection Projects	No
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by Community.

E. Stafford County Capability Assessment

As an additional tool to assist with the examination of the hazards identified and to evaluate the community's ability to plan, develop, and implement hazard mitigation activities, the MAC developed a local capability assessment for Stafford County. This assessment is designed to highlight both the regulatory tools available to the community to assist with natural hazard mitigation and the community assets that may help facilitate the planning and implementation of natural hazard mitigation over time. The capability matrix presented in Table 6-8 outlines the locality's current and planned programming that will impact the community's ability to plan for and mitigate against natural hazards.

Form of Governance

The County is governed by an elected Board of Supervisors and administered on a day-to-day basis by a County Administrator and subsequent departmental staff.

Guiding Community Documents

Stafford County has a range of guidance documents and plans for each of their departments. These include a comprehensive plan, public works, and public utilities plans, capital improvement plans, and emergency management plans. The County uses building codes, zoning ordinances, subdivision ordinances, and various planning strategies to address how and where development occurs. One essential way the region guides its future is through policies laid out in the Comprehensive Plan.

Comprehensive Plan, adopted December 2010

- Plans and analysis of the County's transportation, land use, environmental, and public resources.
- Accounts for the County's desire to retain the viability of its agricultural enterprises and heritage; implement a multi-faceted economic development program; establishment of adequate public infrastructure for planned growth and development trends; and improve and enhance both the man-made and natural environment in the County.
- Accounts for urban, suburban, and rural/agricultural land uses in designated corridors.

Zoning & Development Standards

- Identifies existing federal and state regulations.
- Recommends policies and standards for new and existing development.

Building Codes

The Commonwealth of Virginia is responsible for enacting the Virginia Uniform Statewide Building Code, which the County is responsible for enforcing locally. As of October of 2003, the Uniform Statewide Building Code is based on the IBC, IRC, and IFPC.

The Building Code Effectiveness Grading Schedule (BCEGS) assesses the building codes in effect in a particular community and how the community enforces its building codes, with special emphasis on mitigation of losses from natural hazards. Municipalities with well-enforced, up-to-date codes should demonstrate better loss experience, and insurance rates can reflect that. The BCEGS program assigns

each municipality a BCEGS grade of 1 (exemplary commitment to building-code enforcement) to 10. The BCEGS grade for Stafford County is presented in Table 6-8.

Public Education

Among the readily available public outreach mechanisms available in Stafford County, the County's website provides County residents with pertinent information, provides updates on County programming and events, and answers several Frequently Asked Questions (FAQs). The County also posts most of its guiding documents, including the Comprehensive Plan on this site. The County launched both Twitter and Facebook pages in 2010 to expand its public outreach initiative.

Emergency Preparedness

Stafford utilizes a cable access channel, Reverse911, and Stafford Alert to notify residents of important information. The County does have access to override all cable channels for EAS activation.

Table 6-8. Capabilities Matrix - Stafford County.

Capability	Stafford County
Comp Plan	Yes
Land Use Plan	Yes
Subdivision Ordinance	Yes
Zoning Ordinance	Yes
NFIP/FPM Ordinance	Yes
-Effective FIRM Date	February 4, 2005
-Substantial Damage Language	Yes
- Certified Floodplain Manager	Yes
- # of Floodprone Buildings	1,916
- # of NFIP policies	288
- Maintain Elevation Certificates	Yes
- # of Repetitive Losses	8
CRS Rating	N/A
Stormwater Program	Yes
Building Code Version Full-time Building Official	USBC 2009 Edition (based on IBC)
- Conduct "As-built" Inspections	Yes
BCEGS Rating	Residential - 4; Commercial - 4
Local Emergency Operations Plan	Yes
Hazard Mitigation Plan	Yes
Warning Systems in Place	Yes
- Storm Ready Certified	No
- Weather Radio Reception	Yes; full coverage

Capability	Stafford County
- Outdoor Warning Sirens	No
-Emergency Notification (R-911)	Yes
-other? (e.g., cable over-ride)	Yes-Emergency Broadcast System
GIS system	Yes
-Hazard Data	Yes
-Building footprints	Yes
-Tied to Assessor data	Yes
-Land Use designations	Yes
Structural Protection Projects	No
Property Owner Protection Projects	Yes-Acquisition/Elevation
Critical Facilities Protected	No
Natural Resource Inventory	Yes
Cultural Resources Inventory	Yes
Erosion Control Procedures	Yes
Sediment Control Procedures	Yes
Public Information Program/Outlet	Yes
Environmental Education Program	Yes

Source: Data provided by Community.

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CHAPTER 7 – MITIGATION STRATEGY

This section of the Hazard Mitigation Plan describes the most challenging part of any such planning effort the development of a Mitigation Strategy. It is a process of:

1. Setting mitigation goals,
2. Considering mitigation alternatives,
3. Identifying objectives and strategies, and
4. Developing a mitigation action plan.

In being comprehensive, the development of the strategy included a thorough review of all natural hazards and identifies far-reaching policies and projects intended to not only reduce the future impacts of hazards, but also to assist counties and municipalities achieve compatible economic, environmental and social goals. In being strategic, the development of the strategy ensures that all policies and projects are linked to established priorities and assigned to specific departments or individuals responsible for their implementation with target completion deadlines. When necessary, funding sources are identified that can be used to assist in project implementation.

The 2012 Update includes a complete review of the previous plan's strategies and the updated HIRA that was compiled for this plan update. The previous plan's strategies were reviewed in order to determine progress made and applicability for inclusion in the plan update. Many of the strategies were brought forward into the new plan, but many were also completed, or determined to no longer be applicable based on the updated HIRA and the capabilities of each jurisdiction. As such, each jurisdiction compiled a new set of mitigation strategies that were determined to be the most effective use of their resources. To review these strategies, please refer to section III of this chapter.

I. Planning Process

The hazard mitigation planning process conducted by the MAC is a typical problem-solving methodology:

- Describe the problem (Hazard Identification),
- Estimate the impacts the problem could cause (Vulnerability Assessment),
- Assess what safeguards exist that might already or could potentially lessen those impacts (Capability Assessment), and
- Using this information, determine what, if anything, can be done, and select those actions that are appropriate for the community in question (Develop an Action Plan).

When a community decides that certain risks are unacceptable and that certain mitigation actions may be achievable, the development of *goals* and *objectives* takes place. Goals and objectives help to describe what actions should occur, using increasingly narrow descriptors. Initially, long-term and general statements known as broad-based goals are developed. Goals then are accomplished by meeting objectives, which are specific and achievable in a finite time period. In most cases there is a third level, called *strategies,* which are detailed and specific methods to meet the objectives.

The MAC discussed regional goals and objectives for this plan at two points in the planning process. First, they attended a workshop on July 12, 2011, to discuss the results of the hazard identification and risk assessments and to begin developing the mitigation strategy by discussing the 2006 mitigation goals. These original goals were broad and the committee felt that in general, they still were applicable to the 2012 plan update. Then, during the mitigation strategies development conference call on September 8, the committee finalized the regional goals and added two additional objectives to goal 3.

Following the development of the regional goals, each jurisdiction set out to develop their own action plans and update their 2006 actions. Weekly conference call question and answer sessions where held during the month of September to assist the jurisdictions when needed. After the individual actions plans were developed the committee convened on October 4 to discuss regional mitigation strategies. In doing so, the committee reviewed the individual action plans and found several themes among the various action plans. Many of the jurisdictions had actions relating to the development of a preparedness guide, a special needs registry/plan, and each had several flood-related actions as well. The committee considered all of these themes and developed six regional actions that they will work to accomplish within the next planning cycle.

II. Mitigation Alternatives

During the month of September, member jurisdictions were asked to develop their new 2012 action plans. During the weekly conference calls, the jurisdictions were provided a range of alternatives that were identified and prioritized by each jurisdiction. These alternatives are presented below.

A. Identification and Analysis of Mitigation Techniques

In formulating the GWRC's mitigation strategy, a wide range of activities were considered in order to help achieve the general regional goals in addition to the specific hazard concerns of each participating jurisdiction. This includes the following activities as recommended by the Emergency Management Accreditation Program (EMAP):

1) The use of applicable building construction standards;
2) Hazard avoidance through appropriate land-use practices;
3) Relocation, retrofitting, or removal of structures at risk;
4) Removal or elimination of the hazard;
5) Reduction or limitation of the amount or size of the hazard;
6) Segregation of the hazard from that which is to be protected;
7) Modification of the basic characteristics of the hazard;
8) Control of the rate of release of the hazard;
9) Provision of protective systems or equipment for both cyber or physical risks;
10) Establishment of hazard warning and communication procedures; and
11) Redundancy or duplication of essential personnel, critical systems, equipment, information materials.

All activities considered by the MAC can be classified under one of the following six (6) broad categories of mitigation techniques:

Prevention

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes

- Open space preservation
- Floodplain regulations
- Stormwater management regulations
- Drainage system maintenance
- Capital improvements programming
- Shoreline / riverine / fault zone setbacks

Property Protection

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (e.g., windproofing, floodproofing, seismic design techniques, etc.)
- Safe rooms, shutters, shatter-resistant glass
- Insurance

Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes and sand dunes. Parks, recreation or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Beach and dune preservation
- Riparian buffers
- Forest/vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)
- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization

Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams / levees / dikes / floodwalls / seawalls
- Diversions / detention / retention
- Channel modification
- Beach nourishment
- Storm sewers

Emergency Services

Although not typically considered a "mitigation" technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Evacuation planning and management
- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children educational programs
- Hazard expositions

B. Prioritizing Alternatives

Through discussion and a qualitative analysis by the jurisdiction committee representative, each jurisdiction used the STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) Criteria to prioritize the appropriate mitigation alternatives for their community. This methodology requires that social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions for the area's jurisdictions to undertake. This process was used to help ensure that the most equitable and feasible actions would be undertaken based on a jurisdiction's capabilities. Table 7-1, below, provides information regarding the review and selection criteria for alternatives.

Table 7-1. STAPLEE Review and Selection Criteria for Mitigation Alternatives.

STAPLE/E Review and Selection Criteria for Alternatives
Social
• Is the proposed action socially acceptable to the community(s)? • Are there equity issues involved that would mean that one segment of a community is treated unfairly? • Will the action cause social disruption?
Technical
• Will the proposed action work? • Will it create more problems than it solves? • Does it solve a problem or only a symptom? • Is it the most useful action in light of other community(s) goals?
Administrative
• Can the community(s) implement the action? • Is there someone to coordinate and lead the effort? • Is there sufficient funding, staff, and technical support available? • Are there ongoing administrative requirements that need to be met?
Political
• Is the action politically acceptable? • Is there public support both to implement and to maintain the project?
Legal
• Is the community(s) authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? • Are there legal side effects? Could the activity be construed as a taking? • Is the proposed action allowed by a comprehensive plan, or must a comprehensive plan be amended to allow the proposed action? • Will the community(s) be liable for action or lack of action? • Will the activity be challenged?
Economic
• What are the costs and benefits of this action? • Do the benefits exceed the costs? • Are initial, maintenance, and administrative costs taken into account? • Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)? • How will this action affect the fiscal capability of the community(s)? • What burden will this action place on the tax base or local economy? • What are the budget and revenue effects of this activity? • Does the action contribute to other community goals, such as capital improvements or economic development? • What benefits will the action provide?
Environmental
• How will the action affect the environment? • Will the action need environmental regulatory approvals? • Will it meet local and state regulatory requirements? • Are endangered or threatened species likely to be affected?

Ranking was completed in order of relative priority based on the STAPLE/E criteria, as well as the strategy's potential to reduce vulnerability to natural hazards.

III. Goals, Objectives and Strategies

A. Goals and Strategies

Through a series of meetings the following goals and strategies for the Region were accepted by the MAC. The goals and strategies form the basis for the development of a Mitigation Action Plan and specific mitigation projects to be considered for the Region. The process consisted of 1) setting goals, 2) considering mitigation alternatives, 3) identifying strategies, and 4) developing an action plan results in a mitigation strategy.

Community officials should consider the goals that follow before making community policies, public investment programs, economic development programs, or community development decisions for their communities. In addition, Regional strategies have been developed for each goal. These strategies state a more specific outcome that the jurisdictions of the GWRC region expect to accomplish over the next five years. The strategies will outline the specific steps necessary to achieve that end.

The jurisdictions came to an agreement upon what the regional and goals should be. Those goals then also applied to each individual community. Table 7-2 lists those goals and objectives. Section B provides a table of all of the regional and community specific mitigation actions; section C provides community specific mitigation action plans.

Table 7-2. 2012 Mitigation Goals & Objectives.

#		Goals & Objectives
Goal 1:		Reduce the future impacts and losses from identified hazards.
Goal 2:		Educate and engage the public regarding hazards, their impacts, and feasible actions.
Goal 3:		Maximize the impact of public resources through effective coordination among agencies and the efficient use of technology.
	Objective 1:	Enhance inter-operable emergency communications among all agencies.
	Objective 2:	Enhance public/private partnerships.
Goal 4:		Improve and enhance emergency management capabilities.

B. Regional Goals, Objectives and Strategies

See next page.

GWRC Regional Mitigation Action Plan

Mitigation Action Plan 1. GWRC Region.

ID Number	Year	Project Description	Hazards Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies brought forward from 2006																
GWRC-4	2006	It is recommended to establish a minimum standard for GIS capabilities and data throughout the GWRC region as jurisdictions begin to add GIS to their current hazard mitigation capabilities. Completed and Ongoing.	X	X	X	X	X	X	X	X	X	GWRC	Local	On-going	Continued transmission of GIS datasets to central ftp site	Medium
GWRC-6	2006	It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions. The following actions were suggested by the HMPC:	This is an over-arching action. Please refer to GWRC 6.1 – 6.7 for more specific actions													
GWRC-6.1	2006	Improve signage along major interstates and thoroughfares with interactive signs, operated by VDOT, to provide hazard warnings, including weather reports during tornado and hurricane events, road closings and blockages. The signs can also alert motorists to call 511 for road conditions, or to tune their radios to the emergency radio station for up-to-date conditions. Suggested locations include I-95 and Routes 1, 3, 17, 301, and 610	X	X	X	X	X	X	X	X	X	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Incorporation in LRTP as program recommendation	Low
GWRC-6.2	2006	Investigate emergency lane/shoulder improvements for Emergency Services access on all primary roads	X	X	X	X	X	X	X	X	X	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Recommendations in special corridor studies	Low
GWRC-6.3	2006	Identify and publicize local evacuation routes throughout the region.	X	X	X	X	X	X	X	X	X	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Incorporation in LRTP as program recommendation	High
GWRC-6.4	2006	Identify traffic plan/alternate routes due to closures on primary routes such as 1, 3, 17, 301, and 610	X	X	X	X	X	X	X	X	X	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Recommendations in special corridor studies	Low
GWRC-6.5	2006	Coordinate locally with VDOT on updates to VDOT's Regional Transportation Plans	X	X	X	X	X	X	X	X	X	GWRC/FAMPO	FAMPO Unified Planning Work Program	On-going	Incorporation in LRTP as program recommendation	Medium
GWRC-6.6	2006	Purchase and place into operation AM radio stations along routes to relay emergency information to motorists during a disaster or emergency	X	X	X	X	X	X	X	X	X	GWRC Regional Inter-operability Communications Committee	Committee meeting minutes	On-going	Grant award to fund AM station broadcast equipment.	Low
GWRC-6.7	2006	Facilitate discussions with neighboring regions on traffic flow for emergency service vehicles	X	X	X	X	X	X	X	X	X	GWRC Regional Inter-operability Communications Committee	Committee meeting minutes	On-going	Reciprocal operating agreement or other instrument documenting coordination effort.	Medium
GWRC-8	2006	It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.	X	X	X	X	X	X	X	X	X	GWRC Regional Inter-operability Communications Committee	Local	On-going	Adoption of MOUs	Medium

ID Number	Year	Project Description	Hazards Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies developed for the 2012 update																
Goal 1: Reduce the future impacts and losses from identified hazards.																
GW1.1 (formerly GWRC-2)	2006	Evaluate the vulnerability of the region's critical facilities to hazards and make recommendations for improving resiliency; focusing on generator power to shelters.	X	X	X	X	X	X	X	X	X	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	2016	Define critical facility	High
GW1.2	2012	Review regional compliance with the NFIP on an annual basis and make recommendations where appropriate.	X					X	X			GWRC	FEMA Unified Hazard Mitigation Assistance Funding	Annually	Determine review parameters	High
Goal 2: Educate and engage the public regarding hazards, their impacts, and feasible actions.																
GW2	2012	Develop a regional preparedness guide focusing on natural hazards to disseminate to the public by 2013.	X	X	X	X	X	X	X	X	X	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	2013	Identify funding source and determine hazards to be included in guide	Low
Goal 3: Maximize the impact of public resources through effective coordination among agencies and the efficient use of technology.																
Objective 1: Enhance inter-operable emergency communications among all agencies.																
GW3.1 (formerly GWRC-7)	2006	Continue to improve regional inter-operable emergency communications and planning by coordinating data and information- sharing across all technologies (i.e. mapping and CADD, when possible)	X	X	X	X	X	X	X	X	X	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Develop information sharing plan to focus on sharing GIS datasets, MOUs, and IT procurement documents	Medium
GW3.2 (formerly GWRC-3)	2006	Refine and make available to the jurisdictions, the current regional critical facilities database maintained by the GWRC. Ensure common definition of critical facilities among the region and map each location using GIS.	X	X	X	X	X	X	X	X	X	GWRC	FEMA Unified Hazard Mitigation Assistance Funding	2013	Define critical facility	Low
Objective 2: Enhance public/private partnerships.																
Goal 4: Improve and enhance emergency management capabilities.																
GW4	2012	Develop a regional special needs registry and plan by 2016.	X	X	X	X	X	X	X	X	X	GWRC	FEMA Unified Hazard Mitigation Assistance Funding, EMPG funding	2013	Identify funding source	Medium

C. Local Mitigation Strategies

In formulating a mitigation strategy, a wide range of activities were considered in order to help achieve the goals and to lessen the vulnerability of the GWRC area to the effects of natural hazards. Strategies were ranked by each community. Ranking was completed in order of relative priority based on the STAPLE/E criteria, as well as the strategy's potential to reduce vulnerability to natural hazards. Actions were given a ranking of high, medium or low, with the following meanings:

- High (H) – implement in the short-term
- Medium (M) – implement in the long-term
- Low (L) – implement only as funding becomes available

When deciding on which strategies should receive priority in implementation, the communities considered:

- Time – Can the strategy be implemented quickly?
- Ease to implement – How easy is the strategy to implement? Will it require many financial or staff resources?
- Effectiveness – Will the strategy be highly effective in reducing risk?
- Lifespan – How long will the effects of the strategy be in place?
- Hazards – Does the strategy address a high priority hazard or does it address multiple hazards?
- Post-disaster implementation – Is this strategy easier to implement in a post-disaster environment?

In addition, the anticipated level of cost effectiveness of each measure was a primary consideration when developing mitigation actions. Because mitigation is an investment to reduce future damages, it is important to select measures for which the reduced damages over the life of the measure are likely to be greater than the project cost. For structural measures, the level of cost effectiveness is primarily based on the likelihood of damages occurring in the future, the severity of the damages when they occur, and the level of effectiveness of the selected measure. Although detailed analysis was not conducted during the mitigation action development process, these factors were of primary concern when selecting measures. For those measures, that do not result in a quantifiable reduction of damages, such as public education and outreach, the relationship of the probable future benefits and the cost of each measure was considered when developing the mitigation actions. Each jurisdiction's mitigation strategy can be found below.

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Caroline County Mitigation Action Plan

Mitigation Action Plan 2. Caroline County.

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies brought forward from 2006																
CC-3	2006	Investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and /or model shelters										**Updated information not provided by the jurisdiction**				
CC-6	2006	Establish a minimum standard for GIS capabilities and data throughout the region as jurisdictions being to add GIS to their current hazard mitigation capabilities										**Updated information not provided by the jurisdiction**				
CC-7	2006	Establish a clearinghouse of GIS data for all jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards										**Updated information not provided by the jurisdiction**				
CC-8	2006	Enhance the Caroline Alert system to provide information and warnings to citizens and businesses on specific events throughout the region										**Updated information not provided by the jurisdiction**				
CC-9	2006	Improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions										**Updated information not provided by the jurisdiction**				
CC-10	2006	Establish a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the region										**Updated information not provided by the jurisdiction**				
Strategies developed for the 2012 update																
C1	2012	Evaluate the vulnerability of critical facilities to natural hazards and improve service redundancy to facilities where appropriate.	X	X	X	X	X	X	X	X	X	Department of Fire-Rescue and Emergency Management	Local funding	2015	Compile a list of facilities to be evaluated and the capabilities considered crucial for their operation by June 2014	High
C2	2012	Develop an Earthquake preparedness, response, and recovery brochure for distribution at public outreach events, i.e. county fair.				X						Department of Fire-Rescue and Emergency Management	HMGP grant funding	2014	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium
C3	2012	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.						X	X			Department of Fire-Rescue and Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
C4	2012	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.						X	X			Department of Fire-Rescue and Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2013.	Medium
C5	2012	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	X	X	X	X	X	X	X	X	X	Department of Fire-Rescue and Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium
C6	2012	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.						X	X			Department of Fire-Rescue and Emergency Management	Local funding	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2013.	Medium

City of Fredericksburg Mitigation Action Plan

Mitigation Action Plan 3. City of Fredericksburg.

