



Chapter 7: Jurisdiction Executive Summaries

Chapter 7 is a new chapter for the 2010 plan update. It was reviewed and approved by the Northern Virginia MAC.

I. Alexandria

What is now the City of Alexandria was first settled as part of the British Colony of Virginia in the late 1690s. In 1791, George Washington included portions of the City of Alexandria in what was to become the District of Columbia. That portion was given back to Virginia in 1846 and the City of Alexandria was re-chartered in 1852. In 1870, the City of Alexandria became independent of Alexandria County, with the remainder of the county changing its name to Arlington County in 1920. The population of the city was 128,283 as of the 2000 Census and was estimated to be 141,738 in 2009.



Alexandria has a moderate climate. The average annual temperature is approximately 58 degrees. Temperatures generally range from January lows in the mid-20s to July highs in the upper-80s and lower-90s. Annual precipitation averages above 40 inches and approximately 14 - 16 inches of snow falls in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Alexandria's high population density and its location along the banks of the Potomac River increase the city's vulnerability to a variety of hazards, most notably flooding. In addition to snow melt and rain-related river flooding episodes, Alexandria is also subjected to tidal and storm surge flooding. As sea levels rise, permanent inundation of low lying areas along and near the river shoreline is also a concern. Winter weather and high wind events also pose a significant threat to the city as the 2009 – 2010 winter and summer seasons have proven.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Alexandria, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC³⁸. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.



The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Landslide hazards were ranked as ‘High’ for Alexandria. See Table 7.1 for a summary of hazard rankings.

Table 7.1: Hazard Ranking for Alexandria									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
	High	High	High	High	Med-High	Med	Low	Med-Low	Med-Low

Annualized loss statistics for Alexandria based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.2. It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

Table 7.2: NCDC Annualized Loss by Hazard for Alexandria					
Annualized Loss as determine through NCDC data <i>(based on property and crop damages and years of record)</i>					
County	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss
<i>Years of Record</i>	17	21	59	17	(for all hazards)
City of Alexandria	\$57,033	\$193,936	\$149	\$60,484	\$311,602

HAZUS^{MH} provides another method for estimating annualized loss that uses science and engineering principals in addition to historical data to analyze potential damage and economic loss. Annualized loss statistic for Alexandria based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.3, 7.4 and 7.5 below.

Table 7.3: HAZUS ^{MH} - Annualized Loss Due to Flood for Alexandria								
Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
City of Alexandria	\$6,460,000	\$5,306,000	\$54,000	\$10,000	\$1,000	\$12,000	\$7,000	\$11,850,000



Table 7.4: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Alexandria								
Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
City of Alexandria	\$387,234	\$57,628	\$427	\$30,477	\$4,701	\$17,598	\$6,277	\$504,342

Table 7.5: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Alexandria	
Jurisdiction	Annualized Loss
City of Alexandria	\$198,495

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory, and related effects is extremely high at more than \$11.8 million for flooding and \$504,342 for hurricane. The earthquake annualized loss estimate is relatively low, but earthquakes occur only occasionally in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Alexandria Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2006)	Adopt revised FIRM.	Transportation and Environmental Services	X		X		X										Internal funding	May 2011	Complete final adoption public review as prescribed by NFIP.	Critical	No
1 (2010)	Excavate sediment from channel bed of Cameron Run-Hunting Creek to Potomac River.	Regional project with Fairfax County and VDOT and Transportation and Environmental Services	X										X				FEMA Unified Hazard Mitigation Assistance funding, United States Army Corp of Engineers, Virginia Department of Transportation, Fairfax County, City of Alexandria	Ongoing	Secure funding for project by March 2011	High	No
2 (2010)	Identify and exploit the most effective tools for communications with the public during emergencies, including leveraging emerging technologies.	Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal funding	Ongoing	3,000 new subscribers to e-News for receipt of emergency alerts by end of 2012.	High	No
3 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant	Transportation and Environmental Services	X		X		X										Internal funding	Ongoing	Develop outreach materials, or identify appropriate outreach	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completi on Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
	assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.																		materials for dissemination by June 2011.		
6 (2006)	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.	Transportation and Environmental Services	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
4 (2010)	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.	Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
5 (2010)	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.	Transportation and Environmental Services	X		X		X										Local program	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No
6 (2010)	Install warning signs in park areas subject to flooding.	Recreation, Parks & Cultural	X		X		X										Internal funding	2011	Develop prioritized list	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completi on Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
		Activities																	of sites requiring signage.		
7 (2010)	Re-grade section of lower King Street, Union Street and The Strand to improve drainage and minimize flooding.	Transportation and Environmental Services	X	X	X												Alexandria Capital Improvement Project funding	2015	Integrate into capital improvement budgets; complete design and permitting.	Low	No
8 (2010)	Construct an elevated walkway along Potomac riverfront to elevation 6.0 feet (NAVD88) to mitigate flooding.	Transportation and Environmental Services	X	X	X												Alexandria Capital Improvement Project funding and developer contributions	2020	Integrate into capital improvement budgets; complete design and permitting.	Low	No



II. Arlington County

The area that today encompasses Arlington County was first settled as part of the British Colony of Virginia in the late 1690s. In 1791, George Washington surveyed the area in what was to become the District of Columbia. Congress returned the area to the Commonwealth of Virginia in 1842 as the County of Alexandria. In 1870, the City of Alexandria became independent of Alexandria County. The county portion was officially renamed Arlington County in 1920. The 2009 census estimate for the county is 212,038, an approximately 12% increase during the past decade. Based on the 2005-2009 American Community Survey, the county population was comprised of 71.3% white, 8.1% black or African American, 0.3% Native American, 0.1% Pacific Islander, 8.4% Asian, 8.5% from other races, and 3.3% bi-racial. Hispanic or Latino of any race were 16.7% of the total population. Arlington's schools are incredibly diverse with students from 124 nations fluent in 93 languages.



Arlington has a moderate climate. The average annual temperature is approximately 58 degrees. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 40 inches of rain and 15 inches of snowfall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Arlington is an urban county of about 26 square miles located directly across the Potomac River from Washington DC. Arlington's central location in the Washington DC metropolitan area, its ease of access by car and public transportation, and its highly skilled labor force have attracted an increasingly varied residential and commercial mix. Arlington is one of the most densely populated communities in the nation with more than 7,315 persons per square mile.

Arlington's high population density and its location along the banks of the Potomac River, increase the county's vulnerability to a variety of hazards, most notably flooding. In addition to snow melt and rain-related river flooding episodes, Arlington is also subjected to tidal and storm surge flooding. As sea levels rise, permanent inundation of low lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Arlington, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC³⁹. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence
- Vulnerability of population in the hazard area
- Historical impact, in terms of human lives and property and crop damage



The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as ‘High’ for Arlington. See Table 7.6 for a summary of hazard rankings.

Table 7.6: Hazard Ranking for Arlington									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Med	Med-Low	Med-Low

Annualized loss statistics for Arlington based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.7.

Table 7.7: NCDC Annualized Loss by Hazard for Arlington					
Annualized Loss as determined through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (for all hazards)
<i>Years of Record</i>	17	21	59	17	
Arlington	\$279,199	\$230,954	\$22,033	\$60,484	\$678,428

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records. One reason Arlington’s annualized estimates using the NCDC data base are so low is the likely under-reporting by Arlington’s diverse citizenry. Many do not report damage to insurers, and many properties are not insured. Finally, Arlington has significant Federal property – damages to Federal installations such as the Pentagon or Reagan National Airport would not show in the NCDC data sets.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Arlington based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.8, 7.9 and 7.10 below.

Table 7.8: HAZUS ^{MH} - Annualized Loss Due to Flood for Arlington								
Jurisdiction	Building	Content	Inventory	Relocation	Income	Rental	Wage	Total
Arlington	\$1,935,000	\$1,620,000	\$20,000	\$3,000	\$0	\$0	\$15,000	\$3,593,000



Table 7.9: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Arlington								
Jurisdiction	Building	Content	Inventory	Relocation	Income	Rental	Wage	Total
Arlington	\$543,847	\$77,574	\$573	\$40,176	\$5,554	\$24,946	\$7,342	\$700,012

Table 7.10: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Arlington	
Jurisdiction	Annualized Loss
Arlington	\$256,214

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is extremely high at more than \$3.5 million for flooding and more than \$700,000 for hurricane. The earthquake annualized loss estimate is relatively low, but earthquakes occasionally occur in the region. That was the case July 16, 2010 when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. Arlington Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
1 (2010)	Enhance the ability of patrol officers, through increased training and additional equipment, to respond to active shooter and/or terrorist attacks	Police Department														X	Bureau of Justice Administration DHS funding	Dec. 2012	Funding Secured Training in progress Equipment upgrades ongoing	Critical	No
2 (2010)	Improve the ability of the SWAT Team to operate in tactical and terrorism related incidents through the purchase of CBRN equipped armored vehicle.	Police Department														X	State of Virginia Homeland Security Funds	July 2011	Funding Secured	High	No
3 (2010)	Complete a Commodity Flow Survey for the County and region.	Office of Emergency Management	X	X	X	X					X					X	UASI funding	January 2012	Secure funding and develop a planning/oversight committee June 2011.	High	No
4 (2010)	Include pandemic as a hazard in the next 5-year mitigation planning cycle	Office Emergency Management and Health Department														X	FEMA Unified Hazard Mitigation Assistance Grants	2016	Secure funding for next 5-year planning cycle by June 2014.	High	No
5 (2010)	Establish a partnership and committee between members of the County and utility companies (i.e. water, natural gas, propane, power).	Office of Emergency Management, Office of Environmental Services, Department of Transportation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County funding and UASI grants	January 2012	Identify organizations that should be members of this committee by June 2011.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
			X	X	X	X	X	X	X	X	X	X	X	X	X	X					
5 (2010)	Seek funding and storage space for additional cots in the NRC.	Arlington Red Cross	X	X	X	X	X		X	X	X	X	X	X	X	X	UASI	June 2011	Secure funding and storage and order supplies by January 2011.	High	No
6 (2010)	Secure additional special needs supplies to support the special needs population.	Arlington Red Cross	X	X	X	X	X		X	X	X	X	X	X	X	X	UASI	June 2011	Secure funding and storage and order supplies by January 2011.	High	No
7 (2010)	Establish and execute protocols for real time reporting on snow clearing efforts.	Department of Environmental Services, ESF 3 – Public Works and Engineering		X													County funding	June 2011	Develop protocols and test technology by January 2011.	High	No
8 (2010)	Develop alternate site for the Public Safety Communications Center.	Office of Public Safety	X	X	X	X	X	X	X	X	X	X	X	X	X	X	DHS Grants	In progress	Secure funding by April 2011.	High	No
9 (2010)	Complete battery backup of critical traffic signals.	Department of Environmental Services, Department of Transportation	X	X	X	X	X			X		X	X		X	X	County Funding	Dec. 2020	Identify funding source by December 2012 Complete 5 per year with operational funds	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
1 (2006)	Upgrade county EOC to modern standards.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Not Determined	Dec. 2015	Funding sources identified/secured by December 2012. EOC upgrade plan developed by December 2011.	High	No
2 (2006)	Evaluate, update, exercise government Continuity of Operations (COOP) plans.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	DHS grants	June 2012	Training and exercises designed by June 2011. Training and exercises implemented by May 2012. After action report June 2012. Update/Edit COOPs June 2012.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
			X	X	X	X	X	X	X	X	X	X	X	X	X	X					
10 (2010)	Coordinate regionally to integrate multiple evacuation plans.	VDEM/Arlington County Office of Emergency Management	X	X	X	X	X		X	X		X	X	X	X	X	State and Federal funding sources	Dec. 2011	Regional evacuation plan developed by August 2011.	High	No
10 (2006)	Enhance the security of the water infrastructure system within Arlington County.	Arlington County Office of Emergency Management Department of Environmental Services	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Federal, state and local funding sources	December 2015	Conduct gap analysis of current water infrastructure security by January 2012.	High	No
11 (2010)	Secure prisoner transportation resources in the event of a jail evacuation.	Sheriff's Office	X	X	X	X	X		X	X		X	X	X	X	X	County Funding	Sept. 2011	Determine number and type of assets required by March 2011.	High	Yes
12 (2010)	Identify building(s) to house the Courts, if the Courthouse is compromised. How would wildfire impact the court building? Do you want to re-state this to "locate an appropriate redundant location for the courts facility?"	Sheriff's Office/ Department of Environmental Services				X	X		X							X	County Funding	June 2011	Determine capacity and resource requirements to house the Courts by February 2011.	High	No
13 (2010)	Upgrade the Courthouse security system.	Department of Environmental Services														X	County Funding	January 2012	Secure funding by April 2011.	High	No
14 (2010)	Secure resources and agreements for short-term housing (72 hours) for evacuated inmates.	Sheriff's Office	X	X	X	X	X		X	X		X	X	X	X	X	County Funding	Sept. 2011	Determine number and type of assets required by	High	Yes



