

1858 - CID510090_LoudounCounty_CFPF

Application Details

Funding Opportunity:	1448-Virginia Community Flood Preparedness Fund - Study Grants - CY23 Round 4
Funding Opportunity Due Date:	Nov 12, 2023 11:59 PM
Program Area:	Virginia Community Flood Preparedness Fund
Status:	Under Review
Stage:	Final Application
Initial Submit Date:	Nov 9, 2023 9:29 AM
Initially Submitted By:	Doug Fritz
Last Submit Date:	
Last Submitted By:	

Contact Information

Primary Contact Information

Active User*:	Yes
Type:	External User
Name*:	Mr. Chris Stone Salutation First Name Last Name
Title:	Stormwater Chief
Email*:	chris.stone@loudoun.gov
Address*:	PO Box 7100 801 Sycolin Road, S.E. Suite 300 Leesburg Virginia 20175 City State/Province Postal Code/Zip
Phone*:	571-258-3542 Ext. Phone #####-#####
Fax:	#####-#####-#####
Comments:	

Organization Information

Status*:	Approved
Name*:	Loudoun County
Organization Type*:	County Government
Tax ID*:	540948306
Unique Entity Identifier (UEI)*:	T6BKTJUZVV29

Organization Website:

Address*:

1 Harrison Street SE

Leesburg Virginia 20175-
City State/Province Postal Code/Zip

Phone*:

571-258-3996 Ext.

######

Fax:

######

Benefactor:

Vendor ID:

Comments:

VCFPF Applicant Information

Project Description

Name of Local Government*: Loudoun County

Your locality's CID number can be found at the following link: [Community Status Book Report](#)

NFIP/DCR Community Identification Number (CID)*: 510090

If a state or federally recognized Indian tribe,

Name of Tribe:

Authorized Individual*: Tim Hemstreet
First Name Last Name

Mailing Address*: P.O Box 7000
Address Line 1
Address Line 2

Leesburg Virginia 20177
City State Zip Code

Telephone Number*: 703-777-0200

Cell Phone Number*: 571-233-6559

Email*: coadmin@loudoun.gov

Is the contact person different than the authorized individual?

Contact Person*: Yes

Contact: Chris Stone
First Name Last Name
P.O. Box 7100
Address Line 1
Suite 304
Address Line 2

Leesburg Virginia 20175
City State Zip Code

Telephone Number: 571-258-3542

Cell Phone Number: 571-233-6559

Email Address: chris.stone@loudoun.gov

Enter a description of the project for which you are applying to this funding opportunity

Project Description*:

The County will develop a PCSWMM model to characterize the contribution of the Muddy Branch tributary on the existing flooding hazards at the tributary's confluence with Muddy Branch and identify potential mitigation options. Deliverables will include existing and proposed condition model results and, more broadly, potential paths toward reducing flood risk to life, property, and environment within the study area.

Low-income geographic area means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income, or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. A project of any size within a low-income geographic area will be considered.

Is the proposal in this application intended to benefit a low-income geographic area as defined above?

Benefit a low-income geographic area*: Yes

Information regarding your census block(s) can be found at census.gov

Census Block(s) Where Project will Occur*: Tract 611300 Blocks 2012 & 2013; Tract 611400 Blocks 1003, 2000, 2001, 2006, 3001 & 3005

Is Project Located in an NFIP Participating Community?*: Yes

Is Project Located in a Special Flood Hazard Area?*: No

Flood Zone(s) (if applicable): X

Flood Insurance Rate Map Number(s) (if applicable): FIRM #s - 51107C0269E, 51107C0385E

Eligibility - Round 4

Eligibility

Is the applicant a local government (including counties, cities, towns, municipal corporations, authorities, districts, commissions, or political subdivisions created by the General Assembly or pursuant to the Constitution or laws of the Commonwealth, or any combination of these)?

Local Government*: Yes
Yes - Eligible for consideration
No - Not eligible for consideration

If the applicant is not a town, city, or county, are letters of support from all affected local governments included in this application?

Letters of Support*: N/A
Yes - Eligible for consideration
No - Not eligible for consideration

Has this or any portion of this project been included in any application or program previously funded by the Department?

Previously Funded*: No
Yes - Not eligible for consideration
No - Eligible for consideration

Has the applicant provided evidence of an ability to provide the required matching funds?

Evidence of Match Funds*: Yes
Yes - Eligible for consideration
No - Not eligible for consideration
N/A- Match not required

Scope of Work - Studies - Round 4

Scope of Work

Upload your Scope of Work

Please refer to Part IV, Section B. of the grant manual for guidance on how to create your scope of work

Scope of Work*: [CID510090_Loudoun County_Muddy Branch Tributary Modeling CFPF Final Scope of Work.pdf](#)

Comments:

Budget Narrative

Budget Narrative Attachment*: [CID510090_Loudoun County_CFPF Grant Budget.pdf](#)

Comments:

CID#510090_Loudoun County CFPF Grant Budget

Scoring Criteria for Studies - Round 4

Scoring

Revising floodplain ordinances to maintain compliance with the NFIP or to incorporate higher standards that may reduce the risk of flood damage. This must include establishing processes for implementing the ordinance, including but not limited to, permitting, record retention, violations, and variances. This may include revising a floodplain ordinance when the community is getting new Flood Insurance Rate Maps (FIRMs), updating a floodplain ordinance to include floodplain setbacks or freeboard, or correcting issues identified in a Corrective Action Plan.