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies brought forward from 2006																
F-6	2006	Investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and/or model shelters	X	X	X	X	X	X	X	X	X	Public Works Department	Local Funding	End of CY 2014	Identify and compare the cost of the available safeguards	Medium
F-8	2006	Identify all critical facilities and map their locations using GIS.	X	X	X	X	X	X	X	X	X	Information Technology Department	Local funding	End of CY 2014	Identify 50% of critical facility buildings using GIS	Medium
F-9	2006	Investigate the vulnerability of City owned facilities and infrastructure to natural hazards.	X	X	X	X	X	X	X	X	X	Building & Development Department	Local funding	End of CY 2013	Identify all vulnerable priority structures	Medium
F-16	2006	Establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.	X	X	X	X	X	X	X	X	X	Fire Department	Local funding	End of CY 2014	Have the ability for 80% of the involved agencies to communicate with each other by the end of CY 2013	High
Strategies developed for 2012 update																
CF1	2012	Foster interdepartmental relationships for hazard mitigation across the City.	X	X	X	X	X	X	X	X	X	Fire Department	Local funding	End of CY 2012	Successful joint exercise held to establish cooperation between departments	Medium
CF2	2012	Study the feasibility for construction of barriers or structures to reduce the impact of hazards / floods.						X				Public Works Department	Local funding	End of CY 2013	Identify priority City locations that would benefit from flood barriers	Medium
CF3	2012	Identify priorities for protection among critical facilities identified in the hazard mitigation plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up.	X	X	X	X	X	X	X	X	X	Building & Development Department	Local funding	End of CY 2013	Install generators in buildings identified as needing them	Medium
CF4	2012	Develop an earthquake preparedness guide and distribute at local events (i.e. Fredericksburg Agricultural Fair)				X						Fire Department	HMGP grant funding	End of CY 2013	Draft version of plan approved and ready for distribution by end of FY 2012 (June 2012)	Medium

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
CF5	2012	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.						X	X			Public Works Department	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium
CF6	2012	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.						X	X			Building & Development Department	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2013.	Medium
CF7	2012	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	X	X	X	X	X	X	X	X	X	Building & Development Department	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium
CF8	2012	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.						X	X			Public Works Department	Local funding	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2013.	Medium
CF9	2012	Develop hazard loss processes that influence the way land and buildings are developed and built.	X	X	X	X	X	X	X	X	X	Building & Development Department	Local funding	End of CY 2015	Establish preliminary standards for building development that meet hazard loss prevention expectations	Low

King George County Mitigation Action Plan

Mitigation Action Plan 4. King George County.

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies brought forward from 2006																
KG-17	2006	Evaluate County/region interoperability problems, propose corrective actions, and seek grants to fund interoperable communications.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services /Sheriffs Office	DHS, AFG/SHSP grants	2015	2013 - Meet with Sheriffs Office and other regional entities to identify problem and possible solutions. 2. Determine potential solutions and funding source.	M
Strategies developed for the 2012 update																
KG1	2012	Evaluate hazards to critical facilities and shelters, analyze their potential risks, identify mitigation and emergency planning actions, and prioritize actions based on the potential for risk reductions.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	County	2015	2013 - All critical facilities and shelters identified, and potential risks/vulnerabilities evaluated.	M
KG2	2012	Conduct more enforcement and inspections related to building and fire codes, and Virginia codes.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services & Community Development	County	Ongoing	2012 - Meet with building and fire personnel monthly to plan inspections.	M
KG3	2012	Establish a policy that encourages builders of new homes in the County to provide connections for home generators.	X	X	X	X	X	X	X	X	X	Community Development	County	2014	2013 - Policy has been developed, meetings held with large builders in County.	M
KG4	2012	Provide funding to Community Development for County flyover to improve mapping in disaster preparedness activities.	X	X	X	X	X	X	X	X	X	Community Development	HMGP grant	2015	2013 - Source for funding identified, funds requested.	M
KG5	2012	Establish a "hotline" for citizens to call for non-emergency information during a disaster.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	County	2012	2012 - Policy established that phone line will be set up for all emergency events, existence of line routinely communicated to public.	H
KG6	2012	Develop additional ways (both web-based and paper) to educate the public, businesses, e.g., EM website, Twitter, Facebook, AM radio stations, and newspapers.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	County	2013	2012 - EM website completed, Twitter and Facebook sites routinely utilized.	M
KG7	2012	Develop/purchase additional signage for use at all designated emergency shelters.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services /Social Services	EMPG grant	2014	2012 - Needed signs have been identified, sources for their procurement identified.	M

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
KG8	2012	Complete purchase and installation of new electronic emergency notification sign at Company 1 and explore signs for other companies.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	HMGP grant	2012	2011 - Type and size of sign determined, contract awarded.	H
KG9	2012	Partner with schools, churches, civic groups, and volunteers to communicate on emergency issues and increase their involvement in emergency planning and response.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	County	Ongoing	2012 - Meet with School staff, churches, and civic groups to discuss proposal and emergency planning and response.	M
KG10	2012	Provide additional information on the risks of earthquakes and plans to mitigate their damage in the County.				X						Department of Fire Rescue and Emergency Services	County	2013	2012 - Information on risks of earthquakes identified, and distributed to schools, news media, and civic groups.	M
KG11	2012	Evaluate the Fairview Beach/Company 3 facility to identify safety, fire, and building deficiencies, develop a plan for their correction, and correct deficiencies.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services & KGFR	County	2018	2012 - Facility evaluated to identify and prioritize deficiencies and violations of building and fire codes and safety regulations, corrective action plan developed.	M
KG12	2012	Expand the LEPC to include more County businesses and associations, and continue to make it an "all hazards" organization.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	County	2012	2012 - Local businesses identified and contacted and informed of what the LEPC is and how they can participate.	H
KG13	2012	Improve County policies, codes, and regulations to reduce or eliminate impacts of known natural hazards.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services & Community Development	County	Ongoing	2013 - County policies, codes, and regulations associated with impacts of natural hazards identified, a team of Community Development and DFRES staff set up to review them.	M
KG14	2012	Investigate and implement structural projects that will reduce or eliminate the effects of natural hazards on public and private property in the County.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services / SERV AUTH/GEN PROP/SCHOOL SYSTEM	County	2015	2013 - County property evaluated to identify vulnerabilities to natural hazards, recommendations developed to mitigate the risks.	M
KG15	2012	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	2013 - FEMA-listed repetitive loss property in the County identified, potential mitigation actions identified, and contacts made with property owners to discuss auctions.	M

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
KG16	2012	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.						X				Department of Fire Rescue and Emergency Services	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	2013 - All flood-prone structures identified and mapped on GIS, and proposed actions determined to mitigate the risk of floods.	M
KG17	2012	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	X	X	X	X	X	X	X	X	X	Department of Fire Rescue and Emergency Services	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	2013 - Critical facilities evaluated to identify structural weaknesses and electrical deficiencies, and plans established to upgrade them.	M
KG18	2012	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.						X				Department of Fire Rescue and Emergency Services	Local funding	Ongoing	2013 - Identified all permitted projects in 100 year flood plain, and first annual review of Floodplain Ordnances completed.	M

Spotsylvania County Action Plan

Mitigation Action Plan 5. Spotsylvania County.

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies brought forward from 2006																
SP-3	2006	Develop advisory development design standards based upon FIREWISE principles and defensible space.			X							FREM/DOF	Local	Ongoing	Develop written guidance.	Medium
SP-6	2006	Develop a regional public awareness program	X	X	X	X	X	X	X	X	X	FREM	Local	Ongoing	Program is developed	Medium
SP-7	2006	Develop a Weather Spotter program						X	X	X	X	FREM & National Weather Service	Local / Federal	Ongoing	Identify the relevant information to be included, and the events that they are to be presented/distributed at.	Medium
SP-8	2006	Establish a minimum standard for GIS capabilities and data throughout the region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.	X		X	X	X	X	X	X	X	GIS	Local	Ongoing	Standard established	Medium
SP-9	2006	Establish a clearinghouse of GIS data for all of the jurisdictions in the region. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to natural hazards	X		X	X	X	X	X	X	X	GIS	Local	Ongoing	Data sharing established	Medium
SP-11	2006	Improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions	X		X	X	X	X	X	X	X	VDOT/ FAMPO/ Planning	Federal/ State/ Local	Ongoing	Coordination is occurring	Medium
SP-12	2006	Investigate the feasibility of establishing a common means of communication such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the region	X	X	X	X	X	X	X	X	X	FREM/RPAC-I	Federal/ State/ Local	Ongoing	Coordination is occurring	Medium
SP-13	2006	Investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys	X	X	X	X	X	X	X	X	X	FREM/RPAC-I	Federal / State / Local	Ongoing	Funding is available	Medium
Strategies developed for the 2012 update																
SP1	2012	Develop and conduct an education campaign on Earthquake Safety				X						Fire, Rescue, and Emergency Management	HMGP grant funding		Identify the relevant information to be included, and the events that they are to be presented/distributed at.	Medium
SP2	2012	Develop an emergency preparedness guide for distribution at public events	X	X	X	X	X	X	X	X	X	Fire, Rescue, and Emergency Management	HMGP grant funding	2014	Identify the materials to be included in the guide and the events that they are to be distributed at.	Medium

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
SP3	2012	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	X	X	X	X	X	X	X	X	X	Spotsylvania County Building Department	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium
SP4	2012	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.						X	X			DCR/ Spotsylvania Code Compliance	Local funding	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2013.	Medium
SP5	2012	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.						X	X			DCR/ Spotsylvania Code Compliance with FREM	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium/Low
SP6	2012	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.						X	X			DCR/ Spotsylvania Code Compliance with FREM	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2013.	Medium/Low

Stafford County Action Plan

Mitigation Action Plan 6. Stafford County.

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies brought forward from 2006																
ST-1	2006	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.						X	X			Emergency Management (FR)/County Public Information	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium
ST-2	2006	Ensure proper elevation through retrofit and anchoring of mobile homes and other attendant appurtenances located in the floodplain to reduce the risk of future flood damage.						X				Planning/Public Works/Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	2015	Identify all mobile homes located in flood-prone areas by December 2013	Medium
ST-4	2006	Develop and adopt building code requirements protecting the wildland urban interface, specifically utilizing best practices such as the FIREWISE program.			X							Fire and Rescue Department	Local funding	2015	Have one FIREWISE Community Completed by 2013	Medium
ST-6	2006	Investigate the development of a tree-trimming program to protect life and property from falling debris during high wind events. Determine feasibility of partnering with local contractors.							X	X	X	Public Utilities	Local funding	2013	Develop a prioritized list of work that needs to be done, and the budget to do it with. Reach out to local vendors for a price estimate.	Low
ST-7	2006	Identify all critical facilities using GIS	X	X	X	X	X	X	X	X	X	Geographic Information Systems/Emergency Management	Local funding	2013	Identify a list of critical facilities and identify them on a map	Medium
ST-10	2006	Establish a minimum standard for GIS capabilities and data throughout the region as jurisdictions begin to add GIS to their current hazard mitigation capabilities	X	X	X	X	X	X	X	X	X	Geographic Information Systems/Emergency Management	Local funding	2015	Conduct a region wide assessment of GIS capabilities and create a GIS subcommittee to work on standards for the region	Low
ST-11	2006	Establish a clearinghouse of GIS data for all jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to natural hazards	X	X	X	X	X	X	X	X	X	Geographic Information Systems/Information Technology/Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	2015	Establish a centrally located GIS clearinghouse for regional data sharing	Low

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies developed for the 2012 update																
ST1	2012	Upgrade aging equipment and technologies in the EOC/JOC.	X	X	X	X	X	X	X	X	X	Emergency Management (FR)	EMPG	2012	Conduct a current capabilities assessment of the EOC/JOC and determine which equipment needs to be replaced/updated. Include priorities for upgrades.	High
ST2	2012	Evaluate how the ECC's ability to manage surge capacity during an emergency can be augmented.	X	X	X	X	X	X	X	X	X	Emergency Management (FR)	Local funding	2012	Create a Draft Communications Manual for Review by Jan 2012	Medium
ST3	2012	Develop Stand-by contracts and MOUs with private companies for surge logistical support durring an emergency; specifically, emergency energy supplies to critical facilities.	X	X	X	X	X	X	X	X	X	Planning/Public Works/Emergency Management	Local funding	2013	Identify a list of critical facilities that are in need of such support and a list of the vendors in the area that can provide such services.	Medium
ST4	2012	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.						X	X			Planning/Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2013.	Medium
ST5	2012	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	X	X	X	X	X	X	X	X	X	Public Works/Code Enforcement	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium
ST6	2012	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.						X	X			Planning	Local funding	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2013.	Medium
ST7	2012	Develop an Earthquake/Landslide Awareness course for all County and School Staff.				X	X					Emergency Management (FR)	LEMPG	2012	Develop Draft Materials by Spring 2012	Low

Town of Bowling Green Action Plan

Mitigation Action Plan 7. Town of Bowling Green.

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority - (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies developed for the 2012 update																
B1	2012	Evaluate the vulnerability of critical facilities to natural hazards and identify a shelter facility within the Town limits	X	X	X	X	X	X	X	X	X	Town Administrator / County Department of Fire and Rescue / Emergency Management	Local funding	2015	1. Identify the facilities to be identified and the criteria that they must meet. 2. Establish special needs and transportation resources registry	High
B2	2012	Improve current stormwater management system by establishing an adequate maintenance program to clear storm drains.						X	X		X	Public Works	Local funding / Grant funding	2014	1. Develop a Cooperative Working Agreement with VDOT 2. Identify maintenance to be performed, maintenance scheduling, and parties responsible	High
B3	2012	Develop an earthquake preparedness brochure, for distribution at major public events around Bowling Green.				X						Caroline County Office of Emergency Management	HMGP funding	2014	Identify materials to be included in the brochure and the events they will be distributed at	High
B4	2012	Investigate establishing a secondary electrical power feed	X	X	X	X	X	X	X	X	X	Town Administrator / Power Suppliers	Local Funding	2015	Identify resources for establishing a secondary electrical supply, and conduct a cost analysis	Medium
B5	2012	Evaluate critical facilities and shelters to evaluate their resistance to all hazards and make recommendations on ways they can be strengthened or hardened (specifically as they relate to back-up power and electrical systems).	X	X	X	X	X	X	X	X	X	Town Administrator / Caroline County Dept of Fire and rescue / Emergency Management	Local funding	2013	1. Identify the type of backup to be implemented and which facilities they are to be installed in. 2. Identify potential contractors that can provide this service, and obtain a written estimate.	Medium
B6	2012	Investigate the feasibility of implementing an outdoor warning system using sirens and visual notification systems.	X	X	X	X	X	X	X	X	X	Emergency Management (FR)	HMGP funding	2013	1. Identify the types of systems available and conduct cost/benefit analysis 2. Identify parties responsible for implementation, maintenance, and operation	Medium

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority - (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
B7	2012	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.						X	X			Emergency Management (FR)/County Public Information	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium
B8	2012	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.						X	X			Planning/Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2013.	Medium
B9	2012	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	X	X	X	X	X	X	X	X	X	Public Works/Code Enforcement	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium
B10	2012	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.						X	X			Planning	Local funding	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2013.	Medium

Town of Port Royal Action Plan

Mitigation Action Plan 8. Town of Port Royal.

ID	Year	Project Description	Hazard Being Mitigated									Lead/Support Agency	Funding Source	Target Completion Date	Interim Measure of Success	Priority – (High, Medium, Low)
			Dam Failure	Drought & Extreme Heat	Wildfires	Earthquakes	Sinkholes & Landslides	Flooding & Erosion	Hurricanes & Thunderstorms	Tornadoes	Winter Storms & Nor'easters					
Strategies developed for the 2012 update																
P1	2012	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.						X	X			Emergency Management (FR)/County Public Information	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium
P2	2012	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.						X	X			Planning/Emergency Management	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2013.	Medium
P3	2012	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.	X	X	X	X	X	X	X	X	X	Public Works/Code Enforcement	FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium
P4	2012	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.						X	X			Planning	Local funding	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2013.	Medium
P5	2012	Develop an Earthquake preparedness, response, and recovery brochure for distribution at public outreach events.				X						Emergency Management Agency	HMGP grant funding	2014	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2013.	Medium

CHAPTER 8 – PLAN MONITORING, EVALUATION AND UPDATE

The long-term success of the George Washington Regional Commission's mitigation plan is directly correlated with its routine monitoring, evaluation, and updating. This process ensures that the plan remains up to date and is retained as a useful tool for preventing and mitigating damages from known hazards.

I. Adoption

Seven local governments in south central Virginia participated in this planning process and formally adopted this plan by resolution of their governing board. The adoption process itself took several months, as significant coordination by the Region, the Mitigation Advisory Committee, as well as local representatives, was necessary in order to 1) place the plan review and adoption on the appropriate meeting agendas in each jurisdiction, 2) produce and provide copies in official meeting packets, 3) facilitate the actual adoption, 4) collect the adoption resolution, and 5) incorporate the adopted resolutions into the final Hazard Mitigation Plan.

II. Implementation

Upon adoption, the plan faces its biggest test: implementation. While this plan puts forth many worthwhile, and "High" priority recommendations, which action to undertake first will be the first decision that the George Washington Regional Commission and its participating communities faces.

Funding of mitigation strategies is always a critical issue when it comes to implementation. Therefore, pursuing low or no-cost high-priority recommendations may be one approach that a community chooses to take. An example of a low-cost, high-priority recommendation would be to install flood level markers on bridges to warn of high water levels.

Another implementation approach is to prioritize those actions that can be completed in a relatively short amount of time. Being able to publicize a successful project can build momentum to implement the other parts of the plan. An example of an effective but easy-to-implement strategy is to participate in the National Weather Service's *StormReady* program.

Monitoring funding opportunities should be done simultaneously with the implementation effort. Funding can be leveraged to implement one of the more costly recommendations. The following section, *Integration*, discusses other areas of planning and growth that may present opportunities for accomplishment of multiple planning goals, and potential funding sources. Other funding opportunities should also be pursued such as pre- and post-disaster funds, special district budgeted funds, state or federal ear-marked funds, and grant programs, including those that can serve or support multi-objective applications.

III. Integration

It is important to the long-term implementation of the plan that the underlying principles of this Hazard Mitigation Plan are incorporated into other community plans and mechanisms, such as:

- Comprehensive Planning
- Stormwater Management Plans
- Capital Improvement Program Budgeting

- Emergency Operations Plans
- Disaster Recovery Plans

The capability assessment section of this plan provides insight into the current comprehensive plans for each community. The emergency management coordinator for each jurisdiction will provide a copy of this plan to the planning director and work with them to ensure that the appropriate information from this plan is incorporated into the next update of their comprehensive plan. Information from the hazard identification and risk assessment as well as mitigation goals and strategies may be directly included as a comprehensive plan element or will be included in other elements, as appropriate. Projects that require large investments, such as acquisition or road retrofits, are candidates for inclusion in capital improvement plans.

Mitigation is most successful when it is incorporated within the day-to-day functions and priorities of government and development. This integration is accomplished by a constant effort to network and to identify and highlight the multi-objective, "win-win" benefits to each program, the communities and their constituents. This effort is achieved through monitoring agendas, attending meetings, and sending memos.

Simultaneous to these efforts, it will be important to constantly monitor funding opportunities that can be utilized to implement some of the higher cost recommended actions. This will include creating and maintaining a repository of ideas on how any required local match or participation requirement can be met. Then, when funding does become available, the GWRC communities will be in a position to take advantage of an opportunity. Funding opportunities that can be monitored include special pre- and post-disaster funds, special district budgeted funds, state or federal ear-marked funds, and grant programs, including those that can serve or support multi-objective applications.

With adoption of this plan, the GWRC communities will attempt to:

- Pursuing the implementation of the high-priority, low/no-cost recommended actions.
- Keeping the concept of mitigation in the forefront of community decision-making by identifying and stressing the recommendations of the Hazard Mitigation Plan when other community goals, plans and activities are discussed and decided upon.
- Maintaining a constant monitoring of multi-objective, cost-share opportunities to assist the participating communities in implementing the recommended actions of this plan for which no current funding or support exists.

In addition, the communities of the George Washington Regional Commission remain committed to the National Flood Insurance Program. They will continue to enforce floodplain regulations and undertake other actions to remain in compliance with the program.

IV. Public Involvement

Public participation in guiding community documents is an important part of the planning process. It allows community residents to recognize, evaluate, and vet the actions of its government. Significant changes or amendment to the plan may require a public hearing prior to adoption. Determination of this requirement will need to be made on a case-by case basis by the regional commission and the steering committee.