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
																			March 2011.		
15 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
16 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
17 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
18	Review locality's compliance with the	Office of	X		X		X										County	Ongoing	Establish a	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completi on Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red- acted (Yes/No)
(2010)	National Flood Insurance Program with an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain.	Emergency Management															funding.		schedule of review and review committee (if necessary) by June 2011.		
19 (2010)	Develop a Communications Plan with the private industry within Arlington County for emergency management (preparedness and response) purposes.	Office of Communications	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County funding	January 2013	Create a partnering committee with at least 5 members of the private industry to assist in developing the plan by January 2012.	Medium	No
20 (2010)	Conduct a gap analysis of workforce safety within the County.	Department of Human Resources	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County funding	June 2011	Establish parameters of analysis (i.e. determine what areas need to be analyzed specifically) by April 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
			X	X	X	X	X	X	X	X	X	X	X	X	X	X					
21 (2010)	Establish a partnership with members of the academic community. Look at specific opportunities to partner with Virginia Tech.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County funding	March 2011	Schedule a meeting between County and academic partners to discuss opportunities by January 2011.	Medium	No
22 (2010)	Conduct preparedness presentations in the community to ensure public awareness of steps the public can take to care for themselves during an emergency.	Arlington Red Cross	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Arlington Red Cross	June 2011	Schedule the first presentation by April 2011.	Medium	No
8 (2006)	Obtain a backup supply of generator fuel.	Department of Environmental Services, ESF 12-Energy	X	X	X	X	X	X	X	X	X		X	X		X	County funding or possible OEM grant.	August 2011	Secure funding May 2011.	Medium	No
7 (2006)	Continue training for employees and partners on the Incident Command System.	Office of Public Safety	X	X	X	X	X	X	X	X	X	X	X	X	X	X	DHS and Authority	Continual	Continue periodic training and exercise activities internally and with Arlington County.	Medium	No
23 (2010)	Acquire updated Mobile Command Vehicle.	Office of Public Safety	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Authority funding	2013	Acquire funding commitment by January 2012.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
			X	X	X	X	X	X	X	X	X	X	X	X	X	X					
24 (2010)	Develop Computer Aided-Design (CAD) to CAD interface between Authority and County Communication Centers.	Office of Public Safety	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Federal funding	2011	Connect the two Centers via NCRNET by June 2011.	Medium	No
25 (2010)	Expand network of traffic cameras.	Department of Environmental Services, Department of Transportation	X	X	X	X	X		X	X		X	X	X	X	X	FHWA County Funding	Dec. 2014	Complete Phase 1 Fiber Optics in Spring 2012	Medium	No
4 (2010)	Expand public warning siren system within Arlington County.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	DHS grants	Dec. 2015	Funding sources identified/secured by Dec. 2012. Warning system equipment purchased/installed by Dec. 2013.	Medium	No
6 (2006)	Certify additional shelter capacity.	Office of Emergency Management Parks, Recreation, and Cultural Resources Arlington Public Schools Other departments as identified	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	Dec. 2011	Gap analysis of sheltering capacity/locations within Arlington County by June 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red-acted (Yes/No)
9 (2010)	Upgrade GIS system for critical infrastructure mapping.	Office of Emergency Management GIS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	Dec. 2011	Conduct gap analysis of current software capabilities by May 2011.	Medium	No
26 (2010)	Acquire the ability to have remote access to medical records.	Sheriff's Office	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County Funding	January 2014	Secure funding by January 2012	Medium	No
27 (2010)	Identify the most effective tools for communications with the public during emergencies, including leveraging emerging technologies, e.g., social media.	Office of Communications	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	July 2011	Improve situational awareness to enhance public outreach and notification by April 2011.	Medium	No
28 (2010)	Identify effective means of communicating with special populations, e.g., - Non-English speakers - Special needs - Tourists - Non-digital	Office of Communications	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	Fall 2011	Hold discussions with disability coordinator, diversity coordinator, Visitors Center, Dept. of Human Services by Spring 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completi on Date	Interim Measure of Success	Priority (Critical, High, Medium, Low)	Keep Action Red- acted (Yes/No)
			X	X	X	X	X	X	X	X	X	X	X	X	X	X					
29 (2010)	Ensure delivery of critical emergency text messages (Arlington Alert) to Arlington Public Schools' School Talk alert system.	Office of Communications	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	Summer 2011	Hold discussions with Arlington Public Schools and set-up process by Spring 2011.	Medium	No
30 (2010)	Improve evidence and/or equipment inventory through the use of a bar code system.	Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	BZZP Grant	July 2012	Awaiting funding approval	Medium	No
31 (2010)	Equip selected vehicles with License Plate Readers (LPR) to identify stolen, felony, and Terrorist Watch List vehicles. Install a server to provide access to the data. Connect to other NCR L.E. agencies to share LPR data.	Police Department														X	UASI Funding	July 2012	Funding Secured LPR's & server installed Data sharing pending	Medium	No
8 (2006)	Acquire 6 additional generators for signal backup.	Department of Environmental Services, Department of Transportation	X	X	X	X	X			X		X	X			X	County Funding	Dec. 2011	Secure funding by June 2011.	Low	No



III. Fairfax County

The land that is now Fairfax County was part of the Northern Neck Proprietary granted by King Charles II in 1660 and inherited by Thomas Fairfax, Sixth Lord Fairfax of Cameron, in 1719. The county itself was formed in 1742 from Prince William County. The 2009 census population estimate for the county is 1,036,473, an approximately 7% increase during the past decade. Based on the 2005-2009 American Community Survey, the county population was comprised of 66.7% white, 9.2% black or African American, 0.4% Native American, 0.1% Pacific Islander, 16% Asian, 4.8% from other races, and 2.8% bi-racial. Hispanic or Latino of any race were 14% of the total population.



Fairfax County has a moderate climate. Due to its situation on both the Virginia piedmont and the Atlantic coastal plain, the county experiences a variety of weather. The average annual temperature is approximately 58 degrees. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 40 inches of rain and 15 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Fairfax County comprises about 407 square miles located directly across the Potomac River from Washington, DC. The county's location in the Washington metropolitan area, its ease of access by car and public transportation, and its highly skilled labor force have attracted an increasingly varied residential and commercial mix. Most commercial development is centered in Tysons Corner, which is the 12th largest central business district in the Nation.

The diversity of Fairfax County's landscape increases the county's vulnerability to a variety of hazards, most notably flooding and severe storms. In addition to snow melt and rain-related river flooding episodes, low-lying areas of Fairfax County along the Potomac River are also subject to tidal and storm surge flooding. As sea levels rise, permanent inundation of low lying areas along and near the river shoreline is also a threat. Additionally, winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Fairfax County, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁴⁰. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.



The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as ‘High’ for Fairfax County. See Table 7.11 for a summary of hazard rankings.

Table 7.11: Hazard Ranking for Fairfax County									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med	Med-Low

Annualized loss statistics for Fairfax County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.12.

Table 7.12: NCDC Annualized Loss by Hazard for Fairfax County					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (for all hazards)
<i>Years of Record</i>	17	21	59	17	
Fairfax County	\$801,903	\$612,562	\$2,265,041	\$60,537	\$3,830,698

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records. Fairfax County has significant Federal property – damages to Federal installations such as Fort Belvoir would not show in the NCDC data sets.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Fairfax County based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.13, 7.14 and 7.15 below.

Table 7.13: HAZUS ^{MH} - Annualized Loss Due to Flood for Fairfax County								
Jurisdiction	Building Loss	Contents Loss	Inventor y Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Fairfax	\$27,603,000	\$19,456,000	\$85,000	\$46,000	\$0	\$5,000	\$19,00	\$47,214,000



Table 7.14: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Fairfax County								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Fairfax County	\$2,086,176	\$212,519	\$1,641	\$119,367	\$11,790	\$50,745	\$13,512	\$2,495,750

Table 7.15: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Fairfax County	
Jurisdiction	Annualized Loss
Fairfax County	\$1,194,034

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is extremely high at more than \$47.2 million for flooding and nearly \$2.5 million for hurricane. Earthquakes occasionally occur in the region; that was the case July 16, 2010 when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. Fairfax County Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Survey generator hookups throughout the County.	Department of Public Works	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County funding	January 2012	Complete shelter survey by June 2011	Critical	No
22 (2006)	Install piezometers at six PL566 Pohick Creek Dams and the Holmes Run Reservoir (Res 2A) and connect these to an electronic real-time monitoring system so that the phreatic surface in the dams of these facilities can be closely monitored, particularly after major storm events.	Stormwater Planning	X		X	X						X					Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	January 2014	Install at least 3 piezometers by January 2013.	High	Yes
2 (2010)	Encourage homeowners to make homes more resilient to wind and flood by additional outreach methods such as websites and brochures.	Office of Emergency Management, Office of Public Affairs	X		X	X	X										County funding	December 2011	Include mitigation strategies on the County website by April 2011.	High	No
3 (2010)	Engage in a public private partnership to encourage people to report suspicious activity "See something, say something."	Office of Emergency Management, Police Department														X	County funding	December 2011	Develop a schedule for placing dynamic message boards around the County in April 2011.	High	No
4 (2010)	Educate the public about the dangers of driving through flooded roadways, maintain depth signs and police presence at high hazard water crossings.	Office of Emergency Management	X		X	X											County funding	May 2011	Develop radio and/or newspaper and television advertisements for public release by April 2011.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
5 (2010)	Work with private dam owners to repair or decommission private dams within the county.	Department of Public Works										X					Hazard Mitigation Grant Program – 5% initiative funds FEMA has a national dam safety program: unsure if funding is available. Virginia Floodplain Management Fund (administered by DCR Division of Dam Safety and Floodplain Management)	December 2015	Identify all private dam owners by January 2012.	High	No
6 (2010)	Continue to employ a broad range of warning systems throughout the county.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
7 (2010)	Develop a policy of “record keeping and maintenance” to support the County’s financial recovery efforts following an event.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County funding	July 2011	Draft the initial policy by March 2011.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
8 (2010)	Develop training and education courses for first responders to deal with transportation-based hazardous materials releases.	Police Department, Fire Department														X	UASI funding, DHS grants	July 2013	Identify specific topics that should be included in the training, and their target audience, by July 2011.	High	No
9 (2010)	Secure funding and conduct a commodity flow study (region-wide preferably).	Office of Emergency Management, Fire Department														X	UASI funding	December 2012	Secure funding by June 2011.	High	No
10 (2010)	County facilities need to be inventoried, evaluated and mitigated (by priority).	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	July 2012	Create inventory database by July 2011.	High	No
11 (2010)	County shelters do not meet CAT 4 requirements. Secure funding and conduct a study to examine buildings (schools, recreation centers, etc).	Fairfax County Health Department, Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	HMGP funding	December 2012	Secure funding by October 2011.	High	No
12 (2010)	Identify funding opportunities to replace vulnerable or undersized culvert stream crossings with bridges or larger culverts to reduce flood hazards.	Park Authority	X		X							X					FEMA Unified Hazard Mitigation Assistance Grants	December 2015	Develop list of vulnerable or undersized culverts by January 2012.	High	Yes



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
13 (2010)	Increase flood warning capabilities, particularly as they relate to dam failure.	Park Authority	X		X		X					X					FEMA Unified Hazard Mitigation Assistance Grants	January 2014	Identify warning system best suitable for dam failure by January 2012.	High	Yes
14 (2010)	Establish flood level markers along bridges and other structures to indicate the rise of water levels along creeks and rivers in potential flood-prone areas.	Park Authority	X		X		X					X					FEMA Unified Hazard Mitigation Assistance Grants	December 2013	Secure funding by December 2011.	High	Yes
15 (2010)	Retrofit Huntsman Lake, a high-hazard state-regulated dam, to adequately pass the Spillway Design Flood.	Stormwater Planning	X		X		X									X	Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	December 2016	Completed engineering assessment of retrofit needs by December 2012.	High	No
16 (2010)	Upgrade the New Alexandria/Belle View pump station and tide gate.	Stormwater Planning	X		X		X										Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	June 2014	Secure funding by June 2012.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
5 (2006)	Continue to install remote lake level sensors, data collectors/alarms, stream flow gauges, tide gauges and rain gauges at critical locations throughout the county to allow for earlier warning of potential flooding. Continue to develop action plans for public education and warning.	Stormwater Planning	X		X		X					X					Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	Ongoing	Establish prioritization for installation by December 2011.	High	No
17 (2010)	Continue to seek voluntary buy-outs of FEMAs repetitive loss properties within the floodplain.	Stormwater Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, County Funding	Ongoing	Complete one buy-out per year.	High	No
2 (2006)	Continue to implement flood proofing methods for some structures based on the outcome of analyzing alternative solutions to flood causes.	Stormwater Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, County Funding	Ongoing	Implement flood proofing methods for at least one county facility each year.	High	No
18 (2010)	Develop and implement a stormwater management ordinance.	DPWES, Planning and Zoning	X		X		X									X		January 2012	Complete a draft ordinance by July 2011.	High	No
19 (2010)	Improve the county's Community Rating System (CRS) classification from Class 7 to Class 6.	Stormwater Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, County Funding	January 2012	Examine criteria and establish roles and responsibilities for completion by January 2011.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
20 (2010)	Collaborate with FEMA to develop risk maps for the Cameron Run Watershed and the Belle View communities.	Stormwater Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, County Funding	December 2015	Form a working group by December 2013.	High	No
21 (2010)	Develop an outreach program aimed at assisting private dam owners.	Stormwater Planning	X		X		X					X					Hazard Mitigation Grant Program – 5% initiative funds FEMA has a national dam safety program: unsure if funding is available. Virginia Floodplain Management Fund (administered by DCR Division of Dam Safety and Floodplain Management)	June 2013	Identify specific outreach techniques for this audience by June 2011.	High	Yes
22 (2010)	Develop a public outreach plan specific to evacuation-communication before and during an event.	Office of Emergency Management, Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding	January 2012	Create a planning committee by January 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
23 (2010)	Identify gaps in current Recovery Planning efforts within the county.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County funding	July 2011	Establish metrics for review of plan by February 2011.	Medium	No
24 (2010)	Continue to plan and exercise anthrax related events.	Office of Emergency Management, Police Department, Fire Department														X	UASI funding	December 2011	Schedule and develop a planning committee for an exercise by March 2011.	Medium	No
13 (2006)	Identify need for backup generators, communications, and/or vehicles at critical public facilities. Develop means to address shortfall identified.	Park Authority	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, county funding	July 2014	Conduct generator survey to identify which facilities require a backup generator by January 2012.	Medium	Yes
25 (2010)	Encourage purchase of NOAA radios. Provide NOAA weather radios to public facilities.	Park Authority	X	X	X	X	X		X	X		X		X		X	UASI funding, DHS grants, county funding	December 2011	Secure funding by June 2011.	Medium	Yes
26 (2010)	Use fee simple and/or permanent easement to prevent development in the highest priority undeveloped floodplain (and/or wetlands) areas. Work with land trusts to purchase the land or conservation easements. Use these areas as public open space for passive recreational uses.	Park Authority	X														FEMA Unified Hazard Mitigation Assistance Grants, county funding	December 2013		Medium	Yes



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
26 (2006)	Continue to update GIS to 2-foot contours from 5-foot contours (part of the overall planimetrics features update).	DIT/ Stormwater Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, County Funding	Ongoing	Complete half of the county by December 2014.	Medium	No
28 (2006)	Continue to implement building and development standards as required under the National Flood Insurance Program.	DPWES	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	Ongoing	Implement one new standard (at least at County facilities) every year.	Medium	No
27 (2010)	Continue development of a comprehensive River Flood Response System for New Alexandria/Belle View and Huntington in partnership with the National Weather Service and the U.S. Army Corps of Engineers.	Stormwater Planning	X		X		X									X	Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	June 2015	Establish working group by June 2011.	Medium	No
28 (2010)	Develop a template for emergency action plans (EAP) for dambreaks and other intense flooding incidents that incorporate the best EAP features of the jurisdictions in the Washington Metropolitan Area.	Stormwater Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, County Funding	December 2011	Establish a working group to develop template by March 2011.	Medium	Yes
29 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation	Ongoing	Develop outreach materials, or identify	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
	providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.																Assistance funding,		appropriate outreach materials for dissemination by June 2011.		
36 (2006)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
30 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
31 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
32 (2010)	Encourage public and private water conservation plans, including consideration of rainwater catchment system.	Park Authority					X										County funding	January 2013	Engage in public outreach regarding water conservation by January 2012.	Low	Yes
33 (2010)	Work with the Virginia Department of Forestry to review local zoning and subdivision ordinances to identify areas to include wildfire mitigation principles.	Park Authority						X									Hazard Mitigation Assistance grant funding	December 2012	Establish working group by December 2011.	Low	Yes



IV. Loudoun County

Loudoun County was established in 1757 and was formerly part of Fairfax County. It was named after John Campbell, Forth Earl of Loudoun and past Governor of the Commonwealth of Virginia. It was the most populous county in Virginia during the time of the American Revolution. Since 1757, the county seat has always been Leesburg. In 2010, Loudoun County was ranked by Forbes as America's wealthiest county. The County has a total area of 521 square miles, of which one square mile is water. As of the 2000 Census, it has a population density of 272 persons per square mile. The population was estimated to be approximately 298,113 in 2009 by the U.S. Census Bureau, a nearly 76% increase over the 2000 population of 169,599. Based on the 2005-2009 American Community Survey, the county population was comprised of 73.2% white, 7.8% black or African American, 0.1% Native American, 0.1% Pacific Islander, 12.2% Asian, 3.9% from other races, and 2.7% bi-racial. Hispanics or Latinos of any race were 10.1% of the total population.



Geographically, Loudoun County is bounded to the North by the Potomac River; to the south by Prince William and Fauquier counties; and on the west by the watershed of the Blue Ridge Mountains. The Bull Run Mountains and Catoctin Mountain run through the County. There are seven incorporated and 60 unincorporated towns within the County.

Loudoun County has a moderate climate. The average annual temperature is approximately 58 degrees. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and 20 inches or so of snow fall in any given year. The wettest month on average is May. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Risk factors for the county are in part due to its proximity to the Nation's capital and its growth rate. The county has a risk of flooding due to low lying areas surrounding the Potomac River and other natural hazards and risks, such as storm damage and winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Loudoun County, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁴¹. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;



- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, Winter Weather and Drought hazards were ranked as ‘High’ for Loudoun County. See Table 7.17 for a summary of hazard rankings.

Table 7.17: Hazard Ranking for Loudoun County									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-High	Med-Low	Med-Low

Annualized loss statistics for Loudoun County based on NCDC historical data as the result of those hazards considered to be ‘High’ (Drought, Flood, High Wind, Tornado and Winter Storm) are summarized in Table 7.18. Annualized losses for the County total to nearly \$900,000 for all natural hazards examined.

Table 7.18: NCDC Annualized Loss by Hazard for Loudoun County						
Annualized Loss as Determine through NCDC Data <i>(based on property and crop damages and number of years of record)</i>						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Losses (All Hazards)
Years of Record	17	17	21	59	17	
Loudoun County	\$351,549	\$216,429	\$176,618	\$119,785	\$31,982	\$896,364

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Loudoun County based on HAZUS^{MH} runs for flood, hurricane, and earthquake are found in Tables 7.19, 7.20, and 7.21 below.



Table 7.19: HAZUS ^{MH} - Annualized Loss Due to Flood for Loudoun County								
Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Loudoun County	\$10,332,000	\$7,935,000	\$105,000	\$7,000	\$1,000	\$1,000	\$11,000	\$18,392,000

Table 7.20: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Loudoun County								
Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Loudoun County	\$242,275	\$20,143	\$435	\$12,197	\$1,113	\$4,444	\$1,341	\$281,948

Table 7.21: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Loudoun County	
Jurisdiction	Annualized Loss
Loudoun County	\$222,490

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is more than \$18.3 million for flooding, \$281,948 for hurricane and \$281,948 for earthquake. Although somewhat rare, earthquakes occasionally occur in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. Loudoun County Mitigation Actions and Action Plan



#	Agency/Department : Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority
1 (2010)	Meet with VDOT and develop a plan for adding flooding signage and gates for known trouble spots	Office of Emergency Management/Loudoun County Sheriff's Office	X		X		X										Internal county funding, Federal Highway Administration grants Tiger Grants	2013	Within ninety days of endorsement of the plan have our kick-off meeting – within six months of our kick-off meeting have identified and vetted locations for action. Remaining period of time to identify funding sources and complete installation.	High



3 (2006)	Collaboration with VDOT and law enforcement in developing a strategy for installation of back-up power capabilities at key intersections in Loudoun County.	Office of Emergency Management/Loudoun County Sheriff's Office	X	X	X	X	X										Internal county funding, Federal Highway Administration grants Tiger Grants	2013	Within ninety days of endorsement of the plan have our kick-off meeting – within six months of our kick-off meeting have identified and vetted locations for action. Remaining period of time to identify funding sources and complete installation.	High
2 (2010)	Evaluate Repetitive Loss and Severe Repetitive Loss properties within the County. 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	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Property owner interest and application to participate in FEMA grant program	High



	FEMA HMA programs where appropriate.																			
3 (2010)	Maintain NFIP Ordinance	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Property owner interest and application to participate in FEMA grant program	High
4 (2010)	Collaboration with VDOT, transportation officials and law enforcement to develop a strategy for installation of permanent variable message boards for public messaging and traffic cameras for maintaining situational awareness.	Office of Emergency Management/Loudoun County Sheriff's Office	X	X	X	X	X										Internal county funding, Federal Highway Administration grants Tiger Grants	2015	Within ninety days of endorsement of the plan have our kick-off meeting – within six months of our kick-off meeting have identified and vetted locations for action. Remaining period of time to identify funding sources	Medium



5 (2010)	Research possible vulnerable population registration systems to better identify and serve at risk citizens	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Department of Homeland Security grants, UASI funding, county funding	2012	Continue ongoing work in this area. Within one year of endorsement of the plan be able to identify possible solutions and spend the remaining period of time working to identify funding sources to complete the project.	Medium
8 (2006)	Maintain high quality aerial photography of the County.	Office of Mapping/Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Department of Homeland Security grants, UASI funding, county funding	On-going	Continue to work with our local officials in stressing the importance of this initiative and identify funding to maintain the current capabilities.	Low (Currently being done, but need to ensure it continues to be funded).



V. Prince William County



Prince William County was formed in 1730, and was named by the Virginia General Assembly to honor the son of King George II. The county seat is the City of Manassas. Prince William County has a total area of 338 square miles, of which 11 square miles are water. It has a population density of 819 persons per square mile. In 2009, the population was estimated at 386,934, approximately a 38% increase over the 2000 census. It was the fourth fastest growing county in the United States during that period. Based on the 2005-2009 American Community Survey, the county population was comprised of 60.9% white, 19.4% black or African American, 0.5% Native American, 0.1% Pacific Islander, 6.9% Asian, 9.2% from other races, and 3.1% bi-racial. Hispanics or Latinos of any race were 18.5% of the total population.

Prince William County has a moderate climate. The average annual temperature is approximately 58 degrees. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and 16 inches of snow fall in any given year. The wettest month on average is May. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Prince William County has grown more than 200% over a 20-year period. This is because of its central location to the Washington, DC, metropolitan area. Population growth rate poses another risk; as open land is developed flood management must be addressed with the increasing amounts of impervious surfaces. Flood risk is also due to low lying areas surrounding the Potomac River. Other natural hazards and risks are storm damage and winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Prince William County, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁴². Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as 'High' for Prince William County. See Table 7.22 for a summary of hazard rankings.



Table 7.22: Hazard Ranking for Prince William County								
Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
High	High	High	High	High	Med	Med-Low	Med	Med-Low

Annualized loss statistics for Prince William County based on NCDC historical data as the result of Flood, High Wind, Tornado, and Winter Storm are summarized in Table 7.23.