If it is determined that it is necessary to hold a public hearing, in order to involve the public in the maintenance, evaluation, and revision process, then one or all of the following may be considered:

- Advertising meetings of the MAC in the local newspaper, public bulletin boards, and/or municipal or county office buildings;
- Designating willing and voluntary citizens and private sector representatives as official members of the MAC's mitigation plan steering committee;
- Utilizing local media to update the public of any maintenance and/or periodic review activities taking place;
- Using the jurisdiction's website to advertise any maintenance and/or periodic review activities taking place; and
- Keeping copies of the Plan in public libraries and making it accessible via public websites.

V. Monitoring & Maintenance

Plan Maintenance requires an on-going effort to monitor and evaluate the implementation of the plan, and to update the plan as progress, roadblocks, or changing circumstances are recognized.

The Director of Regional Planning and Regional Demographer for the George Washington Regional Commission will be responsible for monitoring this plan. The county administrator, or town manager will be responsible for appointing one or more representatives (e.g. emergency coordinator, planning director) to a group convened by the GWRC. It is expected that the group- convened by the Planning District Commission will function as an adjunct to the Regional Emergency Managers Group that already meets on a regular basis.

The working group, within 60 days of adoption of the plan, will develop evaluation criteria to judge the progress of implementation of the plan.

Annual Review

The GWRC will make an annual request to the working group representatives for an update to be provided by January 31, on the progress of the implementation of their mitigation Action Plans. These updates will begin in 2013 and will include corrective action plans if needed based on the evaluation criteria set by the working group. The annual progress reports will be consolidated by GWRC and shared with the Virginia Department of Emergency Management.

The GWRC Director of Planning, in coordination with the working group, will determine annually if an update of the plan is needed and the mechanism for doing so. Factors to consider when determining if an update is necessary include:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions,
- Increased vulnerability as a result of new development (and/or annexation),
- New state/federal laws, policies, or programs, and/or
- Changes in resource availability.

Five Year Review

At a minimum, the plan update will be initiated by the GWRC no less than four years after plan adoption; the GWRC will seek grant funding no less than three years after plan adoption. A comprehensive plan review will be completed and adopted no less than five years after the adoption of this plan review.

Disaster Declarations

A major event, such as a Presidentially-declared disaster, may trigger a need to review the plan. If such an event occurs in the GWRC region, the working group will coordinate to determine how best to review and update the plan. The updating of the plan will be by written changes and submissions, as the GWRC communities and the working group deem appropriate and necessary. Major changes to the plan will be submitted to the state and to FEMA Region III.

Public notice will be given and public participation will be invited, at a minimum, through available web postings and press releases to the local media outlets, primarily newspapers and radio stations. In addition, the Region will keep information about the plan on its website and displayed in its office. The participating jurisdictions will continue to use the plan as a resource in developing new plans and community preparedness information; they will discuss the plan at public presentations and seek input continuously during the next planning cycle.

Evaluation of progress can be achieved by monitoring changes in the vulnerability identified in the plan. Changes in vulnerability can be identified by noting:

- Lessened vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions, and/or,
- Increased vulnerability as a result of new development (and/or annexation).

Updating of the plan will be by written changes and submissions, as the George Washington Regional Commission communities and the working group deem appropriate and necessary.

APPENDIX A – ADOPTION

Place jurisdiction adoption resolution in this section.

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APPENDIX B - CROSSWALK

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Instructions for Using the Plan Review Crosswalk for Review of Local Mitigation Plans

Attached is a Plan Review Crosswalk based on the ***Multi-Hazard Mitigation Planning Guidance Under the Disaster Mitigation Act of 2000***, published by FEMA, dated March 2004. This Plan Review Crosswalk is consistent with the *Disaster Mitigation Act of 2000* (P.L. 106-390), enacted October 30, 2000 and *44 CFR Part 201 – Mitigation Planning, Interim Final Rule* (the Rule), published February 26, 2002.

SCORING SYSTEM

N – Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Each requirement includes separate elements. All elements of a requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a summary score of "Satisfactory." A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing.

When reviewing single jurisdiction plans, reviewers may want to put an N/A in the boxes for multi-jurisdictional plan requirements. When reviewing multi-jurisdictional plans, reviewers may want to put an N/A in the prerequisite box for single jurisdiction plans.

States that have additional requirements can add them in the appropriate sections of the *Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

Optional matrices for assisting in the review of sections on profiling hazards, assessing vulnerability, and identifying and analyzing mitigation actions are found at the end of the Plan Review Crosswalk.

The example below illustrates how to fill in the Plan Review Crosswalk.

Example

Assessing Vulnerability: Overview

Requirement §201.6(c)(2)(ii): *[The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan include an **overall summary** description of the jurisdiction's **vulnerability** to each hazard?	Section II, pp. 4-10	The plan describes the types of assets that are located within geographically defined hazard areas as well as those that would be affected by winter storms.		✓
B. Does the plan address the **impact** of each hazard on the jurisdiction?	Section II, pp. 10-20	The plan does not address the impact of two of the five hazards addressed in the plan. **Required Revisions:** • Include a description of the impact of floods and earthquakes on the assets. **Recommended Revisions:** • This information can be presented in terms of dollar value or percentages of damage.	✓	
		SUMMARY SCORE	✓	

Local Mitigation Plan Review and Approval Status

Jurisdiction:	Title of Plan:	Date of Plan:
George Washington Regional Commission	2012 George Washington Regional Commission Hazard Mitigation Plan Update	March 2012

Local Point of Contact: Kevin Byrnes	**Address:** 406 Princess Anne St. Fredericksburg, VA 22401
Title: Director of Regional Planning and Regional Demographer	
Agency: George Washington Regional Commission	
Phone Number: (540)373-2890	**E-Mail:** byrnes@gwregion.org

State Reviewer:	Title:	Date:

FEMA Requirement:		
Contractor Reviewer: Jake Jarosz	**Title:** Program Analyst	**Date:** 11/07/2011
Contractor QA/QC:	**Title:**	**Date:**
FEMA Reviewer:	**Title:**	**Date:**
FEMA QA/QC:	**Title:**	**Date:**
Date Received in FEMA Region [Insert #]		
Plan Not Approved		
Plan Approved		
Date Approved		

Jurisdiction:	NFIP Status*			
	Y	N	N/A	CRS Class
1. City of Fredericksburg	X			NA
2. Caroline County	X			NA
3. King George County	X			NA
4. Spotsylvania County	X			NA
5. Stafford County	X			8
6. Town of Bowling Green	X**			NA
7. Town of Port Royal	X			NA

*** Notes:** **Y = Participating** **N = Not Participating** **N/A = Not Mapped**

**The Town of Bowling Green participates as part of Caroline County.

LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted.

Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a **"Needs Improvement"** score.

SCORING SYSTEM

Please check one of the following for each requirement.

N – Needs Improvement: The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

S – Satisfactory: The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

Prerequisite(s) (Check Applicable Box)	NOT MET	MET
Adoption by the Local Governing Body: §201.6(c)(5) **OR**		
Multi-Jurisdictional Plan Adoption: §201.6(c)(5) **AND**		
Multi-Jurisdictional Planning Participation: §201.6(a)(3)		

Planning Process	N	S
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)		

Risk Assessment	N	S
Identifying Hazards: §201.6(c)(2)(i)		
Profiling Hazards: §201.6(c)(2)(i)		
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)		
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)		
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)		
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)		
Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)		

Mitigation Strategy	N	S
Local Hazard Mitigation Goals: §201.6(c)(3)(i)		
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)		
Implementation of Mitigation Actions: §201.6(c)(3)(iii)		
Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)		

Plan Maintenance Process	N	S
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)		
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)		
Continued Public Involvement: §201.6(c)(4)(iii)		

Additional State Requirements*	N	S
Insert State Requirement		
Insert State Requirement		
Insert State Requirement		

LOCAL MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED ☐

PLAN APPROVED ☐

*States that have additional requirements can add them in the appropriate sections of the *Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

See Reviewer's Comments

PREREQUISITE(S)

Adoption by the Local Governing Body

***Requirement §201.6(c)(5)*:** *[The local hazard mitigation plan **shall** include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Has the local governing body adopted the plan?	Pending			
B. Is supporting documentation, such as a resolution, included?	Pending			
		SUMMARY SCORE		

Multi-Jurisdictional Plan Adoption

***Requirement §201.6(c)(5)*:** *For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the plan indicate the specific jurisdictions represented in the plan?	Executive Summary (Pp. vi) Chapter 1 (Pp 1-2)			X
B. For each jurisdiction, has the local governing body adopted the plan?	Pending			
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?	Pending			
		SUMMARY SCORE		

Multi-Jurisdictional Planning Participation

***Requirement §201.6(a)(3)*:** *Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process … Statewide plans will not be accepted as multi-jurisdictional plans.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE NOT MET	SCORE MET
A. Does the plan describe **how** each jurisdiction participated in the plan's development?	Chapter 3: Planning			X

	Process (Pp. 3-1 – 3-6)			
		SUMMARY SCORE		X

PLANNING PROCESS: *§201.6(b): An open public involvement process is essential to the development of an effective plan.*

Documentation of the Planning Process

Requirement §201.6(b): *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process* ***shall*** *include:*
(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and
(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): *[The plan* ***shall*** *document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan provide a narrative description of the process followed to prepare the plan?	Chapter 3: Planning Process (Pps.3-1 – 3-6)			X
B. Does the plan indicate who was involved in the planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, etc.?)	Acknowledgements (Pp. v) Chapter 3: Planning Process (Pp. 3-1 – 3-3)	Pp. v contains a table that identifies the members of the Mitigation Advisory Committee. Chapter 3 (Pp. 3-1) identifies who was involved in the planning process, including the seven jurisdictions, the two contractors, representatives from VDEM, and representatives from FEMA Region III. Chapter 3: Step 1 (Pp. 3-2), describes the committee meetings that were held in order to guide the development of this plan. Chapter 3: Step 2 (Pp. 3-2) describes how the public was engaged in the drafting and review of this plan. (Pending)		X
C. Does the plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	Chapter 3: Step 2 (Pp. 3-2)	Each jurisdiction conducted their own outreach efforts in order to incorporate public opinion and solicit public participation.		X
D. Was there an opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?	Chapter 3: Step 3a: Coordinate with other Departments and Agencies (Pp. 3-4)	Chapter 3: Step 3a (Pp. 3-3) describes how the MAC and the region included other jurisdictions in the planning process.		X

E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	**Chapter 3: Step 3b: Relationship to Other Community Planning Efforts and Hazard Mitigation Activities. (Pp. 3-5)**	Chapter 3: Step 3b (Pp. 3-3) describes how the MAC and reviewed and analyzed other planning efforts in order to identify how some of efforts could be streamlined and incorporated.		X
		SUMMARY SCORE		X

RISK ASSESSMENT: *§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.*

Identifying Hazards

Requirement §201.6(c)(2)(i): *[The risk assessment **shall** include a] description of the type … of all natural hazards that can affect the jurisdiction.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan include **a description** of the types of **all natural hazards** that affect the jurisdiction? If the hazard identification omits (without explanation) any hazards commonly recognized as threats to the jurisdiction, this part of the plan cannot receive a Satisfactory score. Consult with the State Hazard Mitigation Officer to identify applicable hazards that may occur in the planning area.	**Chapter 4: Hazard Identification**	- Table 4-1 (Pg. 4-2) provides a summary table of the hazards identified and their corresponding section. - Dam Failure (P. 4-3) - Drought & Extreme Heat (P. 4-6; 4-10) - Wildfires (P. 4-12) - Earthquakes (P. 4-13) - Sinkholes & Landslides (P. 4-18) - Flooding & Erosion (P. 4-20; 4-22) - Non-Rotational Wind (Hurricanes & Thunderstorms) (P. 4-22; 4-25) - Rotational Wind (Tornadoes) (P. 4-28) - Winter Storms & Nor'easters (P. 4-30) Jurisdiction-specific descriptions are provided for hazards each jurisdiction ranked as high or medium-high: *Drought:* - King George (p. 4-64) - Spotsylvania (p. 4-79) *Wildfire:* - Caroline (p. 4-37) - King George (p. 4-65) - Spotsylvania (p. 4-80)		X

		- Stafford (p. 4-104) *Flood:* - Caroline (p. 4-38) - Fredericksburg (p. 4-55) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-99) *Non-Rotational Wind:* - Caroline (p. 4-38) - Fredericksburg (p. 4-56) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Tornado:* - Caroline (p. 4-39) - Fredericksburg (p. 4-56) - King George (p. 4-66) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Winter Storm:* - Caroline (p. 4-39) - Fredericksburg (p. 4-57) - King George (p. 4-66) - Spotsylvania (p. 4-81) - Stafford (p. 4-105)		
			SUMMARY SCORE	X

Profiling Hazards

Requirement §201.6(c)(2)(i): *[The risk assessment **shall** include a] description of the … location and extent of all natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the risk assessment identify the **location** (i.e., geographic area affected) of each natural hazard addressed in the plan?	**Chapter 4: Hazard Identification**	- Dam Failure (Pp. 4-3; Figure 4-1) – Inventory of dams in the region provided on 4-4 - 4-5. Map provided on pp. 4-5. - Drought & Extreme Heat (Pp. 4-7 & 4-10; Figures 4-2, 4-3, 4-4 & 4-5) - Wildfires (Pp. 4-12) - Earthquakes (Pp. 4-13; Figures 4-6,4-7, 4-8, 4-9) - Sinkholes & Landslides (Pp. 4-18 & 4-19)		X

		- Flooding & Erosion (Pp. 4-21 & 4-22) - Non-Rotational Wind (Hurricanes & Thunderstorms) (Pp. 4-23 & 4-25; Figure 4-11) - Rotational Wind (Tornadoes) (Pp. 4-28) - Winter Storms & Nor'easters (Pp. 4-30 & 4-34) Jurisdiction-specific descriptions are provided for hazards each jurisdiction ranked as high or medium-high: *Drought:* - King George (p. 4-64) - Spotsylvania (p. 4-79) *Wildfire:* - Caroline (p. 4-37) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Flood:* - Caroline (p. 4-38) - Fredericksburg (p. 4-55) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-99) *Non-Rotational Wind:* - Caroline (p. 4-38) - Fredericksburg (p. 4-56) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Tornado:* - Caroline (p. 4-39) - Fredericksburg (p. 4-56) - King George (p. 4-66) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Winter Storm:* - Caroline (p. 4-39) - Fredericksburg (p. 4-57) - King George (p. 4-66) - Spotsylvania (p. 4-81) - Stafford (p. 4-105)		
B. Does the risk assessment	**Chapter 4: Hazard**	- Dam Failure (Pp. 4-3 – 4-5; Figure 4-1)		**X**

identify the **extent** (i.e., magnitude or severity) of each hazard addressed in the plan?	**Identification**	- Drought & Extreme Heat (Pp. 4-6 & 4-10; Figures 4-2, 4-3, 4-4 & 4-5) - Wildfires (Pp. 4-12) - Earthquakes (Pp. 4-13; Figures 4-6,4-7, 4-8, 4-9) - Sinkholes & Landslides (Pp. 4-18 & 4-19) - Flooding & Erosion (Pp. 4-21 & 4-22) - Non-Rotational Wind (Hurricanes & Thunderstorms) (Pp. 4-22 & 4-25; Figure 4-11, 4-12) - Rotational Wind (Tornadoes) (Pp. 4-28; Figure 4-13) - Winter Storms & Nor'easters (Pp. 4-30 & 4-34; Figure 4-14) Jurisdiction-specific descriptions are provided for hazards each jurisdiction ranked as high or medium-high: *Drought:* - King George (p. 4-64) - Spotsylvania (p. 4-79) *Wildfire:* - Caroline (p. 4-37) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Flood:* - Caroline (p. 4-38) - Fredericksburg (p. 4-55) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-99) *Non-Rotational Wind:* - Caroline (p. 4-38) - Fredericksburg (p. 4-56) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Tornado:* - Caroline (p. 4-39) - Fredericksburg (p. 4-56) - King George (p. 4-66) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Winter Storm:* - Caroline (p. 4-39)		

		- Fredericksburg (p. 4-57) - King George (p. 4-66) - Spotsylvania (p. 4-81) - Stafford (p. 4-105)		
C. Does the plan provide information on **previous occurrences** of each hazard addressed in the plan?	**Chapter 4: Hazard Identification**	- Dam Failure (P. 4-6) - Drought & Extreme Heat (Pp. 4-7, 4-11; Figures 4-2, 4-3, 4-4 & 4-5) - Wildfires (Pp. 4-12) - Earthquakes (Pp. 4-13; Figures 4-6, 4-7, 4-8, 4-9) - Sinkholes & Landslides (Pp. 4-19; Figure 4-10) - Flooding & Erosion (Pp. 4-21) - Non-Rotational Wind (Hurricanes & Thunderstorms) (Pp. 4-24, 4-25; Figure 4-11 & 4-12; Table 4-7) - Rotational Wind (Tornadoes) (Pp. 4-28; Figure 4-13) - Winter Storms & Nor'easters (Pp. 4-31; 4-33; Table 4-19, 4-11) Jurisdiction-specific descriptions are provided for hazards each jurisdiction ranked as high or medium-high: *Drought:* - King George (p. 4-67; Table 4-26) - Spotsylvania (p. 4-82; Table 4-34) *Wildfire:* - Caroline (p. 4-39; Table 4-14) - King George (p. 4-70; Table 4-27, 4-28) - Spotsylvania (p. 4-84; Table 4-35) - Stafford (p. 4-105; Table 4-44) *Flood:* - Caroline (p. 4-45; 4-15) - Fredericksburg (p. 4-57 & 4-58; Table 4-20, 4-21) - King George (p. 4-71; Table 4-29) - Spotsylvania (p. 4-90; Table 4-36) - Stafford (p. 4-100; Tables 4-41, 4-42) *Non-Rotational Wind:* - Caroline (p. 4-45; Table 4-16) - Fredericksburg (p. 4-58, Table 4-22) - King George (p. 4-72; Table 4-30) - Spotsylvania (p. 4-92; Table 4-37) - Stafford (p. 4-107; Table 4-45) *Tornado:* - Caroline (p. 4-46; Table 4-17) - Fredericksburg (p. 4-59; Table 4-23)		X

		- King George (p. 4-73; Table 4-31) - Spotsylvania (p. 4-93; Table 4-38) - Stafford (p. 4-109; Table 4-47) *Winter Storm:* - Caroline (p. 4-47; Table 4-18) - Fredericksburg (p. 4-60; Table 4-24) - King George (p. 4-74; Table 4-32) - Spotsylvania (p. 4-94; Table 4-39) - Stafford (p. 4-109; Table 4-47)		
D. Does the plan include the **probability of future events** (i.e., chance of occurrence) for each hazard addressed in the plan?	**Chapter 4: Hazard Identification**	- Dam Failure (Pp. 4-6) - Drought & Extreme Heat (Pp. 4-9 & 4-11) - Wildfires (Pp. 4-12) - Earthquakes (Pp. 4-16) - Sinkholes & Landslides (Pp. 4-20) - Flooding & Erosion (Pp. 4-21) - Non-Rotational Wind (Hurricanes & Thunderstorms) (Pp. 4-27) - Rotational Wind (Tornadoes) (Pp. 4-29) - Winter Storms & Nor'easters (Pp. 4-32; 4-35) Jurisdiction-specific descriptions are provided for hazards each jurisdiction ranked as high or medium-high: *Drought:* - King George (p. 4-64) - Spotsylvania (p. 4-79) *Wildfire:* - Caroline (p. 4-37) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Flood:* - Caroline (p. 4-38) - Fredericksburg (p. 4-55) - King George (p. 4-65) - Spotsylvania (p. 4-80) - Stafford (p. 4-99) *Non-Rotational Wind:* - Caroline (p. 4-38) - Fredericksburg (p. 4-56) - King George (p. 4-65) - Spotsylvania (p. 4-80)		X

		- Stafford (p. 4-104) *Tornado:* - Caroline (p. 4-39) - Fredericksburg (p. 4-56) - King George (p. 4-66) - Spotsylvania (p. 4-80) - Stafford (p. 4-104) *Winter Storm:* - Caroline (p. 4-39) - Fredericksburg (p. 4-57) - King George (p. 4-66) - Spotsylvania (p. 4-81) - Stafford (p. 4-105)		
		SUMMARY SCORE		X

Assessing Vulnerability: Overview

Requirement §201.6(c)(2)(ii): *[The risk assessment **shall** include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S

A. Does the plan include an **overall summary** description of the jurisdiction's **vulnerability** to each hazard?	**Chapter 5: Vulnerability Assessment**	**Regional Assessment**
		- Drought (Pp. 5-1)
		- Non-Rotational Wind, Winter Storms & Tornadoes (5-2; Figure 5-1 on pg 5-9)
		- Hurricanes (Pp. 5-2; Figure 5-2 on pg 5-10)
		- Severe Storms (Pg 5-4)
		- Tornado (Pp. 5-5; Figure 5-3 on pg 5-11)
		- Flooding (Pp.5-5; Figures 5-4, 5-5, 5-6, 5-7 on pg 5-12 - 5-15)
		- Wildfire (Pp.5-7; Figures 5-8, 5-9 on pg 5-16 & 5-17)
		