Table 7.23: NCDC Annualized Loss by Hazard for Prince William County						
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (for all hazards)
<i>Years of Record</i>	17	17	21	59	17	
Prince William County	\$114,402	\$155,044	\$795,511	\$117,080	\$60,502	\$1,242,539

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Prince William County based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.24, 7.25, and 7.26 below.

Table 7.24: HAZUS ^{MH} - Annualized Loss Due to Flood for Prince William County								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized
Prince William County	\$8,715,000	\$6,546,000	\$98,000	\$1,000	\$0	\$0	\$8,000	\$15,368,000

Table 7.25: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Prince William County								
Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Prince William County	\$423,454	\$34,613	\$427	\$24,402	\$1,736	\$9,219	\$2,155	\$496,004



Table 7.26: HAZUS^{MH} - Annualized Loss Due to Earthquake for Prince William County

Jurisdiction	Annualized Loss
Prince William County	\$304,948

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is extremely high at more than \$15,368,000 for flooding and more than \$496,004 for hurricane. Earthquakes occasionally occur in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Prince William County Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Compl- -etion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Evaluate vulnerability and redundancy of communication towers in the County.	Office Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program – 5% initiative funds Note: this may be an eligibility stretch, might be something the provider should be doing as a contractual obligation e.g. address at contract renewal.	July 2011	Review communication vendor contracts regarding liability and redundancy requirements. Prioritize evaluation and COOP for communications to determine needs.	Critical	No
2 (2010)	Evaluate Repetitive Loss Properties within the County.	Office Emergency Management , Planning or Housing	X		X		X										FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Property owner interest and application to participate in FEMA grant program	High	No
3 (2010)	Educate those citizens who are at risk of minor flooding (through cooperative extension or a homeowner’s mitigation kit/checklist).	Office Emergency Management , Department of Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program – 5% initiative funds	December 2013	Survey, tracking of website “hits.”	High	No
4 (2010)	Policy for response vehicles operating in high winds.	Office Emergency Management		X	X	X	X										No cost –internal staff support	January 2012	Adherence to revised policy.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
5 (2010)	Planning for Dams, this includes evaluating county owned facilities, inundation mapping for Lake Jackson and working with private owners on inspections, maps and updates.	Department of Public Works	X		X		X					X					Hazard Mitigation Grant Program – 5% initiative funds Virginia Floodplain Management Fund (administered by DCR Division of Dam Safety and Floodplain Management) Prince William storm water utility tax funds (may require change in policy of use of funds)	July 2014	Continue to prioritize dam sites and work to secure funding. RE-evaluate annually.	High	No
6 (2010)	Evaluate schools capabilities and capacity for sheltering and emergency power.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal	December 2013	Develop priority list for evaluation. Seek funding sources.	High	No
7 (2010)	Evaluate parent notification processes at schools to include language evaluation.	Office Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	No cost –internal staff support	July 2011	Survey neighboring school districts for similar policies and processes to determine available approaches, lessons learned.	Medium	No
8 (2010)	Assess the need and or benefits for purchasing reverse 911.	Office Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal staff support Reverse 911 system; FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program – 5% initiative funds. Some local match likely required. Note: this was done for Northern Neck PDC and Wise County through this funding source	July 2013	Evaluate need. Prepare HMGP 5% application to be “ready” for next HMGP funding cycle.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Compl- etion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
9 (2010)	Development of a storm water inventory framework/monitoring system.	Department of Public Works	X		X		X					X					Possible Water Quality Improvement Act funds, revolving loan funds, Section 319 NPS grants from DCR.	December 2012	Develop inventory database or system Complete interim evaluation	Medium	No
10 (2010)	Remediate Dale Blvd for flooding issues.	Department of Public Works	X		X		X					X					Cooperative funding through VDOT, HMGP	July 2014	Develop preferred alternative design and prepare for permits, construction.	Medium	No
11 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
12 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
7 (2006)	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure improvement, to meet or exceed building code	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Compl- etion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
	standards, upgrade of electrical panels to accept generators, etc.																				
13 (2010)	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.	Office of Emergency Management	X		X		X										Prince William County floodplain management program	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No
14 (2010)	Review and update Debris Management Plan as necessary.	Department of Public Works	X	X	X	X						X				X	Internal staff; Contractual resources	December 2015	N/A	Low	No



VI. City of Fairfax

The area encompassing the City of Fairfax was originally settled in the early 18th century by farmers originating from the Virginia Tidewater area. Fairfax was incorporated as a town in 1805 and as an independent city in 1961. The city is home to George Mason University. Its population was 21,498 as of the 2000 Census and was estimated by the Census Bureau to be 24,702 in 2009. Based on the 2005-2009 American Community Survey, the city population was comprised of 72.5% white, 5.3% black or African American, 0.5% Native American, 0.2% Pacific Islander, 15.2% Asian, 3.2% from other races, and 3.2% bi-racial. Hispanics or Latinos of any race were 13.6% of the total population.



The City of Fairfax has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 40 inches of rain and 15 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The city’s location on the eastern edge of the Virginia piedmont make it susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including the City of Fairfax, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁴³. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Wind, Tornado, and Winter Weather hazards were ranked as ‘High’ for Fairfax. See Table 7.29 for a summary of hazard rankings.

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med	Med-Low



Annualized loss statistics for the City of the Fairfax based on NCDC historical data as the result of Flood, High Wind, Tornado, and Winter Storm are summarized in Table 7.30.

Table 7.30: NCDC Annualized Loss by Hazard for City of Fairfax					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss
<i>Years of Record</i>	17	21	59	17	
City of Fairfax	\$0	\$4,482	\$0	\$0	\$4,482

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Fairfax based on HAZUS^{MH} runs for flood, hurricane, and earthquake are found in Tables 7.31 and 7.32 below.

Table 7.31: HAZUS ^{MH} - Annualized Loss Due to Hurricane for City of Fairfax								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
City of Fairfax	\$45,380	\$5,279	\$98	\$3,158	\$731	\$1,460	\$770	\$56,876

Table 7.32: HAZUS ^{MH} - Annualized Loss Due to Earthquake for City of Fairfax	
Jurisdiction	Annualized Loss
City of Fairfax	\$49,175

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is substantial. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. City of Fairfax Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Secure funding and conduct a safety analysis of the tank farm within the City. Consider hardening the facility.	Office of Emergency Management														X	UASI funding, FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program	January 2012	Secure funding by July 2011.	Critical	No
2 (2010)	Conduct a commodity flow survey (regionally).	Office of Emergency Management	X	X	X	X	X			X	X					X	UASI funding	December 2012	Secure funding by June 2011.	High	No
2 (2006)	Identify and prioritize the stormwater management drainage issues.	Department of Public Works	X		X		X										Possible Water Quality Improvement Act funds, revolving loan funds, Section 319 NPS grants from DCR.	December 2014	Develop comprehensive list of stormwater issues to prioritize by December 2012.	High	No
3 (2010)	Develop and disseminate an ambulance wind policy, delineating top wind speeds that ambulances can safely function in.	Office of Emergency Management		X	X	X	X										City funding	June 2011	Draft initial policy for review by February 2011.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization														Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)	
			Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst						Human-Caused
4 (2010)	Catalog the City's critical facilities and create a GIS layer.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding	January 2013	Create committee and team to complete infrastructure survey by April 2012.	High	No
7 (2006)	Consider becoming members of the Community Rating System.	Office of Emergency Management	X		X		X									FEMA Unified Hazard Mitigation Assistance Grants	December 2014	Secure funding by January 2011.	High	No	
5 (2010)	Identify and secure funding to conduct a generator cost estimate for city shelters.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	December 2014	Secure funding by January 2011.	Medium	No	
6 (2010)	Consider posting permanent evacuation signs on City-operated evacuation routes.	Office of Emergency Management	X	X	X	X	X		X	X		X			X	FEMA Unified Hazard Mitigation Assistance Grants	June 2013	Identify where, and how many, signs will be needed by January 2012.	Medium	No	
7 (2010)	Conduct a generator assessment, and secure funding for generators, at City utility facilities.	Office of Emergency Management, Department of Public Works	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	December 2013	Secure funding by Jan	Medium	No	
8 (2010)	Conduct a public outreach campaign using signage on city buses.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	January 2012	Secure funding for advertisements by January 2011.	Medium	No	



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
9 (2010)	Utilize CERT team to help businesses write disaster plans.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal funding	January 2013	Develop plan to direct actions of the CERT by January 2011.	Medium	No
10 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
11 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
12 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
13 (2010)	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.	Office of Emergency Management	X		X		X										City funding.	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No
14 (2010)	Conduct a public outreach campaign educating the public on how registering on the Do Not Call List removes you from Reverse 9-1-1.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Reverse 911 system; FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program – 5% initiative funds	June 2014	Identify various methods of outreach by June 2012.	Low	No



VII. City of Falls Church

The area now known as Falls Church was originally settled in the late 17th century by European colonists who shared the site with the local Native American population. The settlement was centered on the Anglican Falls Church, which was completed in 1734. In 1948, the township broke ties with Fairfax County to become an independent city. The population of the city was 10,377 as of the 2000 Census and was estimated by the Census Bureau to be 11,711 in 2009. Based on the 2005-2009 American Community Survey, the city population was comprised of 79.1% white, 5.1% black or African American, 0.1% Native American, 10% Asian, 3.1% from other races, and 2.5% bi-racial. Hispanics or Latinos of any race were 9.4% of the total population. Falls Church has a significant Vietnamese-American population.



Falls Church has a moderate climate. The average annual temperature is approximately 58 degrees. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 40 inches of rain and 14 to 16 inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The City of Falls Church comprises about 2.2 square miles located approximately 10 miles west of Washington, DC. Falls Church's location in the Washington metropolitan area and its ease of access by car and public transportation have allowed increasingly-varied residential and commercial development. Falls Church is densely populated with more than 5,189 persons per square mile.

Falls Church experiences significant flood threats due to the presence of Four Mile Run and Tripps Run. The City's location on the eastern edge of the Virginia Piedmont make it susceptible to other natural hazards and risks, such as damage from severe storms and winter weather, as evidenced during the 2009 – 2010 winter and summer seasons. Falls Church has been declared a Federal disaster area six times since 1965 for hurricane, severe storm, and winter weather events.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Falls Church, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁴⁴. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.



The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, and Winter Weather hazards were ranked as ‘High’ for City of Falls Church. See Table 7.33 for a summary of hazard rankings.

Table 7.33: Hazard Ranking for Falls Church									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	Med-High	High	Med	Med-Low	Low	Low	Low

Annualized loss statistics for City of Falls Church based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.34.

Table 7.34: NCDC Annualized Loss by Hazard for City of Falls Church					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (All Hazards)
<i>Years of Record</i>	17	21	59	17	
Falls Church	\$53,959	\$198,830	\$88,210	\$60,484	\$492,138

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Falls Church based on HAZUS^{MH} runs for hurricane and earthquake are found in Tables 7.35 and 7.36 below.

Table 7.35: HAZUS ^{MH} - Annualized Loss Due to Hurricane for City of Falls Church								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Falls Church	\$29,561	\$3,820	\$36	\$2,127	\$401	\$1,034	\$488	\$37,468

Table 7.36: ^{MH} - Annualized Loss Due to Earthquake for City of Falls Church	
Jurisdiction	Annualized Loss
City of Falls Church	\$20,589



As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is more than \$37,000 for hurricanes. Earthquakes occasionally occur in the region; that was the case July 16, 2010 when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. City of Falls Church Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Comple- tion Date	Interim Measure of Success	Priority	Keep Action Red- acted (Yes/No)
1 (2010)	Cross training of bus drivers to operate snow removal equipment	Falls Church City Public Schools		X													Falls Church Public Works	2012	Evaluation after first significant snow event.	High	No
2 (2010)	Evaluate the need for and acquire snow removal equipment	Falls Church City Public Schools		X													Fall Church Public Works	2012	Needs assessment in initial budget process.	Medium	No
3 (2010)	Examine feasibility for and acquire structure (if feasible) to provide covered parking for school buses	Falls Church City Public Schools		X	X	X	X										Falls Church School Board	2012	Needs assessment in initial budget process.	Low	No
4 (2010)	Evaluate the need for and acquire vacuum truck (used for flooding)	Falls Church Department of Environmental Services	X														City of Falls Church general revenue funds	2012	Needs assessment in initial budget process.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Comple- tion Date	Interim Measure of Success	Priority	Keep Action Red- acted (Yes/No)
			X	X	X	X	X	X	X	X	X	X	X	X	X	X					
5 (2010)	Evaluate potential contractors for providing resources (human and otherwise) to assist during emergencies	Falls Church Department of Environmental Services	X	X	X	X	X	X	X	X	X	X	X	X	X	X	City of Falls Church general revenue funds FEMA – VDEM Public Assistance funds (reimbursement) for qualified presidential emergency or disaster declarations for Public Assistance Categories A (Debris) and B (Emergency Preparedness Activities).	2013	Needs assessment for budgeting purposes by 2011, procurement and contract in place by 2013.	Medium	No
2 (2006)	Evaluate adding staffing resources to operate AM radio station (used for alerting residents to hazards, relaying info)	Falls Church Police Department?	X	X	X	X	X	X	X	X	X	X	X	X	X	X	City of Fairfax general revenue funds EMPG DHS FEMA – VDEM Public Assistance Category B funds	2011	Staffing analysis of internal staff (volunteers) and external supplemental or contractual staff.	Low	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Comple- tion Date	Interim Measure of Success	Priority	Keep Action Red- acted (Yes/No)
6 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
7 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood- prone structures by December 2011.	Medium	No
8 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Comple- tion Date	Interim Measure of Success	Priority	Keep Action Red- acted (Yes/No)
9 (2010)	Review Falls Church 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.	Office of Emergency Management	X		X		X										Falls Church general funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



VIII. City of Manassas



The City of Manassas is an independent city in the Commonwealth of Virginia and covers an area 10 square miles. The jurisdiction grew from a crossroads after the Civil War, and was incorporated in 1873. The city was the staging ground for the First Battle of Manassas in 1861, also known as First Battle of Bull Run. Originally it was called Manassas Junction for its strategic railroad location leading to Richmond, Washington, DC, and the Shenandoah Valley. Modern history has seen increased development due to its proximity to Washington, DC. The population of the city was 35,135 as of the 2000 Census and was estimated by the Census Bureau to be 36,213 in 2009. Based on the 2005-2009 American Community Survey, the city population was comprised of 65.6% white, 11.4% black or African American, 0.2% Native American, 4.1% Asian, 14.5% from other races, and 4.2% bi-racial. Hispanics or Latinos, of any race, represent 27.2% of the total population.

Manassas has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and 16 inches of snow fall in any given year. The wettest month on average is May. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Manassas is subject to high wind events, winter weather, and flooding. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season. The city has instituted a winter weather preparation program.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Manassas, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁴⁵. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as ‘High’ for Manassas. See Table 7.37 for a summary of hazard rankings.

Table 7.37: Hazard Ranking for City of Manassas								
Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
High	High	High	High	Med-High	Med	Med-Low	Med-Low	Med-Low



Annualized loss statistics for Manassas based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.38.

Table 7.38: NCDC Annualized Loss by Hazard for City of Manassas					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized
<i>Years of Record</i>	17	21	59	17	Loss (for all hazards)
City of Manassas	\$89,084	\$694,402	\$0	\$60,502	\$958,390

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Manassas based on HAZUS^{MH} runs for hurricane and earthquake are found in Tables 7.39 and 7.40 below.

Table 7.39: HAZUS^{MH} - Annualized Loss Due to Hurricane for City of Manassas								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
City of Manassas	\$62,939	\$6,288	\$115	\$3,899	\$396	\$1,534	\$667	\$75,838

Table 7.40: HAZUS^{MH} - Annualized Loss Due to Earthquake for City of Manassas	
Jurisdiction	Annualized Loss
City of Manassas	\$53,204

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is just under \$76,000 for hurricane and just over \$53,000 for earthquake. Although somewhat rare, earthquakes occasionally occur in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. City of Manassas Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Evaluate Repetitive Loss and Severe Repetitive Loss properties within the City. 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.	Emergency Management	X	X	X		X					X					FEMA Unified Hazard Mitigation Assistance	12/31/2005	Obtain funding	High	No
2 (2010)	Shelter back up power evaluation Generator Plan for the 4 shelter sites currently identified	City of Manassas Public Schools with support from Public Works and Utilities	X	X	X	X	X									X	FEMA HMA Grants DHS grants for critical infrastructure City of Manassas funds	1/1/2015	Generator plan for half of the sites identified	Medium	No
3 (2010)	Developing Strategic National Stockpile procedure and policies and conduct drills/exercises	Schools and Health Department	X	X	X	X	X			X		X				X	DHS grants City of Manassas funds	1/1/2015	Development of policies	Medium	No
4 (2010)	Exercise and training for mass sheltering (animal and human)	City of Manassas Public Schools	X	X		X	X			X		X		X	X	X	DHS grants EMPG funds City of Manassas funds	1/1/2015	Committing to a date in which to conduct the training	Medium	No
5 (2010)	Train required City staff on NIMS/ICS	All agencies															EMPG	1/1/2015	Annual staff	Low	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
																			certifications		
6 (2010)	Risk analysis on all schools	City of Manassas Public Schools	X	X	X	X	X	X	X	X	X	X	X	X	X	X	DHS Department of Education	1/1/2015	A plan in place for conducting the analyses	High	No
7 (2010)	Evaluate need for and purchase additional weather radios for the schools	City of Manassas Public Schools	X	X	X	X	X	X	X	X	X	X		X		X	N/A	11/30/2011		High	No
8 (2010)	Purchase weather radio for EOC	EM	X	X	X	X	X	X	X	X	X	X		X		X	N/A	11/30/2011		High	No
9 (2010)	Expand communications and notification participation through public outreach	Emergency Management; Citizen Corps or CERT volunteers	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Staff and volunteer resources	1/1/2015	Complete outreach plan Prioritize outreach efforts Implement outreach to priority stakeholder/citizen groups Development of marketing materials	Medium	No
10 (2010)	Educate citizens on use of reverse 9-11	Emergency Management; Citizen Corps or CERT volunteers	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Staff and volunteer resources	1/1/2015	Prioritize stakeholder groups for 911 outreach effort	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
11 (2010)	Cross train staff across departments to support critical functions	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	County staff resources	1/1/2015	Develop a plan for cross training staff	Medium	No
12 (2010)	Use CERT resources to educate and develop emergency plans, protocols etc...	Emergency management CERT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Emergency Management CERT	Ongoing – within 5 years	Prioritization of necessary plans to develop	Medium	No
13 (2010)	Update flood inundation maps	Contractual support	X				X					X					FEMA Risk MAP County funds	1/1/2015	Develop a plan (including schedule) for updating maps	Low	No
14 (2010)	Conduct Local Emergency Management Operations Course (LEMOC)	Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X		February 24, 2011	Finalized course materials/topics	High	No



IX. City of Manassas Park

The City of Manassas Park was incorporated in 1957 and became an independent city in 1975. It was the last town in Virginia to become a city before a moratorium was placed on other towns achieving similar status. The population of the city was 10,290 as of the 2000 Census and was estimated by the Census Bureau to be 14,026 in 2009. Based on the 2005-2009 American Community Survey, the city population was comprised of 62.9% white, 11.1% black or African American, 0.4% Native American, 6.4% Asian, 16.7% from other races, and 2.6% bi-racial. Hispanics or Latinos, of any race, represent 30.4% of the total population.



The City of Manassas Park is seeing population growth with new residents focusing on the city center in new densely configured housing units. While traditional residents live in less dense areas in older dwellings.

The City of Manassas Park has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and 16 inches of snow fall in any given year. The wettest month on average is May. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The City of Manassas Park is subject to high wind events and extreme winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Manassas Park, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁴⁶. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, and Winter Weather hazards were ranked as 'High' for Manassas Park. See Table 7.41 for a summary of hazard rankings.



Table 7.41: Hazard Ranking for Manassas Park

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	Med-High	Med-High	High	Low	Med-Low	Low	Med-Low	Low

Annualized loss statistics for the City of Manassas Park based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.42.

Table 7.42: NCDC Annualized Loss by Hazard for City of Manassas Park

Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (for all hazards)
<i>Years of Record</i>	17	21	59	17	
City of Manassas Park	\$0	\$573	\$0	\$0	\$573

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for the City of Manassas Park based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.43, 7.44 and 7.45 below.

Table 7.43: HAZUS^{MH} - Annualized Loss Due to Flood for City of Manassas Park

Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
City of Manassas Park	\$36,000	\$31,000	\$0	\$0	\$0	\$0	\$0	\$67,000



Table 7.44: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Manassas Park								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
City of Manassas Park	\$16,418	\$1,395	\$30	\$903	\$47	\$275	\$78	\$19,145

Table 7.45: HAZUS ^{MH} - Annualized Loss Due to Earthquake for City of Manassas Park	
Jurisdiction	Annualized Loss
City of Manassas Park	\$11,457

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is moderately high at more than \$19,000 for high wind and \$67,000 for flooding. The earthquake annualized loss estimate is relatively low, but earthquakes occasionally occur in the region. That was the case July 16, 2010 when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. City of Manassas Park Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Examine (and mitigate if necessary) the roof structure of the Community Center and Middle School to withstand winter storm loads.	Office of Emergency Management, Department of Public Works		X													FEMA Unified Hazard Mitigation Assistance Grants	July 2012	Secure funding by July 2011.	Critical	No
2 (2010)	Continue to develop and finalize the City's stormwater management plan.	Department of Public Works	X	X	X		X										Internal funding, Possible Water Quality Improvement Act funds, revolving loan funds, Section 319 NPS grants from DCR.	January 2012	Finish draft for review by July 2011.	High	No
3 (2010)	Consider implementing stormwater fees to citizens.	Department of Public Works, Office of the City Manager	X	X	X		X										Internal funding	July 2011	Develop initial fee schedule by March 2011.	High	No
4 (2010)	Identify and secure funding to rehabilitate retention ponds within the City.	Department of Public Works	X	X	x		X										FEMA Unified Hazard Mitigation Assistance Grants	December 2014	Catalog all detention ponds to be rehabilitated by December 2012.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
4 (2006)	Consider executing a public outreach campaign in the City's schools to educate students about local hazards.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	No cost – internal staff support	January 2013	Develop agreement with Manassas Park Public Schools to distribute educational fliers by January 2012.	High	No
5 (2010)	Exercise the Reverse 9-1-1 system City-wide.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding	July 2014	Secure funding by July 2013.	Medium	No
4 (2006)	Display and distribute educational hazard and emergency brochures at local events where information displays exist (i.e. Fall Festival).	Office of Emergency Management, Law Enforcement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal funding	June 2011	Ensure sufficient quantity of brochures for dissemination by March 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
4 (2006)	Distribute hazard education fliers in utility mailings at least once a year.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal funding	June 2011	Develop distribution schedule and identify which utility mailing to include the fliers in by May 2011.	Medium	No
6 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
7 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by Dec. 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
7 (2010)	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.	Office of Emergency Management	X		X		X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
8 (2010)	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.	Office of Emergency Management	7		X		X										Internal program support.	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No
9 (2010)	Distribute hazard education fliers at HOA meetings that are attended by City representatives, at least once a year.	Office of Emergency Management, Law Enforcement	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal funding	June 2011	Schedule attendance at one HOA meeting by April 2011.	Low	No



X. Town of Clifton

Formerly known as Devereux Station, Clifton became the first town in Fairfax County when it incorporated on March 9, 1902. The population of the town was 185 as of the 2000 Census and was estimated by the Census Bureau to be 216 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 97.3% white, 0.7% Asian, 1% from other races, and 1% bi-racial. Hispanics or Latinos, of any race, represent 4.7% of the total population.



The Town of Clifton has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 36 inches of rain and 15 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The town’s location on the eastern edge of the Virginia Piedmont make it susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including the Town of Clifton, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁴⁷. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as ‘High’ for the Town of Clifton. See Table 7.46 for a summary of hazard rankings.

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med	Med-Low



Annualized loss statistics for Fairfax County (which includes the Town of Clifton) based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.47. The NCDC only reports losses for hazards at the city and county level.

Table 7.47: NCDC Annualized Loss by Hazard for Fairfax County					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss
<i>Years of Record</i>	17	21	59	17	
Fairfax County	\$801,903	\$612,562	\$2,265,041	\$60,537	\$3,830,698

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for the Town of Clifton based on HAZUS^{MH} runs for flood, hurricane, and earthquake are found in Tables 7.48, 7.49, and 7.50 below.