		Community Specific Assessments provided for each County/City. **Note* Towns of Bowling Green & Port Royal Included in Caroline County Assessment.*
		- Non-Rotational Wind
		  o Caroline (5-22; Figure 5-10, 5-11 on 5-27 - 5-28)
		  o Fredericksburg (5-35; Figure 5-16 & 5-17 on pg 5-39 – 5-40)
		  o King George (5-49; Figure 5-22, 5-23 on pg 5-55 – 5-56)
		  o Spotsylvania (5-64; Figure 5-29, 5-30 on pg 5-70 – 5-71)
		  o Stafford County (5-78; Figure 5-35, 5-36 on pg 5-84 – 5-85)
		- Severe Storm
		  o Caroline (5-23)
		  o Fredericksburg (5-37)
		  o King George (5-50)
		  o Spotsylvania (5-66)
		  o Stafford County (5-79)
		- Tornado
		  o Caroline (5-24; Figure 5-12 on pg. 5-29)
		  o Fredericksburg (5-37; Figure 5-18 on pg 5-41)
		  o King George (5-51; Figure 5-24 on pg 5-57)
		  o Spotsylvania (5-66; Figure 5-31 on pg 5-72)
		  o Stafford County (5-80; Figure 5-37 on pg 5-86)
		- Flood
		  o Caroline (5-24; Figures 5-13, 5-14, 5-15 on 5-30 – 5-32)
		  o Fredericksburg (5-37; Figure 5-19, 5-20, 5-21 on pg 5-42 – 5-44)
		  o King George (5-51; Figure 5-25, 5-26, 5-27, on pg 5-58 – 5-60)
		  o Spotsylvania (5-67; Figure 5-32, 5-33, 5-34 on pg 5-73 – 5-75)
				X

		○ Stafford County (5-80; Figure 5-38, 5-39, 5-40 on pg 5-87 – 5-89) - Drought ○ King George (5-54; Figure on 5-61) - Wildfire ○ Caroline (5-26)		
B. Does the plan address the **impact** of each hazard on the jurisdiction?	**Chapter 5: Vulnerability Assessment**	**Regional Assessment** - Drought (Pp. 5-1) - Non-Rotational Wind, Winter Storms & Tornadoes (5-2; Figure 5-1 on pg 5-9) - Hurricanes (Pp. 5-2; Figure 5-2 on pg 5-10) - Severe Storms (Pg 5-4) - Tornado (Pp. 5-5; Figure 5-3 on pg 5-11) - Flooding (Pp.5-5; Figures 5-4, 5-5, 5-6, 5-7 on pg 5-12 - 5-15) - Wildfire (Pp.5-7; Figures 5-8, 5-9 on pg 5-16 & 5-17) **Community Specific Assessments provided for each County/City.** **Note* Towns of Bowling Green & Port Royal Included in Caroline County Assessment.* - Non-Rotational Wind ○ Caroline (5-22; Figure 5-10, 5-11 on 5-27 - 5-28) ○ Fredericksburg (5-35; Figure 5-16 & 5-17 on pg 5-39 – 5-40) ○ King George (5-49; Figure 5-22, 5-23 on pg 5-55 – 5-56) ○ Spotsylvania (5-64; Figure 5-29, 5-30 on pg 5-70 – 5-71) ○ Stafford County (5-78; Figure 5-35, 5-36 on pg 5-84 – 5-85) - Severe Storm ○ Caroline (5-23) ○ Fredericksburg (5-37) ○ King George (5-50) ○ Spotsylvania (5-66) ○ Stafford County (5-79) - Tornado ○ Caroline (5-24; Figure 5-12 on pg. 5-29) ○ Fredericksburg (5-37; Figure 5-18 on pg 5-41) ○ King George (5-51; Figure 5-24 on pg 5-57) ○ Spotsylvania (5-66; Figure 5-31 on pg 5-72) ○ Stafford County (5-80; Figure 5-37 on pg 5-86) - Flood ○ Caroline (5-24; Figures 5-13, 5-14, 5-15 on 5-30 – 5-32) ○ Fredericksburg (5-37; Figure 5-19, 5-20, 5-21 on pg 5-42 – 5-44) ○ King George (5-51; Figure 5-25, 5-26, 5-27, on pg 5-58 – 5-60) ○ Spotsylvania (5-67; Figure 5-32, 5-33, 5-34 on pg 5-73 – 5-75) ○ Stafford County (5-80; Figure 5-38, 5-39, 5-40 on pg 5-87 – 5-89)		X

		- Drought
		  o King George (5-54; Figure on 5-61)
		- Wildfire
		  o Caroline (5-26)		

		SUMMARY SCORE		X

8. Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement §201.6(c)(2)(ii): *[The risk assessment]* ***must*** *also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe vulnerability in terms of the types and numbers of *repetitive loss properties* located in the identified hazard areas?	**Chapter 5: Vulnerability Assessment Appendix F**	Information on the types and numbers of flood repetitive loss properties is included in the plan: - Caroline (p. 5-24) - Fredericksburg (p. 5-37) - King George (p. 5-52) - Spotsylvania (p. 5-67) - Stafford (p. 5-81)		X
		SUMMARY SCORE		X

Assessing Vulnerability: Identifying Structures

Requirement §201.6(c)(2)(ii)(A): *The plan* ***should*** *describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan describe vulnerability in terms of the **types and numbers** of **existing** buildings, infrastructure, and critical facilities located in the identified hazard areas?	**Chapter 5: Vulnerability Assessment**	**Regional Assessment** - Table 5-1. Total Dollar Value of Exposed Structures from HAZUS (Pp. 5-3) - Table 5-2. Hurricane Risk – Residential; Structures (Pg. 5-4) - Table 5-3. Winter Storm Risk (Pg. 5-4) - Table 5-5. Flood Risk (Pg.5-6) - Table 5-7: Critical Facilities in 100-year flood plain (Pg. 5-7) - Table 5-8. Wildfire Risk (Pg. 5-8) - Table 5-9: Wildfire Risk and Critical Facilities (Pg. 5-8)		X

		Community Specific Assessments provided for each County/City **Note* Towns of Bowling Green & Port Royal are included in Caroline County Assessments.* - Caroline County o Development Trends (Pg. 5-19) o Critical Facilities (Pg. 5-19) o Table 5-10: Critical Facilities – Caroline County (Pg. 5-19) o Table 5-11: Critical Facilities – Town of Bowling Green (Pg. 5-21) o Table 5-12: Critical Facilities – Town of Port Royal (Pg. 5-21) o Table 5-13. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-22) o Table 5-14. Hurricane Risk for Residential Structures (5-23) o Table 5-17. Flood Risk. (5-25) o Table 5-19. Wildfire Risk. (5-26) - City of Fredericksburg o Development Trends (Pg. 5-33) o Critical Facilities (Pg. 5-33) o Table 5-20: Critical Facilities – City of Fredericksburg (Pg. 5-34) o Table 5-21. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-35) o Table 5-22. Hurricane Risk for Residential Structures (5-36) o Table 5-25. Flood Risk. (5-38) - King George County o Development Trends (Pg. 5-45) o Critical Facilities (Pg. 5-46) o Table 5-26: Critical Facilities – King George County (Pg. 5-46) o Table 5-27. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-49) o Table 5-28. Hurricane Risk for Residential Structures (5-50) o Table 5-31. Flood Risk. (5-52) o Table 5-32. Flood Risk. (5-53) - Spotsylvania County o Development Trends (Pg. 5-62) o Critical Facilities (Pg. 5-62) o Table 5-34: Critical Facilities – Spotsylvania County (Pg. 5-63) o Table 5-35. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-65) o Table 5-36. Hurricane Risk for Residential Structures (5-66) o Table 5-40. Flood Risk. (5-67) - Stafford County		

		○ Development Trends (Pg. 5-76) ○ Critical Facilities (Pg. 5-76) ○ Table 5-42: Critical Facilities – Stafford County (Pg. 5-77) ○ Table 5-43. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-78) ○ Table 5-44. Hurricane Risk for Residential Structures (5-79) ○ Table 5-47. Flood Risk. (5-81) ○ Table 5-48. Flood Risk. (5-82)		
B. Does the plan describe vulnerability in terms of the **types and numbers** of **future** buildings, infrastructure, and critical facilities located in the identified hazard areas?		***Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.***	X	
		SUMMARY SCORE		X

Assessing Vulnerability: Estimating Potential Losses

Requirement §201.6(c)(2)(ii)(B): *[The plan **should** describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate … .*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan estimate **potential dollar losses** to vulnerable structures?	**Chapter 5: Vulnerability Assessment**	**Regional Assessment** - Figure 5-1. Total Dollar Value of Exposed Structures from HAZUS (Pp. 5-3) - Table 5-2. Hurricane Risk – Residential; Structures (Pg. 5-4) - Table 5-3. Winter Storm Risk (Pg. 5-4) - Table 5-5. Flood Risk (Pg.5-5) - Table 5-8. Wildfire Risk (Pg. 5-8) **Community Specific Assessments provided for each County/City** **Note* Towns of Bowling Green & Port Royal are included in Caroline County Assessments.* - Caroline County o Development Trends (Pg. 5-19) o Critical Facilities (Pg. 5-19) o Table 5-10: Critical Facilities – Caroline County (Pg. 5-19) o Table 5-11: Critical Facilities – Town of Bowling Green (Pg. 5-21) o Table 5-12: Critical Facilities – Town of Port Royal (Pg. 5-21) o Table 5-13. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-22) o Table 5-14. Hurricane Risk for Residential Structures (5-23) o Table 5-17. Flood Risk. (5-25) o Table 5-19. Wildfire Risk. (5-26) - City of Fredericksburg o Development Trends (Pg. 5-33) o Critical Facilities (Pg. 5-33) o Table 5-20: Critical Facilities – City of Fredericksburg (Pg. 5-34) o Table 5-21. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-35) o Table 5-22. Hurricane Risk for Residential Structures (5-36) o Table 5-25. Flood Risk. (5-38) - King George County o Development Trends (Pg. 5-45) o Critical Facilities (Pg. 5-45) o Table 5-26: Critical Facilities – King George County (Pg. 5-46) o Table 5-27. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-49)		X

		○ Table 5-28. Hurricane Risk for Residential Structures (5-50) ○ Table 5-31. Flood Risk. (5-52) ○ Table 5-32. Flood Risk. (5-53) - Spotsylvania County ○ Development Trends (Pg. 5-62) ○ Critical Facilities (Pg. 5-62) ○ Table 5-34: Critical Facilities – Spotsylvania County (Pg. 5-63) ○ Table 5-35. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-65) ○ Table 5-36. Hurricane Risk for Residential Structures (5-66) ○ Table 5-40. Flood Risk. (5-67) - Stafford County ○ Development Trends (Pg. 5-76) ○ Critical Facilities (Pg. 5-76) ○ Table 5-42: Critical Facilities – Stafford County (Pg. 5-77) ○ Table 5-43. Total Dollar Value of Exposed Structures from HAZUS. (Pg.5-78) ○ Table 5-44. Hurricane Risk for Residential Structures (5-79) ○ Table 5-47. Flood Risk. (5-81) ○ Table 5-48. Flood Risk. (5-82)		
B. Does the plan describe the **methodology** used to prepare the estimate?	**Chapter 5: Vulnerability Assessment**	**Regional Assessment** - Drought (Pp. 5-1) - Non-Rotational Wind, Winter Storms & Tornadoes (5-2) - Hurricanes (5-2) - Severe Storms (5-4) - Tornado (5-5) - Flooding (5-5) - Wildfire (5-7) **Community Specific Assessments provided for each County/City.** **Note* Towns of Bowling Green & Port Royal Included in Caroline County Assessment.* - Non-Rotational Wind ○ Caroline (5-22) ○ Fredericksburg (5-35) ○ King George (5-49) ○ Spotsylvania (5-64) ○ Stafford County (5-78) - Severe Storm ○ Caroline (5-23) ○ Fredericksburg (5-36)		X

		○ King George (5-50) ○ Spotsylvania (5-66) ○ Stafford County (5-79) - Tornado ○ Caroline (5-24) ○ Fredericksburg (5-37) ○ King George (5-51) ○ Spotsylvania (5-66) ○ Stafford County (5-80) - Flood ○ Caroline (5-24) ○ Fredericksburg (5-37) ○ King George (5-51) ○ Spotsylvania (5-67) ○ Stafford County (5-80) - Drought ○ King George (5-54) - Wildfire ○ Caroline (5-25)		
		SUMMARY SCORE		X

Assessing Vulnerability: Analyzing Development Trends

Requirement §201.6(c)(2)(ii)(C): *[The plan **should** describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan describe land uses and development trends?	**Chapter 5: Vulnerability Assessment, Section II: Community Specific Assessments**	**Note* Towns of Bowling Green & Port Royal Included in Caroline County Assessment.* - Caroline County ○ Development Trends (Pg. 5-19) - City of Fredericksburg ○ Development Trends (Pg. 5-33) - King George County ○ Development Trends (Pg. 5-45) - Spotsylvania County ○ Development Trends (Pg. 5-62)		X

		- Stafford County - Development Trends (Pg. 5-76)		
		SUMMARY SCORE		X

Multi-Jurisdictional Risk Assessment

Requirement §201.6(c)(2)(iii): *For multi-jurisdictional plans, the risk assessment* ***must*** *assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S

A. Does the plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?	**Chapter 5: Vulnerability Assessment, Section II: Community Specific Assessments**	**Chapter 5: Section II** includes Community Specific Assessments for each of the following hazards:
		- Non-Rotational Wind
		- Severe Storm
		- Tornado
		- Flood
		
		Caroline County was determined to have a specific risk due to wildfire, and King George County to drought.. As such, special hazard analyses were conducted specifically for those jurisdiction. Detailed page numbers for each community assessment of hazards can be found below.
		
		Community Specific Assessments provided for each County/City. **Note* Towns of Bowling Green & Port Royal Included in Caroline County Assessment.*
		- Non-Rotational Wind
		  - Caroline (5-22)
		  - Fredericksburg (5-35)
		  - King George (5-49)
		  - Spotsylvania (5-64)
		  - Stafford County (5-78)
		- Severe Storm
		  - Caroline (5-23)
		  - Fredericksburg (5-36)
		  - King George (5-50)
		  - Spotsylvania (5-66)
		  - Stafford County (5-79)
		- Tornado
		  - Caroline (5-24)
		  - Fredericksburg (5-37)
				X

		○ King George (5-51) ○ Spotsylvania (5-66) ○ Stafford County (5-80) - Flood ○ Caroline (5-24) ○ Fredericksburg (5-37) ○ King George (5-51) ○ Spotsylvania (5-67) ○ Stafford County (5-80) - Drought ○ King George (5-54) - Wildfire ○ Caroline (5-25)		
		SUMMARY SCORE		X

MITIGATION STRATEGY: *§201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

Local Hazard Mitigation Goals

Requirement §201.6(c)(3)(i): *[The hazard mitigation strategy **shall** include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A Does the plan include a description of mitigation **goals** to reduce or avoid long-term vulnerabilities to the identified hazards? (**GOALS** are long-term; represent what the community wants to achieve, such as "eliminate flood damage"; and are based on the risk assessment findings.)	**Chapter 7: 2012 Mitigation Strategies, Section III – Goals Objectives & Strategies (Pg. 7-6)**	The region as a whole, as well as each individual community adopted the same mitigation goals. A table outlining those can be found on page 7-6.		X
		SUMMARY SCORE		X

Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): *[The mitigation strategy **shall** include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan identify and analyze a **comprehensive range** of specific mitigation actions and projects for each hazard?	**Chapter 7: 2012 Mitigation Strategies, Section III – Goals Objectives & Strategies**	A comprehensive range on mitigation strategies are provided for each jurisdiction, as well as the region. The strategies are organized in community specific mitigation action plans. Exact page numbers are provided below. - Mitigation Action Plan 1 – GWRC Regional (Pg. 7-7) ○ 14 All-hazard strategies; 1 flood, hurricane, dam failure specific. - Mitigation Action Plan 2 – Caroline County (Pg. 7-11) ○ 2 All-hazard strategies; 1 flood specific; 1 earthquake; 3flood & hurricane - Mitigation Action Plan 3 – City of Fredericksburg (Pg. 7-13) ○ 8 All-hazard strategies; 1 flood specific; 1 earthquake; 3 flood and hurricane - Mitigation Action Plan 4 – King George County (Pg. 7-15) ○ 16 All-hazard strategies; 2 flood specific; 1 earthquake. - Mitigation Action Plan 5 – Spotsylvania County (Pg. 7-18) ○ 5 All-hazard strategies; 1 Wildfire; 3 flood & hurricane; 4 multi-hazard; 1 earthquake. - Mitigation Action Plan 6 – Stafford County (Pg. 7-20) ○ 5 All-hazard strategies; 1 flood; 3 flood & hurricane; 1 earthquake & sinkholes; 1 hurricane, tornadoes & winter storms; & 1 earthquake and sinkholes. - Mitigation Action Plan 7 – Town of Bowling Green (7-22) ○ 5 All-hazard strategies; 3 flood & hurricane; 1 flood, hurricane and winter storms; 1 earthquake. - Mitigation Action Plan 8 – Town of Port Royal (7-24) ○ 1 All-hazard strategies; 3 flood & hurricane; 1 earthquake.		X
B Do the identified actions and projects address reducing the effects of hazards on **new** buildings and infrastructure?	**Chapter 7: 2012 Mitigation Strategies,**	*The mitigation actions are a mix of soft (planning) and hard (structural). Due to funding difficulties, the emphasis is on planning.* - Section I describes the overall process on how the mitigation strategies were developed for this plan update. - Section II discusses how mitigation strategies were developed and prioritized, while considering mitigation alternatives.		X

		- Section III, subsection A discusses the communities' consideration of various goals, policies, and procedures as they applied to their jurisdiction, and the region as a whole, and how they might provide useful mitigation goals and strategies, **especially as they might relate to future development.** - Section III, Subsection C discusses the specifics of the local mitigation strategies, **especially as they relate to future development.**		
C. Do the identified actions and projects address reducing the effects of hazards on **existing** buildings and infrastructure?	**Chapter 7: 2012 Mitigation Strategies,**	*The mitigation actions are a mix of soft (planning) and hard (structural). Due to funding difficulties, the emphasis is on planning.* - Section I describes the overall process on how the mitigation strategies were developed for this plan update. - Section II discusses how mitigation strategies were developed and prioritized, while considering mitigation alternatives. - Section III, subsection A discusses the communities' consideration of various goals, policies, and procedures as they applied to their jurisdiction, and the region as a whole, and how they might provide useful mitigation goals and strategies, **with special consideration paid to cost effectiveness of specific projects and protection of existing infrastructure.** - Section III, Subsection C discusses the specifics of the local mitigation strategies, **with special consideration paid to cost effectiveness of specific projects and protection of existing infrastructure.**		X
		SUMMARY SCORE		X

15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

Requirement: §201.6(c)(3)(ii): *[The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the new or updated plan describe the jurisdiction (s) participation in the NFIP?	**Chapter 4: Hazard Identification** **Chaper 5:: Section II: Community Specific Assessments**	- p. 4-19 – The first paragraph of the flooding section provides a regional overview of participation in the NFIP. - The Community Specific Assessments Section of Chapter 5 discusses Repetitive Loss structures within each jurisdiction, and efforts the community is making to mitigate them. Table 6-		X

	Chapter 6: Capability Assessment	1 (Pg. 6-2) shows if each jurisdiction participates in the NFIP, the number of flood-prone buildings, employment of a Certified Floodplain Manager, participation in the NFIP, and other flood mitigation efforts that are made. - Each Jurisdiction Specific Assessment includes information about participation in the NFIP. o Caroline County – Table 6-2 (Pg. 6-15) o Town of Bowling Green. Table 6-3 (Pg. 6-17) o Town of Port Royal – Table 6-4 (Pg. 6-18) o City of Fredericksburg – Table 6-5 (Pg. 6-21) o King George County – Table 6-6 (Pg. 6-24) o Spotsylvania County – Table 6-7 (Pg. 6-27) o Stafford County – Table 6-8 (Pg. 6-30)		
B. Does the mitigation strategy identify actions related to participation in and continued compliance with the NFIP?	**Chapter 7: Mitigation Strategy** **Section III: Goals, Objectives and Strategies.** **Mitigation Action Plans.**	**Each jurisdiction adopted the same four goals intended to address the communities' involvement with the NFIP. Those strategies are:** **1.** Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk. **2.** Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate. **3.** Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc. **4.** Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.		X
		SUMMARY SCORE		X

Implementation of Mitigation Actions

Requirement: §201.6(c)(3)(iii): *[The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the mitigation strategy include how the actions are **prioritized**? (For example, is there a discussion of the process and criteria used?)	**Chapter 7: 2012 Mitigation Strategies, Sections II & III**	Section II of Chapter 7 (Pg. 7-2) outlines the process that the communities went through in order to determine review their mitigation strategies, consider alternatives, finalize, and prioritize those actions. Sebsection B (Pg. 7-4)specifically delineates the criteria by which the actions were reviewed and selected by (STAPLEE). Section III, subsection A (Pg. 7-6) delineates factors that community officials considered in deciding upon goals and strategies. Section III, subsection C (Pg. 7-9) goes into more detail about the factors affecting the effectiveness and priority of each community's strategy.		X
B. Does the mitigation strategy address how the actions will be **implemented and administered**? (For example, does it identify the responsible department, existing and potential resources, and timeframe?)	**Chapter 7: 2012 Mitigation Strategies, Section III**	Section III, subsections B & C (Pg. 7-6 & 7-9) provide detailed mitigation action plans that identify responsible parties, deadlines, interim measures of success, funding resources, and priority.		X
C. Does the prioritization process include an emphasis on the use of a **cost-benefit review** (see page 3-36 of *Multi-Hazard Mitigation Planning Guidance*) to maximize benefits?	**Chapter 7: 2012 Mitigation Strategies, Sections I, II & III**	*Discussion on the cost effectiveness of each measure as a consideration when developing mitigation actions.* Section II, subsection B (Pg. 7-4) specifically delineates the criteria by which the actions were reviewed and selected by (STAPLEE). Section III, subsection A (Pg. 7-6)delineates factors that community officials considered in deciding upon goals and strategies. Section III, subsection C (Pg. 7-9) goes into more detail about the factors affecting the cost-benefit ratio of each community's strategy.		X
D. Does the updated plan identify the completed, deleted, or deferred actions as a benchmark for progress, and if activities are unchanged (i.e., deferred) does the updated plan describe why no change has occurred?	**Appendix D – 2006 Strategies Update**	The strategies delineated from the previous plan were reviewed and updated by the jurisdictions. They were marked as ongoing or in-progress, canceled, incomplete, or completed. Those that were canceled or incomplete provide a reason for why. Those that were ongoing or in-progress were brought forward into this plan update. Each mitigation plan identifies the year of the strategy, so old and new		X

		strategies should be readily identifiable. **Note* Towns of Bowling Green and Port Royal's mitigation strategies were previously incorporated into those of Caroline County. For a complete review, refer to Caroline County's Mitigation Action Table.*		
		SUMMARY SCORE		X

Multi-Jurisdictional Mitigation Actions

Requirement §201.6(c)(3)(iv): *For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A Does the plan include at least one identifiable **action item** for each jurisdiction requesting FEMA approval of the plan?	**Chapter 7: 2012 Mitigation Strategies, Section III – Goals Objectives & Strategies**	Each jurisdiction developed their own set of mitigation strategies, with at least one all-hazard action, one- flood specific action, one earthquake specific action, as well as actions to ensure NFIP compliance. Exact page numbers are provided below. - Mitigation Action Plan 1 – GWRC Regional (Pg. 7-7) ○ 14 All-hazard strategies; 1 flood, hurricane, dam failure specific. - Mitigation Action Plan 2 – Caroline County (Pg. 7-11) ○ 2 All-hazard strategies; 1 flood specific; 1 earthquake; 3flood & hurricane - Mitigation Action Plan 3 – City of Fredericksburg (Pg. 7-13) ○ 8 All-hazard strategies; 1 flood specific; 1 earthquake; 3 flood and hurricane - Mitigation Action Plan 4 – King George County (Pg. 7-15) ○ 16 All-hazard strategies; 2 flood specific; 1 earthquake. - Mitigation Action Plan 5 – Spotsylvania County (Pg. 7-18) ○ 5 All-hazard strategies; 1 Wildfire; 3 flood & hurricane; 4 multi-hazard; 1 earthquake. - Mitigation Action Plan 6 – Stafford County (Pg. 7-20) ○ 5 All-hazard strategies; 1 flood; 3 flood & hurricane; 1 earthquake & sinkholes; 1 hurricane, tornadoes & winter storms; & 1 earthquake and sinkholes. - Mitigation Action Plan 7 – Town of Bowling Green (7-22) ○ 5 All-hazard strategies; 3 flood & hurricane; 1 flood, hurricane and winter storms; 1 earthquake.		X

		- Mitigation Action Plan 8 – Town of Port Royal (7-24) ○ 1 All-hazard strategies; 3 flood & hurricane; 1 earthquake.		
B. Does the updated plan identify the completed, deleted, or deferred actions as a benchmark for progress, and if activities are unchanged (i.e., deferred) does the updated plan describe why no change has occurred?	**Appendix D – 2006 Strategy Update**	The strategies delineated from the previous plan were reviewed and updated by the jurisdictions. They were marked as ongoing or in-progress, canceled, incomplete, or completed. Those that were canceled or incomplete provide a reason for why. Those that were ongoing or in-progress were brought forward into this plan update. Each mitigation plan identifies the year of the strategy, so old and new strategies should be readily identifiable. **Note* Towns of Bowling Green and Port Royal's mitigation strategies were previously incorporated into those of Caroline County. For a complete review, refer to Caroline County's Mitigation Action Table.*		X
		SUMMARY SCORE		X

PLAN MAINTENANCE PROCESS

Monitoring, Evaluating, and Updating the Plan

Requirement §201.6(c)(4)(i): *[The plan maintenance process **shall** include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.*

Element	**Location in the Plan** (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan describe the method and schedule for **monitoring** the plan? (For example, does it identify the party responsible for monitoring and include a schedule for reports, site visits, phone calls, and meetings?)	**Chapter 8: Plan Monitoring, Evaluation and Update**	The plan identifies the GWRC Planning Director as the party responsible for monitoring and updating the plan. Also, the plan states that working groups will meet after adoption for annual update criteria. (Pg-8-3)		X
B. Does the plan describe the method and schedule for **evaluating** the plan? (For example, does it identify the party responsible for evaluating the plan and include the criteria used to evaluate the plan?)	**Chapter 8: Plan Monitoring, Evaluation and Update**	The plan indicates that by 2013, groups will review action plans for progress. The working group will meet annually to decide if an update to the plan is necessary. (Pg. 8-3) Drivers for change could be: - Decreased vulnerability as a result of implementing recommended actions, - Increased vulnerability as a result of failed or ineffective mitigation actions, - Increased vulnerability as a result of new development		X

		- New state/federal laws, policies, or programs, and/or - Changes in resource availability. A major event, such as a Presidentially-declared disaster, may trigger a need to review the plan.		
C. Does the plan describe the method and schedule for **updating** the plan within the five-year cycle?	**Chapter 8: Plan Monitoring, Evaluation and Update**	Indicates that by 2013, groups will review action plans for progress. The working group will meet annually to decide if an update to the plan is necessary. At a minimum, the plan is to be updated at the end of the five year planning cycle, measured from the date of adoption.		X
		SUMMARY SCORE		X

Incorporation into Existing Planning Mechanisms

Requirement §201.6(c)(4)(ii): *[The plan **shall** include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan identify other local planning mechanisms available for incorporating the requirements of the mitigation plan?	**Chapter 8: Plan Monitoring, Evaluation and Update**	Sections II & III discuss the initial hurdles of implementing the plan, and the need for integration with other planning efforts. (Pg. 8-1)		X
B. Does the plan include a process by which the local government will incorporate the requirements in other plans, when appropriate?	**Chapter 8: Plan Monitoring, Evaluation and Update**	Sections II & III discuss the initial hurdles of implementing the plan, and the need for integration with other planning efforts. (Pg. 8-1)		X
C. Does the updated plan explain how the local government incorporated the mitigation strategy into other planning mechanisms, when appropriate?	**Chapter 3: Planning Process.** **Chapter 8: Plan Monitoring, Evaluation and Update**	Chapter 3 (Pg. 3-3) identifies other planning efforts that were considered and integrated into this plan update. Chapter 8 (Pg. 8-1) identifies the need and plan for how the region will approach incorporation of the mitigation strategy into other planning mechanisms.		X
		SUMMARY SCORE		X

Continued Public Involvement

Requirement §201.6(c)(4)(iii): *[The plan maintenance process **shall** include a] discussion on how the community will continue public participation in the plan maintenance process.*

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan explain how **continued public participation** will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)	**Chapter 8: Plan Monitoring, Evaluation and Update**	Subsection IV details the need and process for continued public involvement. (Pg. 8-2)		X
		SUMMARY SCORE		X

ADDITIONAL STATE REQUIREMENTS

Virginia State Requirements

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE N	SCORE S
A. Does the plan include a Capability Assessment for each participating jurisdiction?	**Chapter 6: Capabilities Assessments**	This assessment is conducted using 2 approaches: Regionally, and community specific. Section I provides a regional assessment, including federal (Pg. 6-3) and state (Pg. 6-4) partners, as well as the regional commission (Pg. 6-8), and other planning organizations. Section II provides jurisdiction specific assessments (Pg. 6-12). A Comprehensive matrix of the region's capabilities is available on pg. 6-2. **Note* Towns of Bowling Green & Port Royal are included in the Caroline County Assessment.* - Caroline County (Pg. 6-15) - City of Fredericksburg (Pg. 6-20) - King George County (Pg. 6-23) - Spotsylvania County (Pg. 6-26) - Stafford County (Pg. 6-29)		X
B. Are flood maps included for each participating jurisdiction?	**Chapter 5: Vulnerability Assessments**	As part of the HIRA in Chapter 5 and support documentation in Appendix B, flood maps and critical facility overlays are included.		X

		Regional Assessment - Flooding (Pp.5-5; Figures 5-4, 5-5, 5-6, 5-7 on pg 5-12 - 5-15) **Jurisdiction Specific Assessments** **Note* Towns of Port Royal and Bowling Green are included in Caroline County's Assessment.* - Caroline (5-24; Figures 5-13, 5-14, 5-15 on 5-30 – 5-32) - Fredericksburg (5-37; Figure 5-19, 5-20, 5-21 on pg 5-42 – 5-44) - King George (5-51; Figure 5-25, 5-26, 5-27, on pg 5-58 – 5-60) - Spotsylvania (5-67; Figure 5-32, 5-33, 5-34 on pg 5-73 – 5-75) - Stafford County (5-80; Figure 5-38, 5-39, 5-40 on pg 5-87 – 5-89)		

C. Have other high hazard risk maps been included for each participating jurisdiction?	**Chapter 5: Vulnerability Assessment**	**Regional Assessment**
		- Non-Rotational Wind, Winter Storms & Tornadoes (Figure 5-1 on pg 5-9)
		- Hurricanes (Figure 5-2 on pg 5-10)
		- Tornado (Figure 5-3 on pg 5-11)
		- Flooding (Figures 5-4, 5-5, 5-6, 5-7 on pg 5-12 - 5-15)
		- Wildfire (Figures 5-8, 5-9 on pg 5-16 & 5-17)
		
		Community Specific Assessments provided for each County/City. **Note* Towns of Bowling Green & Port Royal Included in Caroline County Assessment.*
		- Non-Rotational Wind
		  o Caroline (Figure 5-10, 5-11 on 5-27 - 5-28)
		  o Fredericksburg (Figure 5-16 & 5-17 on pg 5-39 – 5-40)
		  o King George (Figure 5-22, 5-23 on pg 5-55 – 5-56)
		  o Spotsylvania (Figure 5-29, 5-30 on pg 5-70 – 5-71)
		  o Stafford County (Figure 5-35, 5-36 on pg 5-84 – 5-85)
		- Tornado
		  o Caroline (Figure 5-12 on pg. 5-29)
		  o Fredericksburg (Figure 5-18 on pg 5-41)
		  o King George (Figure 5-24 on pg 5-57)
		  o Spotsylvania (Figure 5-31 on pg 5-72)
		  o Stafford County (Figure 5-37 on pg 5-86)
		- Flood
		  o Caroline (Figures 5-13, 5-14, 5-15 on 5-30 – 5-32)
		  o Fredericksburg (Figure 5-19, 5-20, 5-21 on pg 5-42 – 5-
				X

		44) o King George (Figure 5-25, 5-26, 5-27, on pg 5-58 – 5-60) o Spotsylvania (Figure 5-32, 5-33, 5-34 on pg 5-73 – 5-75) o Stafford County (Figure 5-38, 5-39, 5-40 on pg 5-87 – 5-89) - Drought o King George (Figure on 5-61)		
D. Does the plan include a repetitive loss strategy to verify the geographic location of each repetitive loss property and determine if that property has been mitigated and by what means?	**Chapter 7: Mitigation Strategy**	Each jurisdiction has at least 1 repetitive loss strategy. That strategy is located in the community's mitigation action table. - Caroline County (Pg. 7-10 – 7-11) - City of Fredericksburg (Pg. 7-12 – 7-13) - King George County (Pg. 7-14 – 7-16) - Spotsylvania County (Pg. 7-17 – 7-18) - Stafford County (Pg. 7-19 – 7-20) - Town of Bowling Green (Pg. 7-21 – 7-22) - Town of Port Royal (Pg. 7-23)		X
		SUMMARY SCORE		X

Matrix A: Profiling Hazards

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that their plan addresses each natural hazard that can affect the jurisdiction. **Completing the matrix is not required**.

Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each ***applicable*** *hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Location		B. Extent		C. Previous Occurrences		D. Probability of Future Events	
	Yes	N	S	N	S	N	S	N	S
Avalanche	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coastal Erosion	☐	☐	☐	☐	☐	☐	☐	☐	☐
Coastal Storm	☒	☐	☒	☐	☒	☐	☒	☐	☒
Dam Failure	☒	☐	☒	☐	☒	☐	☒	☐	☒
Drought	☐	☐	☒	☐	☒	☐	☒	☐	☒
Earthquake	☒	☐	☒	☐	☒	☐	☒	☐	☒
Expansive Soils	☒	☐	☒	☐	☒	☐	☒	☐	☒
Extreme Heat	☒	☐	☒	☐	☒	☐	☒	☐	☒
Flood	☒	☐	☒	☐	☒	☐	☒	☐	☒
Hailstorm	☒	☐	☒	☐	☒	☐	☒	☐	☒
Hurricane	☒	☐	☒	☐	☒	☐	☒	☐	☒
Land Subsidence	☐	☐	☐	☐	☐	☐	☐	☐	☐
Landslide	☒	☐	☒	☐	☒	☐	☒	☐	☒
Severe Winter Storm	☒	☐	☒	☐	☒	☐	☒	☐	☒
Tornado	☒	☐	☒	☐	☒	☐	☒	☐	☒
Tsunami	☐	☐	☐	☐	☐	☐	☐	☐	☐
Volcano	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wildfire	☐	☐	☒	☐	☒	☐	☒	☐	☒
Windstorm	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other _____	☐	☐	☐	☐	☐	☐	☐	☐	☐

To check boxes, double click on the box and change the default value to "checked."

Legend:
§201.6(c)(2)(i) Profiling Hazards
A. Does the risk assessment identify the location (i.e., geographic area affected) of each hazard addressed in the plan?
B. Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the plan?
C. Does the plan provide information on previous occurrences of each natural hazard addressed in the plan?
D. Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the plan?

Matrix B: Assessing Vulnerability

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that their plan addresses each requirement. **Completing the matrix is not required**.

Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each ***applicable*** *hazard. An "N" for any element of any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Note: Receiving an N in the shaded columns will not preclude the plan from passing.

To check boxes, double click on the box and change the default value to "checked."

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	§201.6(c)(2)(ii) Assessing Vulnerability: Overview	A. Overall Summary Description of Vulnerability		B. Hazard Impact		§201.6(c)(2)(ii) Assessing Vulnerability: Identifying Structures	A. Types and Number of Existing Structures in Hazard Area (Estimate)		B. Types and Number of Future Structures in Hazard Area (Estimate)		§201.6(c)(2)(ii) Assessing Vulnerability: Estimating Potential Losses	A. Loss Estimate		B. Methodology	
	Yes		N	S	N	S		N	S	N	S		N	S	N	S
Avalanche	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Coastal Erosion	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Coastal Storm	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Dam Failure	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Drought	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Earthquake	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Expansive Soils	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Extreme Heat	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Flood	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Hailstorm	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Hurricane	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Land Subsidence	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Landslide	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Severe Winter Storm	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Tornado	☒		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Tsunami	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Volcano	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Wildfire	☐		☐	☒	☐	☒		☐	☒	☒	☐		☐	☒	☐	☒
Windstorm	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Other _____	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Other _____	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐
Other _____	☐		☐	☐	☐	☐		☐	☐	☐	☐		☐	☐	☐	☐

Legend:

§201.6(c)(2)(ii) Assessing Vulnerability: Overview

A. Does the plan include an overall summary description of the jurisdiction's vulnerability to each hazard?

B. Does the plan address the impact of each hazard on the jurisdiction?

§201.6(c)(2)(ii)(A) Assessing Vulnerability: Identifying Structures

A. Does the plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?

B. Does the plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

§201.6(c)(2)(ii)(B) Assessing Vulnerability: Estimating Potential Losses

A. Does the plan estimate potential dollar losses to vulnerable structures?

B. Does the plan describe the methodology used to prepare the estimate?

Matrix C: Identification and Analysis of Mitigation Actions

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure consideration of a range of actions for each hazard. **Completing the matrix is not required.**

Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each ***applicable*** *hazard. An "N" for any identified hazard will result in a "Needs Improvement" score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Comprehensive Range of Actions and Projects	
	Yes	N	S
Avalanche	☐	☐	☐
Coastal Erosion	☐	☐	☐
Coastal Storm	☒	☒	☐
Dam Failure	☒	☒	☐
Drought	☒	☒	☐
Earthquake	☒	☒	☐
Expansive Soils	☒	☒	☐
Extreme Heat	☒	☒	☐
Flood	☒	☒	☐
Hailstorm	☒	☒	☐
Hurricane	☒	☒	☐
Land Subsidence	☒	☒	☐
Landslide	☒	☒	☐
Severe Winter Storm	☒	☒	☐
Tornado	☒	☒	☐
Tsunami	☐	☐	☐
Volcano	☐	☐	☐
Wildfire	☒	☒	☐
Windstorm	☐	☐	☐
Other _____	☐	☐	☐
Other _____	☐	☐	☐
Other _____	☐	☐	☐

To check boxes, double click on the box and change the default value to "checked."

Legend:
§201.6(c)(3)(ii) Identification and Analysis of Mitigation Actions
A. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?

APPENDIX C – MEETING MATERIALS

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George Washington Regional Commission
Hazard Mitigation Plan Update
Kickoff Meeting
Fredericksburg, Virginia
November 15, 2010
1:30pm

I. Welcome & Introductions

II. Committee and Dewberry

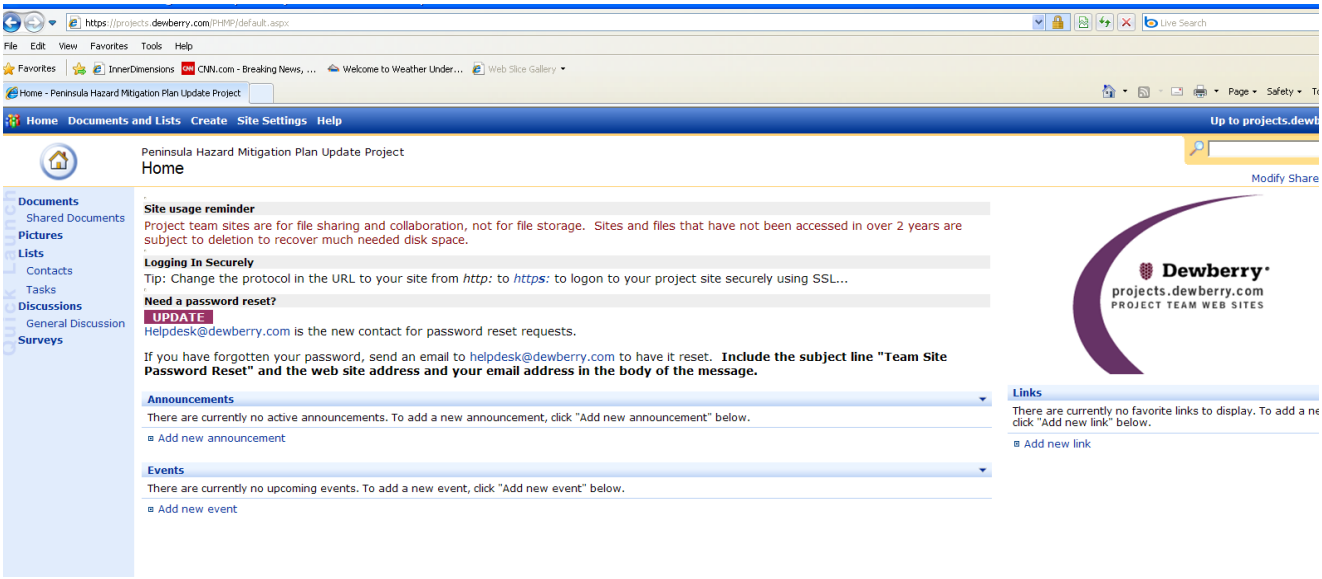
III. Schedule and Plan Update Process

IV. Next Steps

V. Wrap Up & Future Meetings

Project Websites

SharePoint Site: http://projects.dewberry.com/GWRC2010/default.aspx
Email helpdesk@dewberry.com if you need your password reset or other technical support



George Washington Regional Commission Hazard Mitigation Plan Update

Kick-off Meeting

November 15, 2010

Dewberry

CreativePages LLC

Meeting Agenda

1. Welcome & Introductions
2. Committee and Dewberry
3. Schedule and Plan Update Process
4. Next Steps
5. Wrap Up & Future Meetings

Corporate Overview

Dewberry

- 50 years in Northern Virginia
- 2,000 professionals
- More than $300 M annual revenue
- Core service: Emergency Management and Hazard Mitigation

Certified Woman Business Enterprise that specializes in developing a broad collection of communication materials targeted to launch and manage community outreach campaigns and related services.