Table 7.48: HAZUS ^{MH} - Annualized Loss Due to Flood for the Town of Clifton								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Clifton	\$27,000	\$47,000	\$2,000	\$0	\$0	\$0	\$0	\$76,000

Table 7.49: HAZUS ^{MH} - Annualized Loss Due to Hurricane for the Town of Clifton								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Clifton	\$504	\$36	\$0	\$22	\$3	\$7	\$12	\$584

Table 7.50: HAZUS ^{MH} - Annualized Loss Due to Earthquake for the Town of Clifton	
Jurisdiction	Annualized Loss
Town of Clifton	\$475



As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to hurricanes is minimal, due to the Town of Clifton's size. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Clifton Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Assess the roadway structure at various intersections throughout the Town of Clifton to avoid repeated flooding.	Police Department	X		X		X										Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
2 (2010)	Continue to identify and employ a broad range of warning systems throughout the Town of Clifton.	Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
3 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4 (2010)	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.	Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
5 (2010)	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.	Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
6 (2010)	Review Town of Clifton'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.	Police Department	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



XI. Town of Dumfries

Located in Prince William County, Dumfries was chartered on May 11, 1749, and is Virginia's oldest continuously chartered town. John Graham gave the land on which the town was founded and it is named after his birthplace, Dumfrieshire, Scotland. The population of the town was 4,937 as of the 2000 Census and was estimated by the Census Bureau to be 4,954 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 47.6% white, 31.4% black or African American, 0.7% Native American, 2.8% Asian, 12.9% from other races, and 4.6% bi-racial. Hispanics or Latinos, of any race, represent 27.4% of the total population.



Dumfries has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 39 inches of rain and 16 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Dumfries is also subjected to tidal and storm surge flooding, due to the town's location below the Fall Line on Quantico Creek. As sea levels rise, permanent inundation of low lying areas along and near the river shoreline is also a concern. Dumfries is also susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter and summer seasons.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Dumfries, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁴⁸. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Drought hazards were ranked as 'High' for Dumfries. See Table 7.51 for a summary of hazard rankings.



Table 7.51: Hazard Ranking for Town of Dumfries									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-Low	Med	Med-Low

Annualized loss statistics for Prince William County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.52.

Table 7.52: NCDC Annualized Loss by Hazard for Prince William County					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (All Hazards)
<i>Years of Record</i>	17	21	59	17	
Prince William County	\$155,044	\$795,511	\$117,080	\$60,502	\$1,242,539

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Dumfries based on HAZUS^{MH} runs for flood, hurricane, and earthquake are found in Tables 7.53, 7.54 and 7.55 below.

Table 7.53: HAZUS ^{MH} - Annualized Loss Due to Flood for Town of Dumfries								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Dumfries	\$396,000	\$449,000	\$7,000	\$0	\$0	\$0	\$2,000	\$854,000

Table 7.54: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Town of Dumfries								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Dumfries	\$4,441	\$451	\$4	\$392	\$23	\$191	\$41	\$5,542



Table 7.55: HAZUS^{MH} - Annualized Loss Due to Earthquake for Town of Dumfries

Jurisdiction	Annualized Loss
Town of Dumfries	\$2,492

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to flooding is high, due to Dumfries’s location. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Dumfries Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Assess the roadway structure at various intersections throughout the Town of Dumfries to avoid repeated flooding.	Public Works	X		X		X						X				Hazard Mitigation Assistance grant funding, State funding possible, and any Grant programs	December 2015	Identify funding sources by January 2012	High	No
2 (2010)	Continue to implement an effective MS-4 Program which will bring awareness to help prevent hazardous waste material being flushed down the drain or into ditches.	Public Works														X	Environmental Friendly funding, EPA grants, town/county funding, and fee based funding	December 2015, but mainly an ongoing program	Identify all drainage outfalls and have them electronically uploaded on a data base by December 2011.	High	No
3 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Building official with assistance from Zoning Director	X	X		X											FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4 (2010)	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	Public Works in conjunction with Zoning Department	X	X		X											FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
	where appropriate.																				
5 (2010)	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.	Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
6 (2010)	Review Town of Dumfries' 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.	Public Works, Zoning Departments	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No
7 (2010)	Continue to identify and employ a broad range of warning systems throughout the Town of Dumfries.	Town of Dumfries Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	Low	No



XII. Town of Haymarket

Located near Civil War Battlefields and on the “Journey Through Hallowed Ground,” the Town of Haymarket is an important historical site as well as a growing destination for shoppers and history buffs. Chartered in 1799 by the Virginia General Assembly, the Town of Haymarket was incorporated in 1882. The population of the town was 879 as of the 2000 Census and was estimated by the Census Bureau to be 1,252 in 2009.



Since the 1900s it has been popular for fox hunting and steeple chasing and is also known for its wineries. The town covers .5 square miles of land and is located in Prince William County. Based on the 2005-2009 American Community Survey, the town population was comprised of 68.8% white, 17.9% black or African American, 0.4% Pacific Islander, 6.5% Asian, 5.8% from other races, and 0.7% bi-racial. Hispanics or Latinos of any race were 11.3% of the total population.

Haymarket has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and 16 inches of snow fall in any given year. The wettest month on average is May. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Haymarket is subject to high wind events and extreme winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Haymarket, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁴⁹. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as ‘High’ for Manassas Park. See Table 7.56 for a summary of hazard rankings.



Table 7.56: Hazard Ranking for Town of Haymarket									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-Low	Med	Med-Low

Annualized loss statistics for Prince William County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.57.

Table 7.57: NCDC Annualized Loss by Prince William County (including Town of Haymarket)					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (All Hazards)
<i>Years of Record</i>	17	21	59	17	
Prince William County	\$155,044	\$795,511	\$117,080	\$60,502	\$1,242,539

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Haymarket based on HAZUS^{MH} runs for hurricane and earthquake are found in Tables 7.58 and 7.59 below.

Table 7.58: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Haymarket								
Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Haymarket	\$123	\$9	\$0	\$6	\$1	\$2	\$1	\$143

Table 7.59: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Haymarket	
Jurisdiction	Annualized Loss
Town of Haymarket	\$ 165



As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory, and related effects due to hurricanes is minimal, due to the Town of Haymarket's size. The earthquake annualized loss estimate is relatively low, but earthquakes occasionally occur in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. Town of Haymarket Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Assess the roadway structure at various intersections throughout the Town of Haymarket to avoid repeated flooding.	Town of Haymarket Police Department	X		X		X										Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
2 (2010)	Continue to identify and employ a broad range of warning systems throughout the Town of Haymarket.	Town of Haymarket Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
3 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Town of Haymarket Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4 (2010)	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.	Town of Haymarket Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
5 (2010)	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.	Town of Haymarket Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
6 (2010)	Review Town of Haymarket'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		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No
7 (2010)	Assess vacant buildings, determine historical significance, and develop a plan for restoring or demolishing the buildings vulnerable to hazards.	Town of Haymarket Town Manager	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Assess at least one vacant lot per year	Low	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
8 (2010)	Participate in the region-wide Commodity Flow Survey, particularly as it relates to hazardous material transportation on railways. Develop signage to warn motorists and pedestrians at railway crossings.	Town of Haymarket Police Department														X	UASI Funding	December 2014	Identify Funding by December 2012	Low	No



XIII. Town of Herndon

Incorporated as a town in 1879, the area in Fairfax County on which Herndon was built was originally granted to Thomas Culpeper by King Charles II of England in 1688. Much of the downtown was destroyed on March 22, 1917, by a fire but was rebuilt with brick instead of wood. The population of the town was 21,655 as of the 2000 Census and was estimated by the Census Bureau to be 22,579 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 58.3% white, 10.6% black or African American, 2.3% Native American, 16.1% Asian, 10.3% from other races, and 2.4% bi-racial. Hispanics or Latinos, of any race, represent 27.6% of the total population.



The Town of Herndon has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 40 inches of rain and 15 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The town’s location on the eastern edge of the Virginia piedmont makes it susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Herndon, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁵⁰. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as ‘High’ for Herndon. See Table 7.60 for a summary of hazard rankings.

Table 7.60: Hazard Ranking for the Town of Herndon									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med	Med-Low



Annualized loss statistics for Fairfax County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.61. The NCDC only reports losses for hazards at the city and county level.

Table 7.61: NCDC Annualized Loss by Hazard for Fairfax County					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss
<i>Years of Record</i>	17	21	59	17	
Fairfax County	\$801,903	\$612,562	\$2,265,041	\$60,537	\$3,380,698

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for the Town of Herndon based on HAZUS^{MH} runs for flood, hurricane, and earthquake are found in Tables 7.62, 7.63 and 7.64 below.

Table 7.62: HAZUS ^{MH} - Annualized Loss Due to Flood for Town of Herndon								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Herndon	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Table 7.63: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Town of Herndon								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Herndon	\$36,459	\$4,273	\$63	\$2,429	\$456	\$1,099	\$559	\$45,338

Table 7.64: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Town of Herndon	
Jurisdiction	Annualized Loss
Town of Herndon	\$32,972



As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory, and related effects due to hurricanes is minimal due to the Town of Herndon's size. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Herndon Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
9 (2006)	Explore the opportunity to wire the police department building at 397 Herndon Parkway, Herndon Va. 20170 for a back-up generator.	Herndon Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
1 (2010)	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property owner, providing information on mitigation programs (grant assistance, mitigation measures, and flood insurance information) that can assist them in reducing their flood risk.	Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
2 (2010)	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.	Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
3 (2010)	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.	Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
4 (2010)	Review Town of Herndon'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.	Public Works	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



XIV. Town of Leesburg

Steeped in history, Leesburg is the county seat of Loudoun County. Leesburg was established in 1758, and formally became a town by signed act of the Virginia General Assembly on February 18, 1813. It is located just over 30 miles west-northwest of Washington, DC, at the base of Catoctin Mountain and adjacent to the Potomac River. The principal drainage for the town is Tuscarora Creek and its northern “Town Branch,” which empties into Goose Creek located to the east of town.



European settlement began in the late 1730s. After founding, it was the location of the post office and regional courthouse. The town was originally established on 60 acres of land.

The population of the town was 28,311 as of the 2000 Census and was estimated by the Census Bureau to be 40,927 in 2009. As of the 2000 census there were 10,325 households. The population density in 2000 was 2,440 people per square mile. Based on the 2005-2009 American Community Survey, the town population was comprised of 72.8% white, 12% black or African American, 6.7% Asian, 5.2% from other races, and 3.3% bi-racial. Hispanics or Latinos of any race were 12% of the total population.

Leesburg has a moderate climate. The average annual temperature is approximately 58 degrees. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 43 inches in any given year, with approximately 20 inches of snowfall annually. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Leesburg has a rapidly growing population and is less than an hour’s car ride to Washington, DC. Risks for the town include its proximity to the Nation’s capital, its growth rate, flooding of low lying areas surrounding the Potomac River, and other natural hazards such as storm damage and winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Leesburg, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁵¹. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;



- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, Winter Weather and Drought hazards were ranked as ‘High’ for Leesburg. See Table 7.65 for a summary of hazard rankings.

Table 7.65: Hazard Ranking for Leesburg									
	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-High	Med-Low	Med-Low

Annualized loss statistics for Loudoun County based on NCDC historical data as the result of Flood, High Wind, Tornado, and Winter Storm are summarized in Table 7.66.

Table 7.66: NCDC Annualized Loss by Hazard for Loudoun County						
Annualized Loss as Determine through NCDC Data						
<i>(based on property and crop damages and number of years of record)</i>						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Losses (All Hazards)
Years of Record	17	17	21	59	17	
Loudoun County	\$351,549	\$216,429	\$176,618	\$119,785	\$31,982	\$896,364

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Leesburg based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.67, 7.68, and 7.69 below.