CreativePages LLC

Committee and Dewberry

- We are here to:
  - Coach you through the process
    - Inform you of "how" to update a plan
  - Lend technical expertise and consultation
  - Review and Crosswalk the draft and final plan sections
- You need to:
  - Participate & make the final decisions
  - Collect data, analyze data, and draft the plan

Schedule

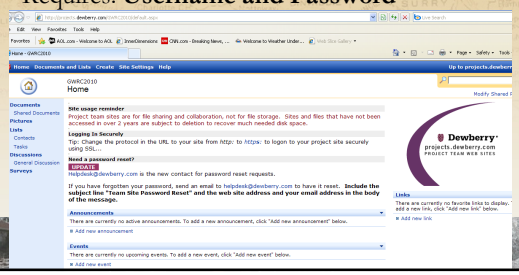
☑ = meeting	2010			2011												2012								
Project Task	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September
Project Management	☑																							
Pre-Planning Support and Data Collection																								
Capability Assessment & Public Outreach				☑																				
Hazard Identification & Risk Assessment							☑			☑			☑											
Goals, Objectives and Strategies																☑			☑					
Plan Production & Submittal																						☑		
Plan Adoption Support																								☑

Tools We Use

- Facilitated Meetings
- Public Workshops (if chosen by Committee)
- Secure GWRC Project Share Site

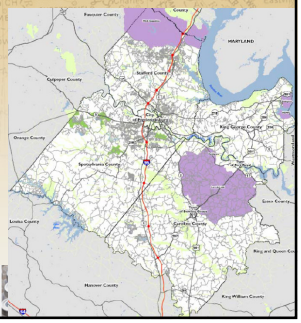
SharePoint

- http://projects.dewberry.com/GWRC2010/default.aspx
- Requires: **Username and Password**



Participating Jurisdictions

- City of Fredericksburg
- Town of Bowling Green
- Town Port Royal
- Caroline County
- King George County
- Spotsylvania County
- Stafford County



FEMA Definition: Mitigation

Sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.

Why does hazard mitigation matter?

VDEM Hazard Mitigation Definition

…is a sustainable action that will reduce or eliminate injury to citizens, damages to structures and allow continuity of critical society functions…

George Washington RC All Hazards Mitigation Plan

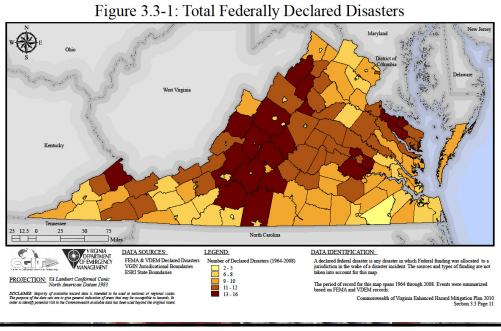
FEMA Approved on September 13, 2006

Hazard Identification Table

Hazard type	Critical vs. Non-Critical	Probability of Occurrence
Flooding	**Critical**	**High**
Northeasters Winter Storms	**Critical**	**High**
Wildfire	**Critical**	**High**
Hurricanes	Critical	Medium
Tornadoes	Critical	Medium
Biological Hazards	Critical	Low
Dam Failure	Critical	Low
Thunderstorms	Non-Critical	High
Drought	Non-Critical	Low
Earthquakes	Non-Critical	Low
Expansive Soils	Non-Critical	Low
Extreme Heat	Non-Critical	Low
Landslides	Non-Critical	Low

Presidentially Declared Disasters

Figure 3.3-1: Total Federally Declared Disasters



FEMA Requirements

- The updated plan must identify the completed, deleted, or deferred actions or activities from the previously approved plan as a benchmark for progress.
  - Reporting on mitigation strategies on an annual basis keeps mitigation progress in the forefront, prevents loss of information due to staff turnover, and prevents having to potentially piece together 5 years of information.

FEMA Requirements

- If mitigation actions remain unchanged from the previously approved plan, the updated plan must indicate why changes are not necessary.
  - The mitigation strategies spreadsheet allows you to track the reasons that certain actions have not been changed such as: lack of funding, manpower, vulnerability has increased, etc.

FEMA Requirements

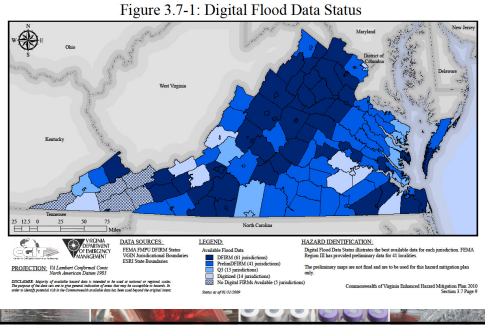
- Document how the community was kept involved during the plan maintenance process over the previous five years

Repetitive Loss Properties (As of 9-4-2008)

Community Name	Number of Rep Loss Properties
City of Fredericksburg	4
Stafford County	9

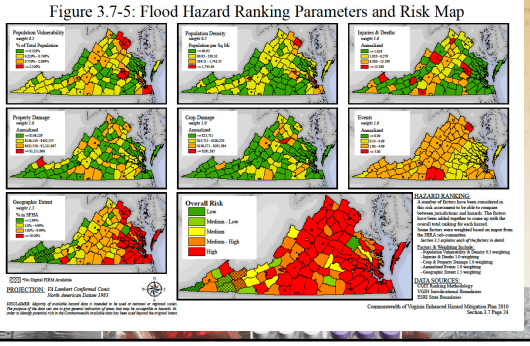
Revised State Hazard Mitigation Plan

Figure 3.7-1: Digital Flood Data Status



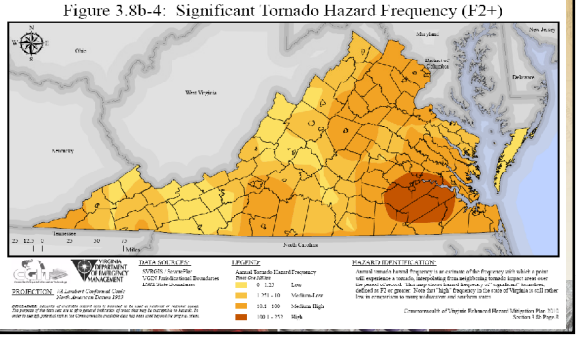
Example of Hazard Ranking

Figure 3.7-5: Flood Hazard Ranking Parameters and Risk Map



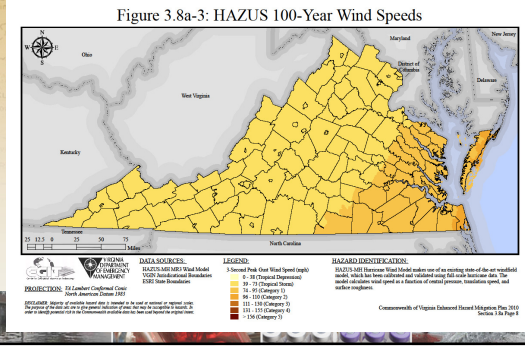
Historical Frequencies (Tornado)

Figure 3.8b-4: Significant Tornado Hazard Frequency (F2+)



Probability (Hurricane Wind)

Figure 3.8a-3: HAZUS 100-Year Wind Speeds



Identified Weaknesses in Existing Plan

Discussion with Planning Committee

- What do you like about current plan?
- Are there other efforts currently going on in your community that we should be aware of?
- Have the necessary people/departments been asked to participate?
- What would you like changed in the revision?

Understanding Requirements

- **New FEMA Local Plan Requirements**
  - Clear roadmap on update process
  - Incorporate previous plan crosswalk comments
  - Integrate NFIP program
  - Describe current status of projects
  - Address critical facilities

2006 Table of Contents

- Introduction
- Regional Profile
- The Planning Process (Public Outreach!!!)
- Hazard Identification and Risk Assessment (HIRA)
- Vulnerability Assessment
- Capability Assessment
- Mitigation Goals and Objectives
- Plan Implementation and Maintenance

Background Information

- Introduction
- Regional Profile
- Location & Profile of Participating Jurisdictions
- Demographics
  - Census Data and Projects
- Land Use and Development
  - Jurisdiction Specific data
- Planning Process

FEMA Guidance for HIRA

- Identify/Validate Hazards
  - Which hazards are significant enough to warrant further investigation or update?
  - Examine how is each hazard defined and refine as necessary
- Must update the hazard profiles
  - Identify Location (geographic areas affected) and Intensity of hazards
  - Update Previous Occurrences (recent disasters)

Hazard Identification

- 2006 Identified Hazards

Biological Hazards/ Epidemics	Hurricanes
Dam Failure	Landslide
Drought	Northeasters
Earthquakes	Thunderstorms
Expansive Soils	Tornadoes
Extreme Heat	Wildfires
Flooding	Winterstorms

Steering Committee:
Does this still represent your region?
Any hazards missing?

Capability Assessment Update

- Circulate capability assessment matrix found on page 18 to all jurisdictions
- Update each jurisdiction's information in the section
  - Guiding Community Documents
    - Comprehensive Plans, Planning and Zoning, Building Codes
    - Public Education (Outreach)

Mitigation Goals, Objectives & Projects

- Inventory and assess status of 2006 mitigation actions
- Develop regional goals and projects by Steering Committee
- Facilitate development of jurisdiction-specific goals and projects
- Create mitigation strategy tracking tool for use over next 5 years

Plan Production and Adoption

- Circulate drafts early and often via SharePoint
- Submit completed plan with crosswalk to VDEM
- Provide adoption resolution templates
- Compile adoption notices and submit full plan to VDEM (Amy Howard) and FEMA

Public Involvement

- Provide opportunities for
  - the public to comment during draft stage and prior to plan approval
  - neighboring jurisdictions to be involved in hazard mitigation activities and the planning process

Public Involvement

- Create presentations
- Create mailers:
  - to notify the public of the Hazard Mitigation Plan Update and
  - to serve as an invitation to public meetings
- Hold public meetings to present the updated plan and provide for both collaborative sessions and individual dialogue with stakeholders
- Prepare maps as illustration boards to show hazard vulnerabilities

Public Involvement

- Write plan-specific brochures
- Have web postings of
  - key plan elements and
  - draft-final version; place hard copies at local libraries
- Use social networking sites: *Follow us on Twitter to receive the latest updates to the plan.*
- Write newspaper articles (if, say, a plan revision can be linked to a recent disaster event); or to notify of a public meeting

800 PUBLIC NOTICES

NOTICE OF PUBLIC MEETING

The Frederick County Department of Emergency Preparedness is hosting a public meeting on Monday, January 12, 2009, at 12:00 p.m. until 1:00 p.m. in the Auditorium of the Frederick Rivers & Co. Semi-Arc Public Library, 110 East Patrick Street, Frederick, Maryland.

The Department of Emergency Preparedness staff will discuss the Frederick County Hazard Mitigation Plan Update and educate the public on the planning process. For more information about the meeting location, please contact 301-600-1746.

Individuals will be given an opportunity to speak at this public meeting. Comments will be limited to five (5) minutes per speaker.

Persons requiring special accommodations for this public meeting are requested to contact the Department of Emergency Preparedness at 301-600-1746 (TTY: Use Maryland Relay) to make the necessary arrangements no later than three (3) business days prior to the meeting.

Frederick County Government does not discriminate on the basis of race, color, national origin, sex, religion, age, or disability in employment or the provision of services.

Dec 27, 2008, Jan 3, 2009

Notice of public meeting.

Public Involvement

- Issue press releases specific to the plan or to alert the onset of a specific hazard season; include these written pieces in e-newsletters
- Broadcast a public service announcement on local radio and/or TV stations
- Create survey to receive public comments and to receive feedback

Public Involvement

- Document how the public was involved
- Document how the public will continue to be involved; include in plan update

DATE	EVENT	LOCATION
September 21, 2002	Presentation to Wyndham, Kiwanis	Weyers Cave, VA
September 7, 2002	Presentation to Chamber of Commerce	Harrisonburg, VA
November 11, 2002	Presentation to Virginia Department of the Deaf and Hard of Hearing	Staunton, VA
November 25, 2002	Presentation to Rockingham Rotary Club	Harrisonburg, VA
February 10, 2003	TV interview – Tweak Out Program	Harrisonburg, VA
June 18, 2003	Presentation to Chesapeake Elementary Summer School	Chesapeake, VA
July 7, 2003	Presentation to Riverheads Elementary Summer School	Augusta County, VA
July 9, 2003	Presentation to Cassell Elementary Summer School	Augusta County, VA
July 22, 2003	Presentation to Gypsy Hill Senior Residents	Staunton, VA
July 24, 2003	Presentation to Rockbridge Area Community Service Board	Lexington, VA

Dewberry documented and included a list of public meetings and events in the Central Shenandoah Valley All-Hazards Mitigation Plan

Capability Assessment Update

Next steps…

- Circulate capability assessment matrix found on pg 18 to all jurisdictions
- Update jurisdiction information starting on pg 161
  - Guiding Community Documents
    - Comprehensive Plans, Planning and Zoning, Building Codes
    - Public Education (Outreach)
- Kevin will disseminate information to update
  - Each jurisdiction will update their section and send back to Kevin
  - Dewberry will review all updates against FEMA requirements and crosswalk

What's Next?

- Periodic conference calls
  - Next: Capability Assessment Update
- Data gathering for Capability Assessment
- Data gathering for HIRA
- Initiation of Public Outreach
- Reporting on 2006 Plan Accomplishments

GWRC Mitigation Plan Update Kick Off Meeting
November 15, 2010 Sign-in Sheet

Name	Department/Organization	Phone	Fax	E-mail
ROBERT WASLOV	Stafford Co. DEPT of Planning	540-658-8668		RWASLOV@co.stafford.va.us
Amy Howard	VDEM/ Recovery+Mitigation	804-897-9974	804-897-6536	Amy.howard@VDEM.VIRGINIA.GOV
Eddie Allen	City of FREDERICKSBURG	540-372-1061	540 372-1050	eallen@fd.fredericksburgva.gov
DAVID LATHAM	Caroline County FIRE	804-633-9831	804-633-9832	DLatham@Co.Caroline.VA.US
MARK GARNETT	CAROLINE Co. Fire-Rescue	804-633-9831	804-633-9832	MGARNETT@CO.CAROLINE.VA.US
DOUG BOGGS	Spotsylvania Co. FIRE/RESCUE/EMERGENCY SVS	540-507-7904	540-582-6957	dboggs@spotsylvania.VA.US
Bruce Sterling	VDEM | Region 2	540-829-7371	540-829-7655	bruce.sterling@vdem.virginia.gov
Mike Finchum	Caroline County Planning	804-633-4303	804-633-1766	mfinchum@co.caroline.va.us
Steve Lynch	King George	540 775 8900	775 9060	slynch@co.kinggeorge.state.VA.US
Paul Lupe	Stafford County Fire/Rescue	540-379-4952	540-658-4545	plupe@co.stafford.va.us
LINDA BERNHARDT	CreativePags, LLC	703-963-8511	N/A	creativepagsllc@aol.com
Wanda Parrish	Spotsylvania Co Planning	540 507 7425	9075077445	wparrish@Spotsylvania.va.US
MICHAEL CARTER	STAFFORD County FIRE & RESCUE	540-658-7200	540-658-4585	mcarter@co.stafford.va.us

Carrie Speranza Dewberry

Kevin Burrows GWRC

George Washington Regional Commission - Hazard Mitigation Plan Update
Hazard Identification, Vulnerability Assessment & Mitigation Goals Meeting
Fredericksburg, Virginia, July 12, 2011, 10:00AM

I. Welcome & Introductions

II. Hazard Identification and Vulnerability Assessment – Ryan Flaherty and Julia Moline

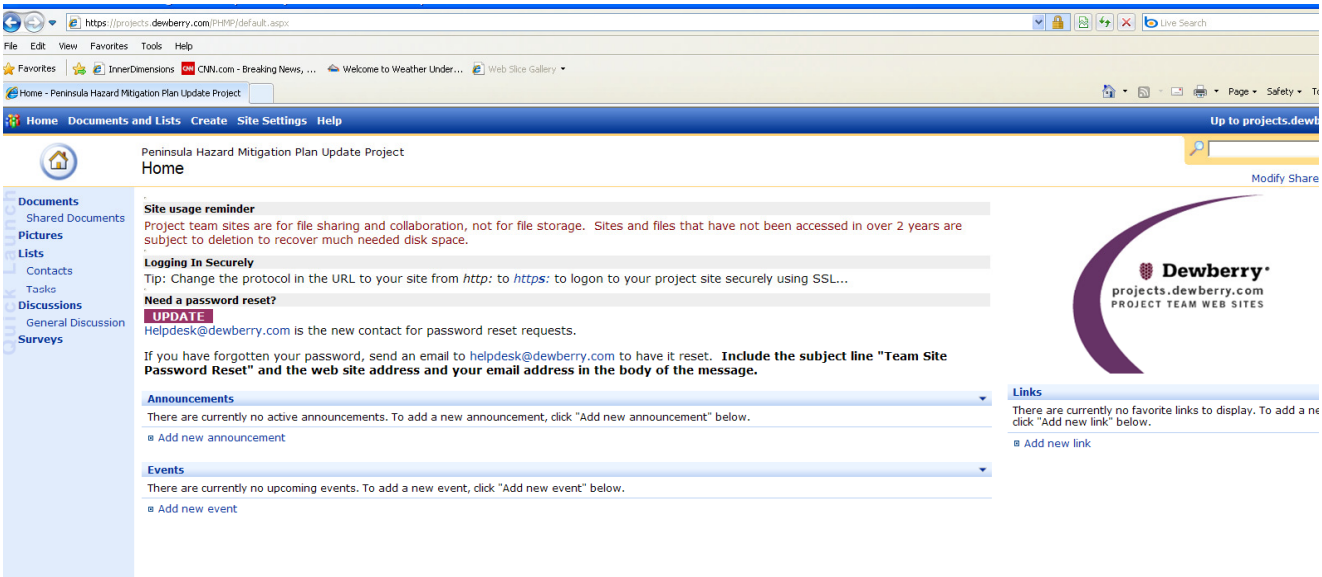
III. Mitigation Goals – Carrie Speranza

IV. Next Steps

V. Wrap Up & Future Meetings

Project Websites

SharePoint Site: http://projects.dewberry.com/GWRC2010/default.aspx
Email helpdesk@dewberry.com if you need your password reset or other technical support



George Washington Regional Commission Hazard Mitigation Plan Update

Hazard Identification, Vulnerability Assessment & Mitigation Goals Meeting

July 12, 2011

Dewberry

Meeting Agenda

1. Welcome & Introductions
2. Hazard Identification and Vulnerability Assessment
3. Mitigation Goals
4. Next Steps
5. Wrap Up & Future Meetings

Hazard Identification and Risk Assessment

- Updates included (add or delete as needed):
  - Refreshing the hazard profiles
  - Updating the previous occurrences
  - Determining annualized number of hazard events and losses by jurisdiction using NCDC and other data sources where available
  - Updating the assessment of risk by jurisdiction based on new data
  - Updating maps and imagery

Hazard Identification

- Overview of what's in the hazard id:
  - Regional hazard ID
  - Local jurisdiction hazard ID
- Both include hazard descriptions and historic events

Regional Hazard Rankings

- Table with 2006 and 2012 rankings

Local Hazard Rankings

- Summary table with local hazard rankings (one or many)

Hazard ID: Data Sources

- Discussion of where the data came from

Federally Declared Disasters

- XX disasters (since [year]) have included at least one community in the GWRC planning area
- Disaster Types:
  - Severe Storms and Flooding
  - Tornadoes
  - Tropical Storms & Hurricanes
  - Winter Storms (Blizzards, Ice Storms)

Vulnerability Assessment

- Overview of what's in the vulnerability assessment:
  - Hazard maps
  - Loss estimates
  - Etc.

HAZUS MH

- Level I Analysis
  - Nationally-developed data for building square footage, building value, population characteristics, costs of building repair and economic data (broken down by census division units)
    - Hurricane Winds
    - Earthquake (via Commonwealth of Virginia hazard mitigation plan)
- HAZUS is not required in Local Mitigation Plans, however, communities are encouraged to use HAZUS to form a scientific basis from which the mitigation strategy is developed.

Flood

- Hazard overview
- How was the analysis done
- What data did you use
- Etc.

Flood Risk

- Flood maps (regional and/or local)

Flood Vulnerability

- Discussion of expected losses, highest vulnerabilities (specific areas), etc.

Repeat for each hazard

Regional Goals

Goal: **general guideline that describes what GWRC would like to achieve**

Objective: **specific and measurable strategies that must be implemented to achieve the identified goals**

Action: **more specific than an objective with identified responsible parties, timeframes, and potential funding sources**

Regional Goals

GOAL #1: **Reduce the future impacts and losses from identified hazards.**

GOAL #2: **Educate and engage the public regarding hazards, their impacts, and feasible actions.**

GOAL #3: **Maximize the impact of public resources through effective coordination and the efficient use of technology.**

GOAL #4: **Improve and enhance emergency management capabilities.**

Next Steps

- Update old actions
- Develop new actions
- Public Outreach

July 12, 2011 Mitigation Advisory Committee
Meeting Minutes

1. Kevin Byrnes of the GWRC, called the HIRA and Mitigation Goals meeting to order at 10am and asked the attendees to introduce themselves around the table.
2. Ryan Flaherty of the GWRC, presented the findings of the Hazard Identification and Vulnerability Assessment (HIRA). The presentation included a discussion of the data analysis and subsequent hazard rankings and dollar losses from each hazard described in the plan. No issues/concerns were raised about the analysis or results.
3. Following the HIRA presentation, Carrie Speranza of Dewberry, presented the 2006 mitigation goals to the committee and asked for their review and approval for the 2012 plan. The following goals, and two objectives, were developed:
    - Reduce the future impacts and losses from identified hazards.
    - Educate and engage the public regarding hazards, their impacts, and feasible actions.
    - Maximize the impact of public resources through effective coordination among agencies and the efficient use of technology.
        - Enhance interoperable communications among all agencies.
        - Enhance public/private partnerships.
    - Improve and enhance emergency management capabilities.
4. Carrie Speranza described the mitigation strategy "coaching timeline" that will be followed to update this particular piece of the plan. (please see attachments)
5. The meeting was adjourned at 11:25am.

NEXT STEPS:

- The committee will review the HIRA document to be disseminated for review in the next couple weeks.
- The committee will review and update their 2006 mitigation actions (handed out at the meeting and attached to this email).
- The committee will develop new mitigation actions based upon the HIRA results for incorporation into the plan update.
- The committee will discuss and finalize the mitigation goals (and two objectives) developed at this meeting, at the next EM monthly meeting in August.
- Following the EM monthly meeting, and after each jurisdiction has developed draft mitigation actions, Dewberry will conduct a conference call with the committee to help finalize the mitigation actions and answer any questions that may arise in the process.

GWRC Mitigation Plan Update HIRA and Goals Meeting
July 12, 2011 Sign-in Sheet

Name	Department/Organization	Phone	Fax	E-mail
Kevin Byrnes	GWRC			byrnes@gwregion.org
Jim Lynch	Fredericksburg Fire			JLYNCH@FD.FREDERICKSBURGVA.GOV
Eddie Allen	Fredericksburg Fire	540-372-1061	540-372-1050	eallen@fd.fredericksburgva.gov
SCOTT HUDSON	VDEM	804-435-1532	SAME	scott.hudson@vdem.virginia.gov
Emily O Smith	Rappahannock Area Health District	540 899-4797 x103	540-899-4599	emily.smith@vdh.virginia.gov
Ryan Flaherty	GWRC			flaherty@gwregion.org
Steve Lynd	King George	540.775.8915		slynd@co.kinggeorge.state.VA.US
Jan Erkert	Spangler Erkert	540.373.5094	540.899-3301	janerkert@spanglererkert.com
Ray Ocel	City of Fredericksburg	540.372-1179		ROCEL@FREDERICKSBURGVA.GOV

George Washington Regional Commission - Hazard Mitigation Plan Update
Regional Strategies and Public Outreach Meeting
Fredericksburg, Virginia, October 4, 2011, 8:30AM

I. Welcome & Introductions

II. Mitigation Strategy Review and Regional Strategy Development

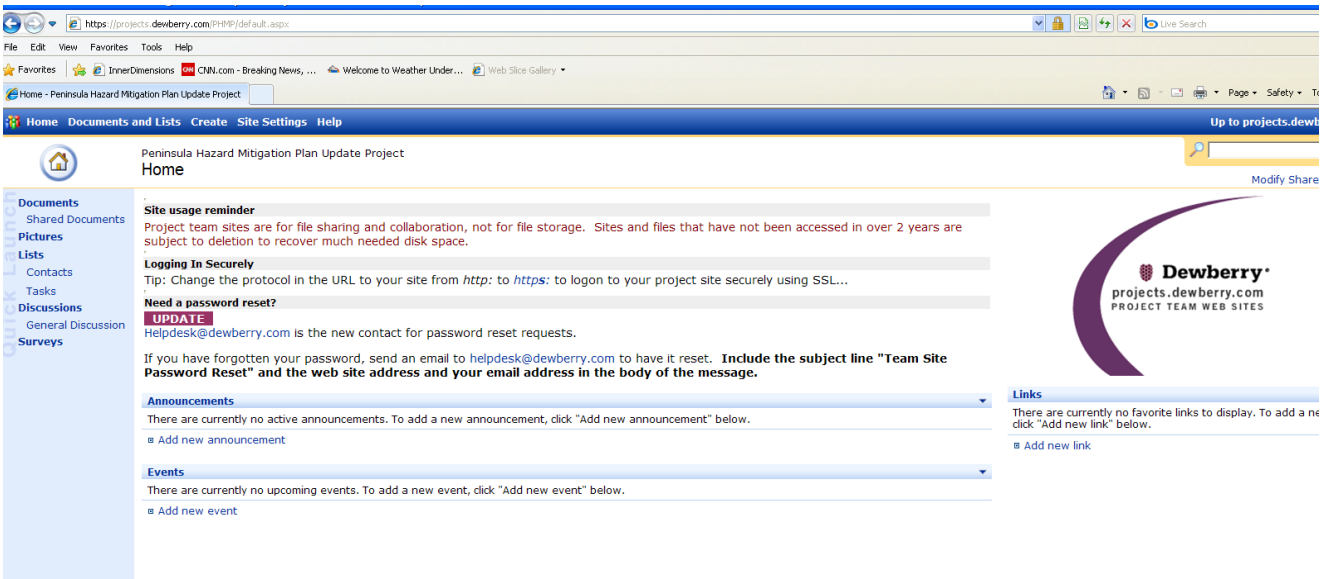
III. Public Outreach – Jan Erkert

IV. Next Steps

V. Wrap Up & Future Meetings

Project Websites

SharePoint Site: http://projects.dewberry.com/GWRC2010/default.aspx
Email helpdesk@dewberry.com if you need your password reset or other technical support



GWRC Mitigation Plan Update Regional Strategies and Public Outreach
October 4, 2011 Sign-in Sheet

Name	Department/Organization	Phone	E-mail
Kevin Byrnes	GWRC	540 373-2890	byrnes@gwregion.org
Paul Lupe	Stafford County F/R	540 379-4952	plupe@co.stafford.va.us
AL WHITE	King George DFRES	775-1977	awhite@co.kinggeorge.state.va
RAY OLEL	FREDERICKSBURG	540 372-1179	ROLEL@FREDERICKSBURGVA.GOV
Doug Betts	Spotsylvania F/R	540 507-7904	dbetts@spotsylvania.va.us
Jim Lynch	FREDERICKSBURG PD	540-372-1059	JLYNCH@PD.FREDERICKSBURGVA.GOV
Jan Erkert	Spangler Erkert	540 3735094	janerkert@spanglererkert.com
SCOTT HUDSON	VDEM	804 435 1532	scott.hudson [redacted] @VDEM.VIRGINIA.GOV
Carrie Spearen	Dewberry		
Wanda Parrish	Spotsylvania Planning	540 507 7425	wparrish@spotsylvania.va.us
Mike Carter	Stafford County F/R	540 379-4947	mcarter@co.stafford.va.us
Amy Howard	VDEM	804-897-9974	amy.howard@VDEM.VIRGINIA.GOV

APPENDIX D – 2006 MITIGATION STRATEGIES UPDATE

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Caroline County Mitigation Strategies

***Note* 2006 Mitigation Strategies for Towns of Bowling Green and Port Royal were previously incorporated into Caroline County's.**

Mitigation Strategies	Strategy ID # (when provided)	Priority H = High M=Medium L = Low	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
It is recommended to investigate the feasibility of updating the Flood Insurance Studies and Flood Insurance Rate Maps for Caroline County, the Town of Bowling Green, and the Town of Port Royal.	CC- 1	H	Completed	Flood Insurance Rate Maps competed 03/09
It is recommended to ensure proper elevation through retrofit and anchoring of mobile homes and other attendant appurtenances located in the floodplain to reduce the risk of future flood damage.	CC- 2	H	Ongoing	Retrofits occur during reconstruction.
It is recommended to investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and/or model shelters.	CC- 3	L	Not Started	Subject to VAUSBC regulation
It is recommended to develop a Regional Public Awareness Program.	CC- 4	H	In-Progress	Caroline Alert System created
It is recommended to initiate a GIS needs assessment and program.	CC- 5	H	Completed	Needs Assessment Done
It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.	CC- 6	L	Not Started	Awaiting Regional Coordination
It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards iden	CC- 7	L	Not Started	Caroline GIS data available for GWRC use. Awaiting Regional Coordination
It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.	CC- 8	H	In-Progress	Caroline Alert establised. Alert systems need coordination.
It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.	CC- 9	L	Not Started	Awaiting Regional Coordination
It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.	CC- 10	H	In-Progress	RFP for radio system upgrade received and under review. System upgade will ensure interoperability with other jurisdictions

City of Fredericksburg Mitigation Strategies

Mitigation Strategies	Strategy ID # (when provided)	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
It is recommended to investigate the feasibility of mitigating the City's repetitive loss structures from future flooding events.	F- 1	Canceled	Lack of funding
It is recommended to investigate the potential to include a provision in the floodplain management ordinance that any project that requires placement of fill in the floodplain will be required to provide 110 percent compensatory floodplain storage.	F- 2	Completed	
It is recommended to assist the Study Contractor in preparing revised Digital Flood Insurance Rate Maps (FIRMs) by identifying areas within the community, which flood frequently and are not reflected appropriately on existing FIRMs. Additionally, provide	F- 3	Completed	
It is recommended to investigate participation in the Community Rating System.	F- 4	Cancelled	Lack of Staffing due to budget cuts
It is recommended to develop and adopt development design standards based upon FIREWISE principles into the City's subdivision ordinance. The design standards should include standard setbacks from trees and above-ground propane tanks, and minimum distance	F- 5	Cancelled	Lack of Staffing due to budget cuts
It is recommended to investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and/or model shelters.	F- 6	In Progress	Process is continuing & involves several City deparmtments.
It is recommended to investigate warning systems for severe weather.	F- 7	Completed	
It is recommended to identify all critical facilities using GIS.	F- 8	In Progress	Process is continuing - GIS installation is nearing completion
It is recommended to identify priorities for protection among critical facilities identified in the plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up.	F- 9	In Progress	Process is continuing - personnel & budget reductions have slowed the process.
It is recommended to develop a Regional Public Awareness Program.	F- 10	Cancelled	Lack of staffing due to budget cuts
It is recommended to investigate the development of a community based emergency contact network.	F- 11	Cancelled	Lack of staffing due to budget cuts
It is recommended to establish a minimum level of GIS data for the City.	F- 12	Completed	
It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards iden	F- 13	Cancelled	Lack of staffing due to budget cuts
It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.	F- 14	Completed	
It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.	F- 15	Cancelled	Lack of staffing due to budget cuts
It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.	F- 16	In Progress	On-going process in cooperation with other agencies and City departments

City of Fredericksburg Mitigation Strategies

Mitigation Strategies	Strategy ID # (when provided)	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.	F- 17	Completed	
It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.	F- 18	Completed	

GWRC Mitigation Strategies			
Action #	Action	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
GWRC - 1	It is recommended for all jurisdictions currently participating in the National Flood Insurance Program (NFIP) remain compliant.	Completed	
GWRC -2	It is recommended to develop and conduct a multi-hazard, seasonal Public Awareness Program that provides citizens and businesses with accurate information describing the risk and vulnerability to natural hazards, and is implemented on an annual basis.	Not Started or Unknown, Will Confirm with Committee Members	
GWRC -3	It is recommended to establish a clearinghouse of GIS data for all GWRC jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards identified in this plan.	In Progress	
GWRC -4	It is recommended to establish a minimum standard for GIS capabilities and data throughout the GWRC region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.	In Progress	
GWRC -5	It is recommended to establish an early warning system, such as river gauging and flood warning systems, for jurisdictions in the GWRC region that can provide event-distinct information to citizens and businesses.	Flood gauge installed on Rappahannock River by the City	
GWRC - 6	It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions. The following actions were suggested by the HMPC:	In progress, presentation planned to FAMPO Technical Advisory Committee in Spetember to add emergency signage and regional disaster traffic mitigation plan to Unified Plannig Work Program.	
GWRC - 6.1	Improve signage along major interstates and thoroughfares with interactive signs, operated by VDOT, to provide hazard warnings, including weather reports during tornado and hurricane events, road closings and blockages. The signs can also alert motorists to call 511 for road conditions, or to tune their radios to the emergency radio station for up-to-date conditions. Suggested locations include I-95 and Routes 1, 3, 17, 301, and 610.		
GWRC - 6.2	Investigate emergency lane/shoulder improvements for Emergency Services access on all primary roads.		
GWRC - 6.3	Identify and publicize local evacuation routes throughout the region.		
GWRC - 6.4	Identify traffic plan/alternate routes due to closures on primary routes such as 1, 3, 17, 301, and 610.		
GWRC - 6.5	Coordinate locally with VDOT on updates to VDOT's Regional Transportation Plans.		
GWRC - 6.6	Purchase and place into operation AM radio stations along routes to relay emergency information to motorists during a disaster or emergency.		
GWRC - 6.7	Facilitate discussions with neighboring regions on traffic flow for emergency service vehicles.		
GWRC -7	It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the GWRC region.	In Progress through Regional Inter-Operability Communications Group monthly meetings	
GWRC -8	It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.		

King George County Mitigation Strategies

Mitigation Strategies	Strategy ID # (when provided)	Priority H = High M=Medium L = Low	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
Revise and create Digital Flood Insurance Rate Maps (FIRMs) by identifying areas within the community, that flood frequently, and are not reflected appropriately on the existing FIRMs. Additionally, providing GIS capabilities and upcoming aerial photograph	KG- 1	H	Completed	
Update the County Ordinance and Zoning to prohibit construction of large occupancy structures within identified hazard areas, such as floodplains or areas adjacent to hazardous materials facilities.	KG- 2	H	Cancelled	Applying alternative
Update the existing floodplain ordinance to require first floor elevations in the floodplain to be constructed at the base flood elevation plus 2 feet.	KG- 3	M	Cancelled	Exceeds requirements
Develop and adopt development design standards based upon FIREWISE principles into a subdivision ordinance. The design standards should include standard setbacks from trees and above-ground propane tanks, and minimum distances from fire hydrants.	KG- 4	L	Cancelled	Not feasible
Ensure all new construction of critical facilities includes hurricane shutters and straps, safe rooms, fire walls, and sprinkler systems.	KG- 5	H	Completed	
Identify priorities for protection among critical facilities identified in the plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up and purchasing required generators.	KG- 6	H	Completed	
Establish a County ordinance that requires future development of mobile home parks to include a community shelter for citizen protection in the event of a disaster or emergency.	KG- 7	M	Cancelled	Not economically feasible
Develop a Regional Public Awareness Program.	KG- 8	H	Not Started	Regional activity
Continue the use of KGALERT to distribute preparedness information to citizens.	KG- 9	M	Completed	
Develop a “hotline” for citizens to call for non-emergency information during a disaster.	KG- 10	M	Completed	
Encourage and provide incentives for citizens to purchase a home generator and for local contractors and builders to include home generators in all homes built in King George County. A county ordinance would be the preferred method.	KG- 11	M	Cancelled	Not economically feasible
Implement citizen notification System for potential dam failures.	KG- 12	M	Completed	
Establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.	KG- 13	n/a	Not Started	Regional activity
Establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community’s vulnerability to the natural hazards identified in this plan.	KG- 14	M	Not Started	Regional activity
Provide additional money to Community Development for the aerial photography to be created from the County flyover in Spring 2006, to improve disaster preparedness capability.	KG- 15	M	Completed	
Establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.	KG- 16	H	Completed at KG level	
Improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.	KG- 17	M	In Progress	
Investigate the feasibility of establishing one radio frequency for use by all emergency services departments in the RADCO Region.	KG- 18	M	In Progress	Regional activity

King George County Mitigation Strategies

Mitigation Strategies	Strategy ID # (when provided)	Priority H = High M=Medium L = Low	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
Investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys.	KG- 19	H	Completed	

Spotsylvania County Mitigation Strategies

Mitigation Strategies	Strategy ID # (when provided)	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
It is recommended to investigate the need to include a provision in the floodplain management ordinance that any project that requires the placement of fill in the floodplain will be required to provide 110 percent compensatory floodplain storage.	SP- 1	Complete	
It is recommended to develop a comprehensive local stormwater management ordinance that provides water quality protection that could compensate for loopholes in related state erosion and sediment control laws, such as the 1 percent loophole noted in Minim	SP- 2	Complete	
It is recommended to develop and adopt development design standards based upon FIREWISE principles and defensible space into the County's subdivision ordinance. The design standards should include standard setbacks from trees and above-ground propane tank	SP- 3	in progress	
It is recommended to create a multi-season power line right-of-way maintenance plan in conjunction with Virginia Dominion Power and Rappahannock Electric Cooperative	SP- 4	Not Started	Not appropriate to Subd. Ord, setbacks in zoning
It is recommended to identify priorities for protection among critical facilities identified in this plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up.	SP- 5	In Progress	
It is recommended to develop a Regional Public Awareness Program.	SP- 6	in progress	
It is recommended to develop a Weather Spotter program within the County.	SP- 7	In progress	
It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.	SP- 8	In progress	
It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards iden	SP- 9	in progress	
It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.	SP- 10	Complete	
It is recommended to improve the flexibility of the transportation network through coordination with the Virginia Department of Transportation (VDOT) and neighboring regions.	SP- 11	In Progress	

Spotsylvania County Mitigation Strategies			
Mitigation Strategies	**Strategy ID # (when provided)**	**Project Status (Not Started, Cancelled, Modified, In Progress, Completed)**	**If Delayed / Canceled Why? (Lack of $, support, manpower, etc)**
It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.	SP- 12	In progress	
It is recommended to investigate and potentially purchase the equipment required to eliminate radio communication gaps in valleys	SP- 13	In progress	

Stafford County Mitigation Strategies

Mitigation Strategies	Strategy ID # (when provided)	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
It is recommended to investigate the feasibility of mitigating the County's repetitive loss structures and historic homes from future flooding events	ST- 1	In progress - Letters were sent to all repetitive loss area homeowners notifying of the danger and recommended course of action to protect their home and property from flooding (as part of Community Rating System Program). No physical mitigation was done.	
It is recommended to ensure proper elevation through retrofit and anchoring of mobile homes and other attendant appurtenances located in the floodplain to reduce the risk of future flood damage.	ST- 2	Not Started	Staffing, funding and resources available
It is recommended to increase the inspection cycle for public and private storm water detention/retention facilities.	ST- 3	The Public Works Department now requires formal maintenance inspections of stormwater management facilities at least once every two years by County staff or the owner. Additionally, the standard Maintenance Agreement for Stormwater Facilities requires more frequent inspections by the owner than our formal inspection program requires.	
It is recommended to develop and adopt development design standards based upon FIREWISE principles and defensible space into the County's subdivision ordinance. The design standards should include standard setbacks from trees and above-ground propane tank	ST- 4	Not Started	Staffing and resources available
It is recommended to investigate safeguards against severe weather including hurricane clips, safe rooms, community shelters, and/or model shelters.	ST- 5	Completed - implemented public warning system, attached that to social media, identified shelters and created CERT program.	
It is recommended to investigate the development of a tree-trimming program, which includes training for local contractors.	ST- 6	Not Started	Staffing and resources available
It is recommended to identify all critical facilities using GIS.	ST- 7	Completed	
It is recommended to identify priorities for protection among critical facilities identified in this plan as well as methods for protection against natural hazards, including the retrofitting of structures for quick external power generator hook up.	ST- 8	Completed - Generators installed at all critical public facilities.	
It is recommended to develop a Regional Public Awareness Program.	ST- 9	In progress - Stafford has utilized the national model to reach out to communities on National Preparedness Month as well as woking with the NOVA region to develop a Regional preparedness web site ReadyNova.org.	
It is recommended to establish a minimum standard for GIS capabilities and data throughout the RADCO region as jurisdictions begin to add GIS to their current hazard mitigation capabilities.	ST- 10	Not Started	Staffing and resources available
It is recommended to establish a clearinghouse of GIS data for all RADCO jurisdictions. This will allow all jurisdictions to have access to compatible data in order to better assess the region and each community's vulnerability to the natural hazards	ST- 11	Not Started	Staffing and resources available