Table 7.67: HAZUS ^{MH} - Annualized Loss Due to Flood for Leesburg			
Jurisdiction	Building Loss	Content Loss	Total Loss
Town of Leesburg	\$474,000	\$339,000	\$813,000



Table 7.68: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Leesburg								
Jurisdiction	Building	Contents	Inventory	Relocation	Incom	Rental	Wage	Total
Town of Leesburg	\$23,601	\$1,807	\$20	\$1,312	\$160	\$612	\$233	\$27,745

Table 7.69: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Leesburg	
Jurisdiction	Annualized Loss
Town of Leesburg	\$29,955

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects total to more than \$813,000 for flooding and \$27,745 for hurricane. Earthquakes occasionally occur in the region. That was the case July 16, 2010 when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. Town of Leesburg Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Compl- etion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Develop and test government Continuity of Operations (Coop) plans.	Town Manager / dept directors	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal Town of Leesburg	12 months from time of award	Develop plan / train staff	High	No
2 (2010)	Develop and test model evacuation and shelter-in-place plans for government facilities to include identifying and stocking shelter areas, testing notification systems	All Departments	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal town funding, U.S. Department of Homeland Security, Office of Domestic Preparedness : Homeland Security Grant Program (HSGP)	12 months from time of award	Develop evac and shelter in place plan for town facilities	Moderate	No
3 (2010)	Provide additional automation and display equipment for Emergency Operations Center (EOC). Develop means for inclusion of GIS capability to track storm-related events including road closures, traffic signal status, power outages and building damage due to storm events. Identify and train staff required to operate EOC	Police, Public Works and IT Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal town funding, Federal Highway Administration grants Tiger Grants, Department of Homeland Security grants, county funding	12 months after availability of funds	Identifying and purchasing needed equipment	Moderate	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
	Variable Traffic Message Signs: This project will add several traffic message boards to the town's inventory. These boards are effective in the dissemination of information in the event of an emergency. They can be programmed with various messages including general traffic rerouting information, and other emergency messages. Additionally locations will be identified and pads prepared with power for deployment	Public Works – Street Department /Police dept	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal town funding, Federal Highway Administration grants Tiger Grants, Department of Homeland Security grants, county funding	Immediately upon receipt of funding	Identify locations	Moderate	No
4 (2010)	Practical Emergency Operations Training Exercise on a town wide basis for a natural disaster.	Town Manager / Police (All Agencies)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal town funding Department of Homeland Security grants, UASI funding, county funding	Six months	Develop exercise	High	



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Compl- etion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
			X	X	X	X	X	X	X	X	X	X	X	X	X	X					
	Improve drainage in low-lying or poor drainage areas along primary and secondary roads where needed town wide. During heavy rain events, several area roadways become inundated with water runoff. Priority Projects: 1. Tuscarora Creek Improvements 2. Town Branch Improvements—King Street 3. Turner-Hardwood Drainage	Public Works, Office of Capital Projects, Planning,	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Coordinate with Virginia Department of Transportation (VDOT)	Undetermined at this point—based on funding availability	Identify funding	High	No
2 (2006)	Improve security measures as needed around critical facilities	Executive Office	X	X	X	X	X	X	X	X	X	X	X	X	X	X	U.S. Department of Homeland Security, Office of Domestic Preparedness : Homeland Security Grant Program (HSGP); Buffer Zone Protection Program (BZPP)	Undetermined at this time—dependent on funding source and availability	Develop security enhancement plan	Moderate	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
3 (2006)	Provide back-up power (generators, where needed) for critical facilities (i.e., fire stations, police stations, water facilities, etc.).	Executive Office/ all depts.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	U.S. Department of Homeland Security, Office of Domestic Preparedness : Homeland Security Grant Program (HSGP); Buffer Zone Protection Program (BZPP)	Time schedule is dependent on funding source and availability	Identify funding	Moderate	No
5 (2010)	Update Town of Leesburg citizen guide to emergency Preparedness. Mail to residents and post on web	Police/ Executive/IT	X	X	X	X	X	X	X	X	X	X	X	X	X	X	U.S. Department of Homeland Security, Office of Domestic Preparedness : Homeland Security Grant Program (HSGP)	Time schedule is dependent on funding source and availability	Identify funding	Moderate	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
6 (2010)	Establish and full test emergency notification procedures and protocols for key government personnel to include; emergency email groups, text based alerts, pager based alerts, etc as well as establishment of Emergency call trees	Executive /All Depts	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal town funding Department of Homeland Security grants, UASI funding, county funding	Six months	Develop protocols	High	No
7 (2010)	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.	Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
8 (2010)	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.	Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
9 (2010)	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.	Public Works	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
10 (2010)	Review Town of Leesburg'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.	Public Works	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



XV. Town of Middleburg

The Town of Middleburg was established in 1787. The population of the town was 632 as of the 2000 Census and was estimated by the Census Bureau to be 976 in 2009. Middleburg is located in Loudoun County and covers approximately 0.6 square miles of land. The population density of the town is 1,083 people per square mile. Based on the 2005-2009 American Community Survey, the town population was comprised of 73.8% white and 26.2% black or African American. Hispanics or Latinos of any race were 0.8% of the total population.

Middleburg has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and approximately 20 inches of snow fall in any given year. The wettest month on average is May. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Middleburg is subject to high wind events and extreme winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Middleburg, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁵². Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, Winter Weather and Drought hazards were ranked as ‘High’ for Middleburg. See Table 7.70 for a summary of hazard rankings.

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-High	Med-Low	Med-Low



Annualized loss statistics for Loudoun County based on NCDC historical data as the result of Flood, High Wind, Tornado, and Winter Storm are summarized in Table 7.71.

Table 7.71: NCDC Annualized Loss for Loudoun County						
Annualized Loss as Determine through NCDC Data						
<i>(based on property and crop damages and number of years of record)</i>						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Losses (All Hazards)
<i>Years of Record</i>	17	17	21	59	17	
Loudoun County	\$351,549	\$216,429	\$176,618	\$119,785	\$31,982	\$896,364

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Middleburg based on HAZUS^{MH} runs for hurricane and earthquake are found in Tables 7.72 and 7.73 below.

Table 7.72: HAZUS^{MH} - Annualized Loss Due to Hurricane for Town of Middleburg								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Middleburg	\$89	\$5	0	\$4	\$1	\$2	\$1	\$101

Table 7.73: HAZUS^{MH} - Annualized Loss Due to Earthquake for Town of Middleburg	
Jurisdiction	Annualized Loss
Town of Middleburg	\$129

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to hurricanes is minimal, due to the Town of Middleburg’s size. Although somewhat rare, earthquakes occasionally occur in the region. That was the case July 16, 2010 when a 3.6 magnitude quake centered near Gaithersburg, Maryland shook the area.

A. Town of Middleburg Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Develop and test government Continuity of Operations Plan (COOP).	Town Administration	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal to general fund	12 months from endorsement of the plan	Develop the COOP and train staff.	High	No
2 (2010)	Develop Geographical Information System with critical layers between the town and the county.	Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Internal to general fund, DHS Grant Funding, Hazard Mitigation Grant Funds	12 months from endorsement of the plan	Development of GIS system and associated data for hazard mitigation.	High	No
3 (2010)	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.	Planning and Zoning	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4 (2010)	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.	Planning and Zoning	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
5 (2010)	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.	Planning and Zoning	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
6 (2010)	Review Town of Middleburg'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.	Planning and Zoning	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



XVI. Town of Occoquan

Derived from a Dogue Indian word meaning ‘at the end of the water’, Occoquan was divided into lots and streets were laid out in 1804 by Nathaniel Ellicott, James Campbell and Luke Wheeler. The town is located in northeastern Prince William County. The population of the town was 759 as of the 2000 Census and was estimated by the Census Bureau to be 834 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 76.7% white, 14% black or African American, 4.5% Native American, 1.2% from other races, and 3.6% bi-racial. Hispanic or Latino, of any race, represents 6.6% of the total population.



Occoquan has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 39 inches of rain and 16 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Occoquan is also subjected to tidal and storm surge flooding, due to the town’s location at the Fall Line on the Occoquan River, a tributary to the Potomac River. As sea levels rise, permanent inundation of low lying areas along and near the river shoreline is also a concern. Occoquan is also susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter and summer seasons.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Occoquan, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁵³. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence
- Vulnerability of population in the hazard area
- Historical impact, in terms of human lives and property and crop damage

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Drought hazards were ranked as ‘High’ for Occoquan. See Table 7.74 for a summary of hazard rankings.



Table 7.74: Hazard Ranking for Town of Occoquan									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-Low	Med	Med-Low

Annualized loss statistics for Prince William County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.75.

Table 7.75: NCDC Annualized Loss by Hazard for Prince William County						
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss (for all hazards)
<i>Years of Record</i>	17	17	21	59	17	
Prince William County	\$114,402	\$155,044	\$795,511	\$117,080	\$60,502	\$1,242,539

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Occoquan based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.76, 7.77 and 7.78 below.

Table 7.76: HAZUS ^{MH} - Annualized Loss Due to Flood for Town of Occoquan								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Occoquan	\$409,000	\$372,000	\$7,000	\$0	\$0	\$0	\$1,000	\$789,000

Table 7.77: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Town of Occoquan								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Occoquan	\$898	\$84	\$1	\$57	\$6	\$29	\$6	\$1,080

Table 7.78: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Town of Occoquan	
Jurisdiction	Annualized Loss
Town of Occoquan	\$635



As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to flooding is high, due to Occoquan's location. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Occoquan Mitigation Actions and Action Plan

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#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Implement the relay dam sirens systems in the event of a dam failure.	Town Manager	X		X		X										USACE, FEMA Unified Hazard Mitigation Assistance funding.	December 2011	Secure funding and develop implementation plan by February 2011	High	No
2 (2010)	Initiate a public outreach campaign to inform residents of local hazards, to include dam failure and the new dam failure sirens.	Town Manager	X	X	X	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance funding, US Army Corp of Engineers funding	December 2012	Develop outreach plan and identify dissemination methods by July 2012.	High	No
3 (2010)	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.	Town Manager	X		X		X					X					FEMA Unified Hazard Mitigation Assistance funding.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
4 (2010)	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.	Town Manager	X		X		X										N/A, town manager evaluation.	Ongoing	Establish a schedule of review by June 2011.	Medium	No



5 (2010)	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.	Town Manager	X		X		X					X				FEMA Unified Hazard Mitigation Assistance funding.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
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XVII. Town of Purcellville

First settled in 1764, the village became known as Purcellville on July 9, 1852, and was incorporated in 1908. Many present structures in the town reflect the Victorian architecture of the turn of the century. Located in the western portion of Loudoun County, the town has a total area of 2.6 square miles. Wine production is a thriving industry in this area, with approximately 30 wineries in the region. The Blue Ridge Mountains are just to the west and in good weather are usually visible from town. Recreation includes the WO&D bike trail, the western portion of which ends here.



The population of the town was 3,584 as of the 2000 Census and was estimated by the Census Bureau to be 5,309 in 2009. The population density in 2000 was 1,512 persons per square mile. There were 1,292 housing units at an average density of 545 per square miles. Based on the 2005-2009 American Community Survey, the town population was comprised of 88% white, 3.8% black or African American, 2.4% Asian, 0.3% from other races, and 5.6% bi-racial. Hispanics or Latinos of any race were 5.8% of the total population.

Purcellville has a moderate climate. The average annual temperature is approximately 58 degrees. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 43 inches with over 20 inches of snow falling in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Purcellville, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁵⁴. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Drought hazards were ranked as 'High' for Purcellville. See Table 7.79 for a summary of hazard rankings.



Table 7.79: Hazard Ranking for Purcellville								
Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
High	High	High	High	High	Med	Med-High	Med-Low	Med-Low

Annualized loss statistics for Purcellville based on NCDC historical data as the result of Flood, High Wind, Tornado, and Winter Storm are summarized in Table 7.80.

Table 7.80: NCDC Annualized Loss by Hazard for Loudoun County						
Annualized Loss as Determine through NCDC Data						
<i>(based on property and crop damages and number of years of record)</i>						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Losses (All Hazards)
<i>Years of Record</i>	17	17	21	59	17	
Loudoun County	\$351,549	\$216,429	\$176,618	\$119,785	\$31,982	\$896,364

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Purcellville based on HAZUS^{MH} runs for hurricane and earthquake are found in Tables 7.81 and 7.82.