Stafford County Mitigation Strategies

Mitigation Strategies	Strategy ID # (when provided)	Project Status (Not Started, Cancelled, Modified, In Progress, Completed)	If Delayed / Canceled Why? (Lack of $, support, manpower, etc)
It is recommended to establish an early warning system for jurisdictions in the RADCO region that can provide event-distinct information to citizens and businesses.	ST- 12	Completed	
It is recommended to investigate the feasibility of establishing a common means of communication, such as one radio frequency or equipment to connect existing radio frequencies, for use by all emergency services departments in the RADCO region.	ST- 13	Completed - Stafford has the ability to communicate with VHF and 700/800MHz digital voice radio with all surrounding jurisdictions. We also have the ability to link our system to other radio systems and hospitals	N/A

APPENDIX E – PUBLIC OUTREACH

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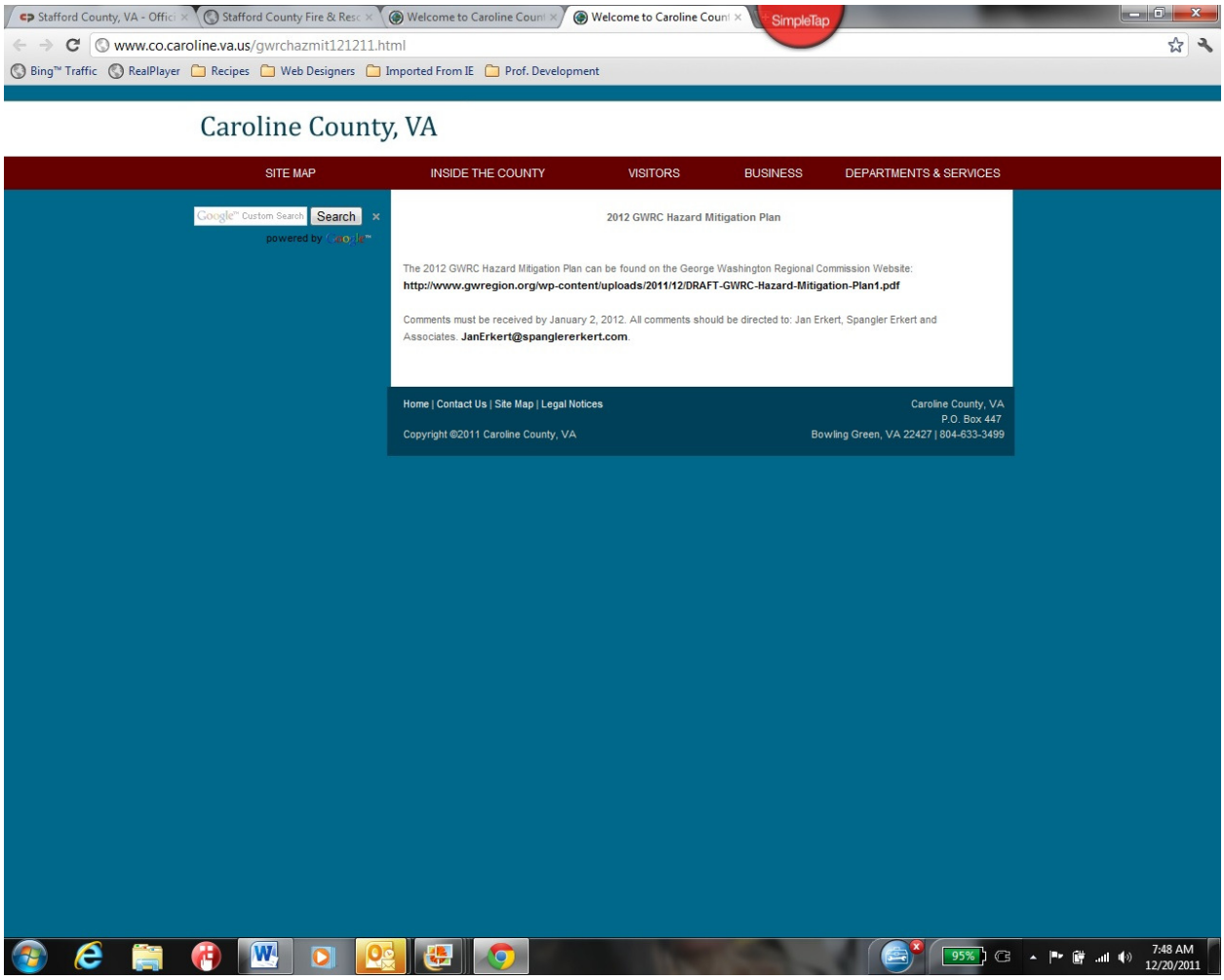
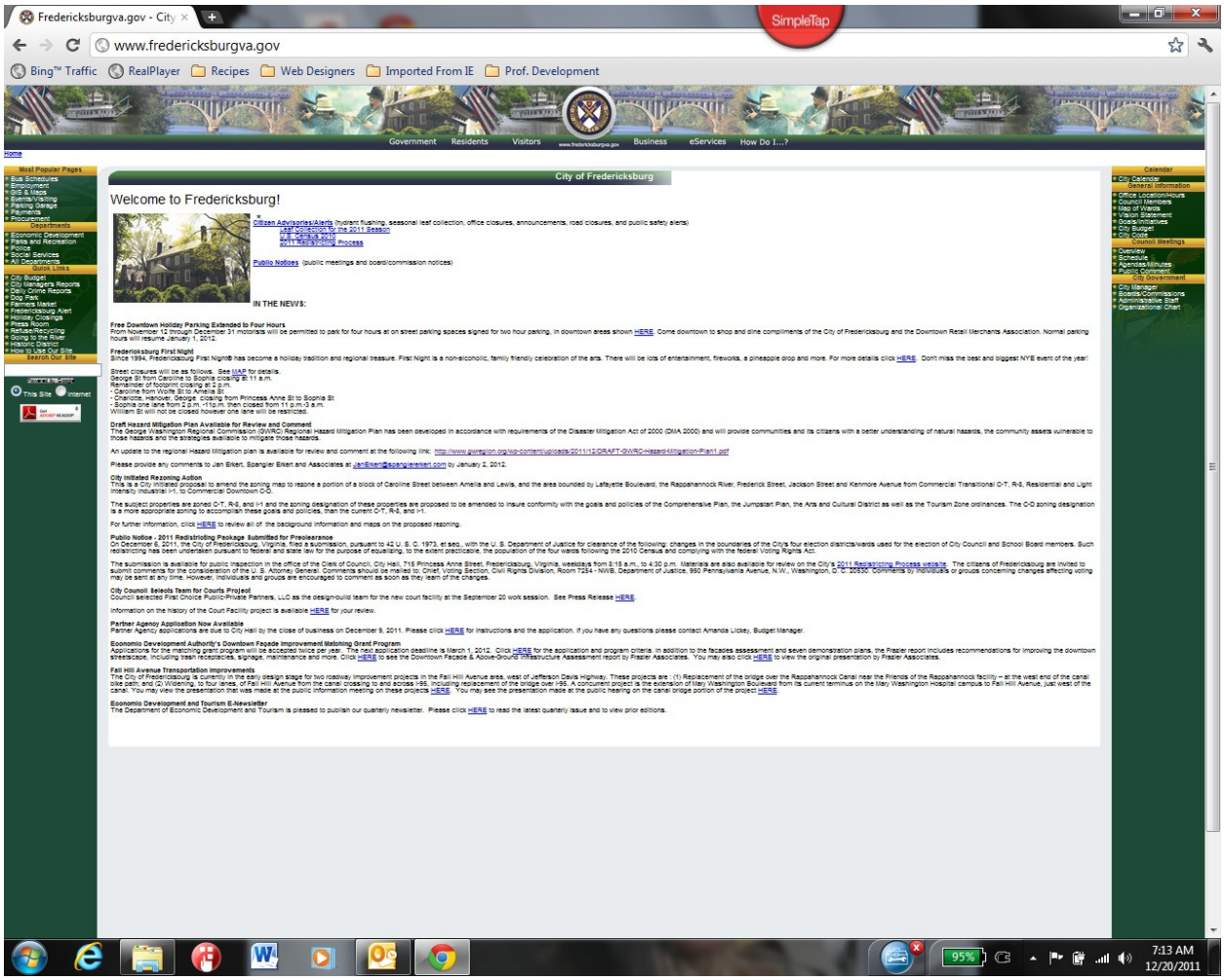
The following are screenshots of where this mitigation plan was posted to each of the participating jurisdictions' websites. These constitute the first public outreach effort to incorporate public input into the planning process. The plan was posted to these websites for a minimum of two weeks between the middle of December, 2011 to early January, 2012. All of the jurisdictions, as well as the region, posted the plan to their website, with the exception of the Town of Port Royal, which doesn't have a website.

George Washington Regional Commission Draft Plan Notice
12-13-11
http://www.gwregion.org/regional-planning/reports-and-studies/

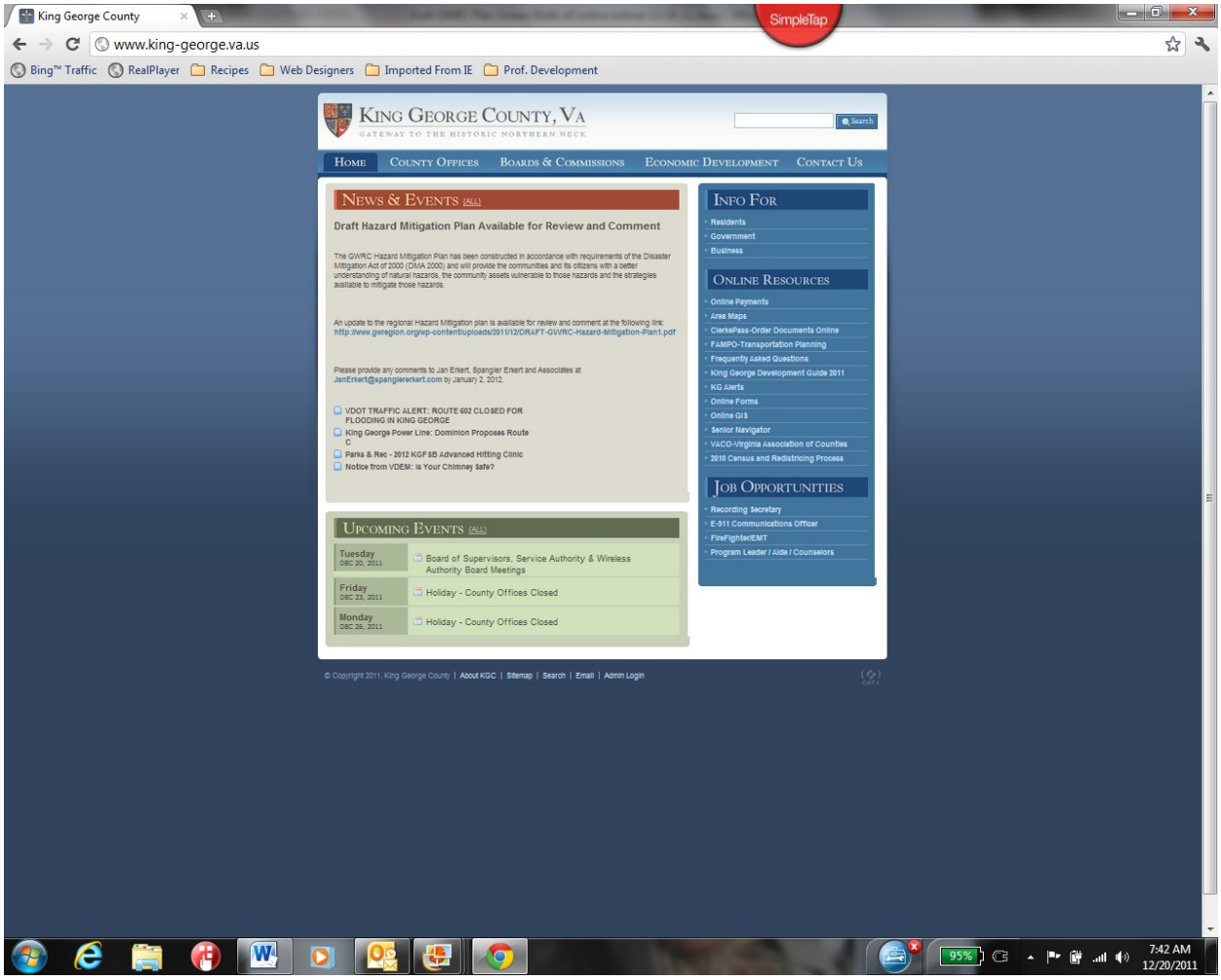
Town of Bowling Green Draft Plan Notice
12-19-11
http://www.townofbowlinggreen.com/?q=node/182



Caroline County Draft Plan Notice
12-19-11
http://www.co.caroline.va.us/gwrchazmit121211.html



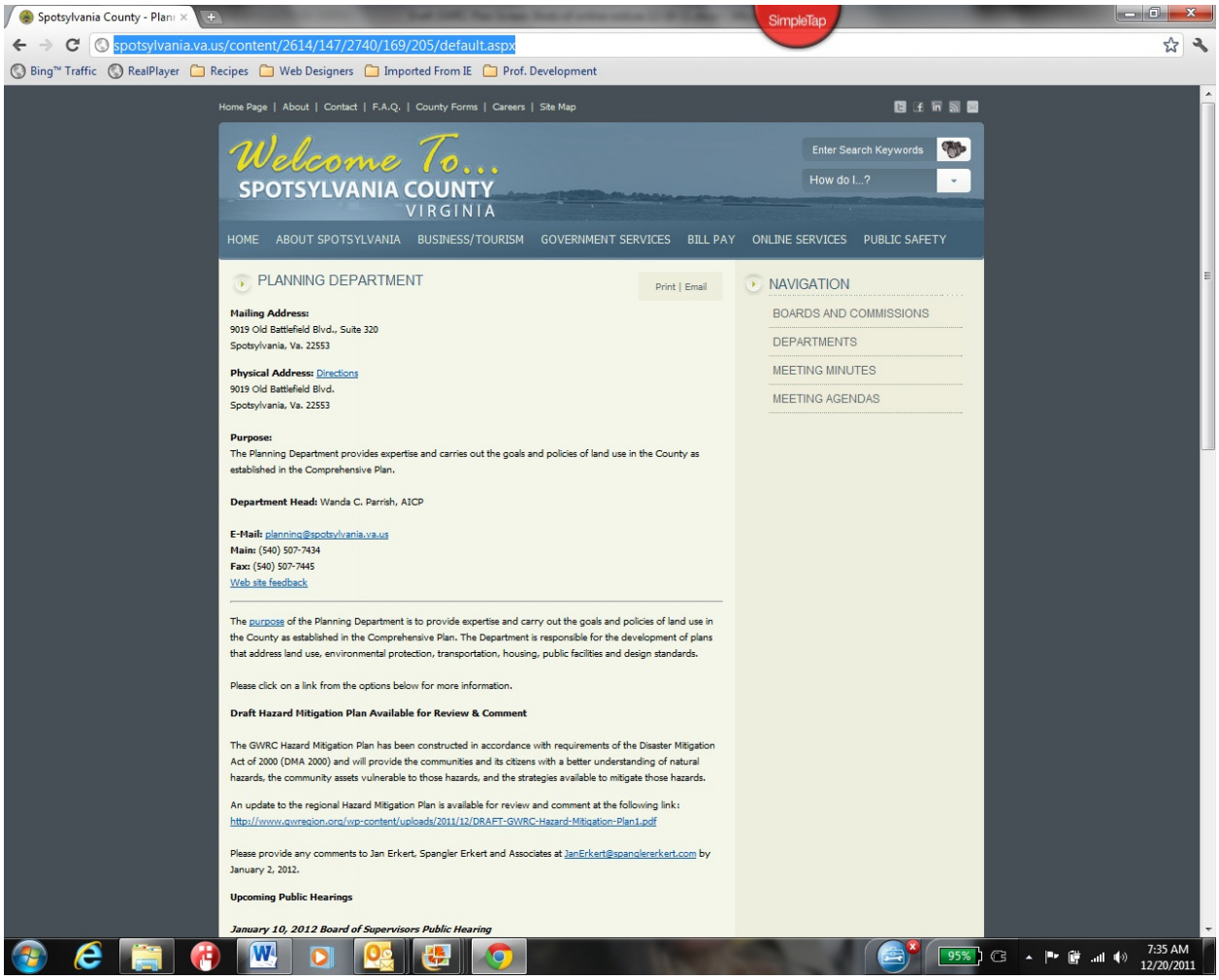
City of Fredericksburg Draft Plan Notice
12-19-11
http://www.fredericksburgva.gov



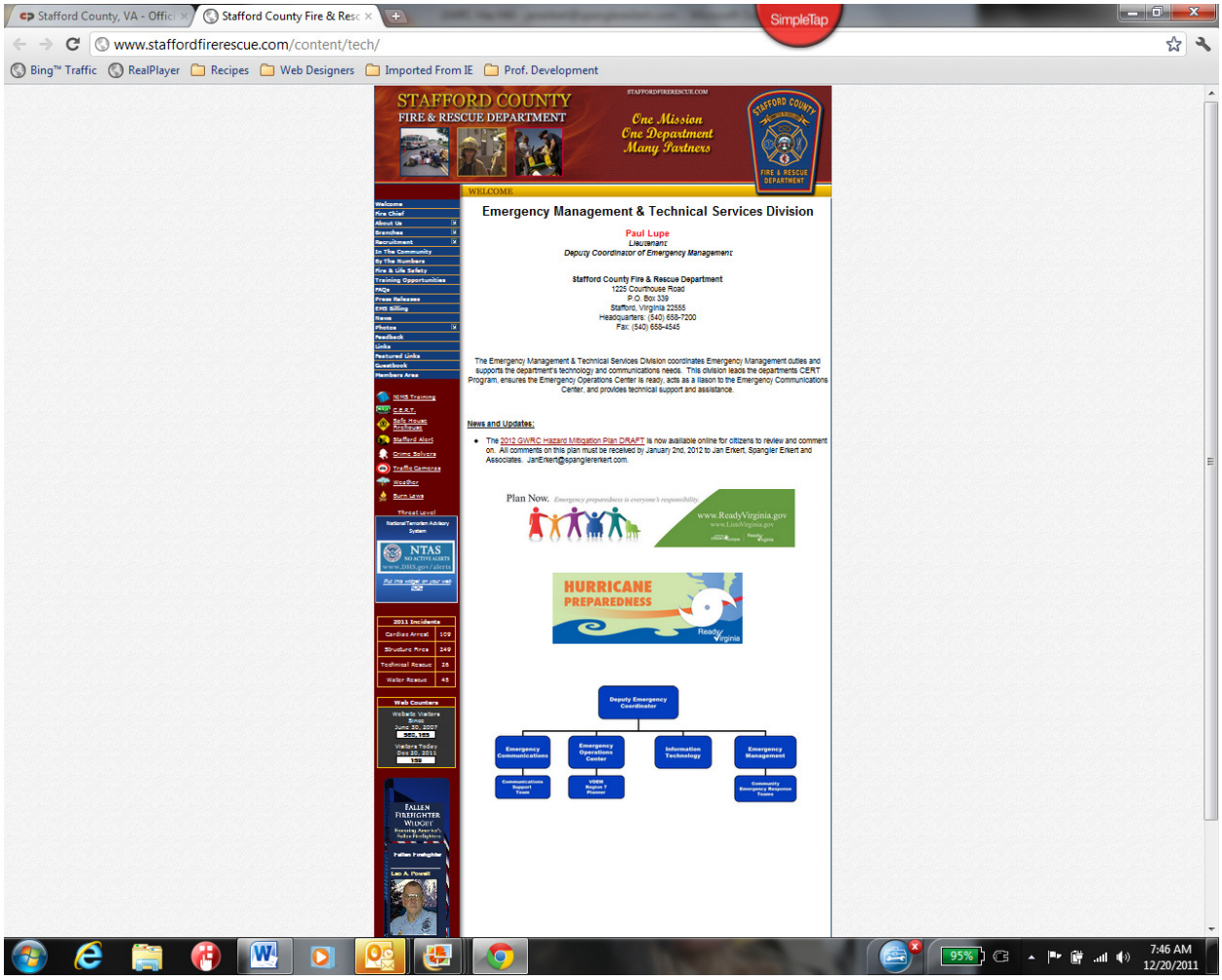
King George County Draft Plan Notice

12-19-11

http://www.king-george.va.us/



Spotsylvania County Draft Plan Notice
12-19-11
http://spotsylvania.va.us/content/2614/147/2740/169/205/default.aspx



Stafford County Draft Plan Notice
12-19-11
http://www.staffordfirerescue.com/content/tech/

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