Table 7.81: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Purcellville								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Purcellville	\$730	\$41	\$1	\$29	\$3	\$10	\$4	\$818

Table 7.82: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Purcellville	
Jurisdiction	Annualized Loss
Town of Purcellville	\$911

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to hurricanes and earthquakes is generally low at less than \$1,000. Although



somewhat rare, earthquakes occasionally occur in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Purcellville Mitigation Actions and Action Plan

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#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
4 (2006)	Assess the roadway structure at various intersections throughout the Town of Purcellville to avoid repeated flooding.	Public Works	X		X		X										Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
1 (2010)	Continue to identify and employ a broad range of warning systems throughout the Town of Purcellville.	Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
2 (2010)	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.	Planning and Zoning	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
3 (2010)	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.	Planning and Zoning	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completi on Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
4 (2010)	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.	Planning and Zoning	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
5 (2010)	Review Town of Purcellville'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.	Planning and Zoning	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



XVIII. Town of Quantico

Quantico is located on the Potomac River in Prince William County and surrounded by Marine Corps Base Quantico. The 2000 census estimate for the town was 561 and was estimated by the Census Bureau to be 607 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 63.8% white, 16.1% black or African American, 1.3% Native American, 6.3% Asian, 2.9% from other races, and 9.5% bi-racial. Hispanics or Latinos, of any race, represent 8.4% of the total population.

Quantico has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 41 inches of rain and 16 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The town is also subjected to tidal and storm surge flooding, due to its location on the Potomac River. As sea levels rise, permanent inundation of low lying areas along and near the river shoreline is also a concern. Quantico is also susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter and summer seasons.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Quantico, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA’s NCDC⁵⁵. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of ‘Low’; ‘Medium-Low’; ‘Medium’; ‘Medium-High’; or ‘High’. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Drought hazards were ranked as ‘High’ for Quantico. See Table 7.83 for a summary of hazard rankings.

Table 7.83: Hazard Ranking for Town of Quantico									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-Low	Med	Med-Low



Annualized loss statistics for Prince William County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.84.

Table 7.84: NCDC Annualized Loss by Hazard for Prince William County						
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized
<i>Years of Record</i>	17	17	21	59	17	Loss (for all hazards)
Prince William County	\$114,402	\$155,044	\$795,511	\$117,080	\$60,502	\$1,242,539

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Quantico based on HAZUS^{MH} runs for flood, hurricane, and earthquake are found in Tables 7.85, 7.86, and 7.87 below.

Table 7.85: HAZUS^{MH} - Annualized Loss Due to Flood for Town of Quantico								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Quantico	\$16,000	\$17,000	\$0	\$0	\$0	\$0	\$0	\$33,000

Table 7.86: HAZUS^{MH} - Annualized Loss Due to Hurricane for Town of Quantico								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Quantico	\$2,050	\$370	\$4	\$211	\$38	\$151	\$40	\$2,864

Table 7.87: HAZUS^{MH} - Annualized Loss Due to Earthquake for Town of Quantico	
Jurisdiction	Annualized Loss
Town of Quantico	\$1,032

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to flooding is high, due to Quantico’s location. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Quantico Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Assess the roadway structure at various intersections throughout the Town of Quantico to avoid repeated flooding.	Office of the Mayor	X		X		X										Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
2 (2010)	Continue to identify and employ a broad range of warning systems throughout the Town of Quantico.	Office of the Mayor	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
3 (2010)	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.	Office of the Mayor	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4 (2010)	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.	Office of the Mayor	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
5 (2010)	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.	Office of the Mayor	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
6 (2010)	Review Town of Quantico'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.	Office of the Mayor	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No



XIX. Town of Round Hill

Named after the 910 foot hill located just southwest of the town center, and part of the foothills of the Blue Ridge Mountains, Round Hill was incorporated in 1900. Round Hill was used during the American Civil War as a signals post by both the Confederate and Union troops.

The Town is located at the crossroads of Virginia routes 7 and 719, approximately 45 miles northwest of Washington, DC. The town was the terminus of the Washington and Old Dominion Railroad, formerly the Washington and Ohio line. It is located 7 miles from the Shenandoah River, 15 miles from Harpers Ferry and four miles from the Appalachian Trail.



The population of the Round Hill was 500 as of the 2000 Census and was 539 in 2010. It is part of Loudoun County. Round Hill covers 0.2 square miles of land. The town population was comprised of 93% white, 2.8% Black or African American, 1.1% Asian, and 0.9% bi-racial.

Round Hill has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 38 inches of rain and 20 inches of snow fall in any given year, with May being the wettest month on average. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

Round Hill is subject to high wind events and extreme winter weather. Winter storms pose significant threats, as evidenced during the 2009 – 2010 winter season.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including Round Hill, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁵⁶. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, Tornado, Winter Weather, and Drought hazards were ranked as 'High' for Round Hill. See Table 7.88 for a summary of hazard rankings.



Table 7.88: Hazard Ranking for Round Hill									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	High	Med	Med-High	Med-Low	Med-Low

Annualized loss statistics for Loudoun County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.89.

Table 7.89: NCDC Annualized Loss by Loudoun County						
Annualized Loss as Determine through NCDC Data						
<i>(based on property and crop damages and number of years of record)</i>						
	Drought	Flood	High Wind	Tornado	Winter Storm	Total Annualized Losses (All Hazards)
Years of Record	17	17	21	59	17	
Loudoun County	\$351,549	\$216,429	\$176,618	\$119,785	\$31,982	\$896,364

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses. Much of the NCDC data is gathered from damage reports and insurance records.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for Round Hill based on HAZUS^{MH} runs for hurricane and earthquake are found in Tables 7.90 and 7.91 below.

Table 7.90: HAZUS ^{MH} - Annualized Loss Due to Hurricane for Round Hill								
Jurisdiction	Building	Contents	Inventory	Relocation	Income	Rental	Wage	Total
Town of Round Hill	\$44	\$2	\$0	\$2	\$0	\$1	\$0	\$48

Table 7.91: HAZUS ^{MH} - Annualized Loss Due to Earthquake for Round Hill	
Jurisdiction	Annualized Loss
Town of Round Hill	\$53

As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects is relatively low at \$49 for hurricane wind and \$53 for earthquake. Although



somewhat rare, earthquakes occasionally occur in the region. That was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Round Hill Mitigation Actions and Action Plan

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#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Hazard Type													Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)		
			Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst						Human-Caused	
1 (2010)	Identify the Town's Critical Infrastructure and develop a GIS layer	Loudoun County Office of Emergency Management/Town of Round Hill Planning	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding, DHS funding, Hazard Mitigation Grant Programs	December 2012	Secure funding	Critical	No
2 (2010)	Implement drainage improvements in low-lying roadways.	Virginia Department of Transportation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	DHS funding, Hazard Mitigation Grant Programs	December 2014	Secure funding	Critical	No
3 (2010)	Provide back-up power for critical facilities.	Town of Round Hill	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding, DHS funding, Hazard Mitigation Grant Programs	December 2014	Secure funding	Critical	No
4 (2010)	Establish and test emergency notification procedures and protocols for Town personnel.	Town of Round Hill	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding	December 2012	Allocate funding	Critical	No
5 (2010)	Develop and test a Continuity of Operations Plan (COOP).	Town of Round Hill / Loudoun County Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Local funding, DHS funding, Hazard Mitigation Grant Programs	December 2014	Secure funding	Critical	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
6 (2010)	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.	Planning Commission	X		X	X											FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
7 (2010)	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.	Planning Commission	X		X	X											FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
8 (2010)	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.	Planning Commission	X		X	X											FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
9 (2010)	Review Town of Round Hill'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.	Planning Commission	X		X		X										General funds	Ongoing	review. Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No

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XX. Town of Vienna

Originally called Ayr Hill, the Fairfax County village agreed in the 1850s to change its name to Vienna at the request of William Hendrick, a medical doctor who grew up in Vienna, New York. Vienna was incorporated into a town in 1890. The population of the town was 14,453 as of the 2000 Census and was estimated by the Census Bureau to be 15,215 in 2009. Based on the 2005-2009 American Community Survey, the town population was comprised of 76.5% white, 6% black or African American, 0.2% Native American, 11% Asian, 4.5% from other races, and 1.8% bi-racial. Hispanics or Latinos, of any race, represent 10.7% of the total population.



The Town of Vienna has a moderate climate. Temperatures generally range from lows in the mid-20s in January to highs in the upper-80s and lower-90s during the month of July. Annual precipitation averages are approximately 45 inches of rain and 15 or more inches of snow fall in any given year. Recent history proves that weather events well outside of these averages can and do occur. Climate change is expected to continue the trend of the past 40 to 50 years of an increased frequency of extreme weather events.

The town's location on the eastern edge of the Virginia piedmont make it susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2009 – 2010 winter season.

The Town of Vienna's situation in the Washington metropolitan area and its ease of access by car and public transportation have attracted an increasingly-varied residential and commercial development. Fairfax County's central business district, Tyson's Corner, is just outside of the town's corporate limits. It is the 12th largest central business district in the United States.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region, including the Town of Vienna, with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, data on historical weather-related events is based on information made available through the Storm Event Database by NOAA's NCDC⁵⁷. Hazards were ranked using a semi-quantitative scoring system that involved grouping the data values (normalized to account for inflation) based on statistical methods. This method prioritizes hazard risk based on a blend of quantitative factors extracted from NCDC and other available data sources. The parameters considered include:

- Historical occurrence;
- Vulnerability of population in the hazard area; and
- Historical impact, in terms of human lives and property and crop damage.

The hazard scores were assigned a category of 'Low'; 'Medium-Low'; 'Medium'; 'Medium-High'; or 'High'. Based on this methodology, Flood, Wind, Tornado, and Winter Weather hazards were ranked as 'High' for the Town of Vienna. See Table 7.92 for a summary of hazard rankings.



Table 7.92: Hazard Ranking for the Town of Vienna									
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med	Med-Low

Annualized loss statistics for Fairfax County based on NCDC historical data as the result of Flood, High Wind, Tornado and Winter Storm are summarized in Table 7.93. The NCDC only reports losses for hazards at the city and county level.

Table 7.93: NCDC Annualized Loss by Hazard for Fairfax County					
Annualized Loss as determine through NCDC data (based on property and crop damages and number of years of record)					
	Flood	High Wind	Tornado	Winter Storm	Total Annualized Loss
<i>Years of Record</i>	17	21	59	17	
Fairfax County	\$801,903	\$612,562	\$2,265,041	\$60,537	\$3,830,698

It should be noted that while the NCDC storm events data is the most comprehensive database available for which to compare most natural hazards, its considerable limitations include spotty property and crop damage data that are considered to significantly under-estimate actual losses.

FEMA’s HAZUS^{MH} model provides another method for estimating annualized loss that uses science and engineering principals and building stock values along with historical hazard occurrences to analyze potential damage and economic loss. Annualized loss statistics for the Town of Vienna based on HAZUS^{MH} runs for flood, hurricane and earthquake are found in Tables 7.94, 7.95 and 7.96 below.

Table 7.94: HAZUS ^{MH} - Annualized Loss Due to Flood for the Town of Vienna								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Vienna	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0

Table 7.95: HAZUS ^{MH} - Annualized Loss Due to Hurricane for the Town of Vienna								
Jurisdiction	Building Loss	Contents Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Annualized Loss
Town of Vienna	\$36,154	\$3,979	\$43	\$2,263	\$403	\$791	\$460	\$44,093

Table 7.96: HAZUS ^{MH} - Annualized Loss Due to Earthquake for the Town of Vienna	
Jurisdiction	Annualized Loss
Town of Vienna	\$29,422



As seen in the HAZUS^{MH} analysis, the potential annual loss to property, contents, inventory and related effects due to hurricanes is significant for the town. Earthquakes occasionally occur in the region; that was the case July 16, 2010, when a 3.6 magnitude quake centered near Gaithersburg, Maryland, shook the area.

A. Town of Vienna Mitigation Actions and Action Plan

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#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
1 (2010)	Assess the roadway structure at various intersections throughout the Town of Vienna to avoid repeated flooding.	Town of Vienna Public Works	X		X		X										Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
2 (2010)	Continue to identify and employ a broad range of warning systems throughout the Town of Vienna.	Town of Vienna Police Department	X	X	X	X	X	X	X	X	X	X	X	X	X	X	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
3 (2010)	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.	Town of Vienna Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	No
4 (2010)	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.	Town of Vienna Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Weather	Thunderstorm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Erosion	Landslides	Karst	Human-Caused	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Keep Action Redacted (Yes/No)
5 (2010)	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.	Town of Vienna Police Department	X		X		X										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	No
6 (2010)	Review Town of Vienna'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.	Town of Vienna Police Department	X		X		X										General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	No