Revising Floodplain Ordinances*: No
Select

Creating tools or applications to identify, aggregate, or display information on flood risk or creating a crowd-sourced mapping platform that gathers data points about real-time flooding. This could include a locally or regionally based web-based mapping product that allows local residents to better understand their flood risk.

Mapping Platform*: No
Select

Conducting hydrologic and hydraulic studies of floodplains. Applicants who create new maps must apply for a Letter of Map Revision or a Physical Map Revision through the Federal Emergency Management Agency (FEMA).

Hydrologic and Hydraulic Studies*: Yes
Select

Studies and Data Collection of Statewide and Regional Significance. Funding of studies of statewide and regional significance and proposals will be considered for the following types of studies:

Updating precipitation data and IDF information (rain intensity, duration, frequency estimates) including such data at a sub-state or regional scale on a periodic basis.

Updating Precipitation Data and IDF Information*: Yes
Select

Regional relative sea level rise projections for use in determining future impacts.

Projections*: No
Select

Vulnerability analysis either statewide or regionally to state transportation, water supply, water treatment, impounding structures, or other significant and vital infrastructure from flooding.

Vulnerability Analysis*: No
Select

Flash flood studies and modeling in riverine regions of the state.

Flash Flood Studies*: Yes
Select

Statewide or regional stream gauge monitoring to include expansion of existing gauge networks.

Stream Gauge Monitoring*: No
Select

New or updated delineations of areas of recurrent flooding, stormwater flooding, and storm surge vulnerability in coastal areas that include projections for future conditions based on sea level rise, more intense rainfall events, or other relevant flood risk factors.

Delineations of Areas of Recurrent Flooding*: Yes
Select

Regional flood studies in riverine communities that may include watershed-scale evaluation, updated estimates of rainfall intensity, or other information.

Regional Flood Studies*: Yes
Select

Regional Hydrologic and Hydraulic Studies of Floodplains

Regional Hydrologic and Hydraulic Studies of Floodplains*:	Yes Select
Studies of potential land use strategies that could be implemented by a local government to reduce or mitigate damage from coastal or riverine flooding.	
Potential Land Use Strategies*:	No Select
Other proposals that will significantly improve protection from flooding on a statewide or regional basis.	
Other Proposals*:	No Select
Is the project area socially vulnerable? (based on ADAPT Virginia's Social Vulnerability Index Score)	
Social Vulnerability Scoring:	
Very High Social Vulnerability (More than 1.5)	
High Social Vulnerability (1.0 to 1.5)	
Moderate Social Vulnerability (0.0 to 1.0)	
Low Social Vulnerability (-1.0 to 0.0)	
Very Low Social Vulnerability (Less than -1.0)	
Socially Vulnerable*:	Very High Social Vulnerability (More than 1.5)
Is the proposed project part of an effort to join or remedy the community's probation or suspension from the NFIP?	
NFIP*:	No
Is the proposed project in a low-income geographic area as defined below?	
"Low-income geographic area" means any locality, or community within a locality, that has a median household income that is not greater than 80 percent of the local median household income, or any area in the Commonwealth designated as a qualified opportunity zone by the U.S. Secretary of the Treasury via his delegation of authority to the Internal Revenue Service. A project of any size within a low-income geographic area will be considered.	
Low-Income Geographic Area*:	Yes
Projects eligible for funding may also reduce nutrient and sediment pollution to local waters and the Chesapeake Bay and assist the Commonwealth in achieving local and/or Chesapeake Bay TMDLs.	
Does the proposed project include implementation of one or more best management practices with a nitrogen, phosphorus, or sediment reduction efficiency established by the Virginia Department of Environmental Quality or the Chesapeake Bay Program Partnership in support of the Chesapeake Bay TMDL Phase III Watershed Implementation Plan?	
Reduction of Nutrient and Sediment Pollution*:	No
Comments:	
This study will identify eroding areas in the Muddy Run Tributary, which may provide opportunity to conduct stream restoration that would result in reduction of nutrients and sediment to the Chesapeake Bay concurrently with flood relief efforts.	

Scope of Work Supporting Information - Studies

Scope of Work Supporting Information	
Is the proposed study a new study or updates on a prior study?	
New or Updated Study*:	New Study
Describe the relationship of the study to the local government's needs for flood prevention and protection, equity, community improvement, identification of nature-based solutions or other priorities contained in this manual	
Relationship of Study to Priorities Contained in this Manual*:	
This study will reflect the items listed in the manual's Commonwealth Resilience Planning Principles. It will investigate future impacts due to climate change, assist the County in determining environmentally-conscious and cost-effective paths to mitigate repetitive flooding, and incorporate input from the public. Further, the study could become a blueprint for future work within the same watershed or others elsewhere in the County where flooding issues are also present. In this sense, completing the study directly and holistically benefits the County's efforts to develop more flood-resilient communities.	
Describe the qualifications of the individuals or organizations charged with conducting the study or the elements of any request for proposal that define those qualifications	
Qualifications of Individuals Conducting Study*:	
The County will utilize a consulting firm previously selected under the Engineering Services for the Loudoun County Stormwater Management	

Program Basic Order Agreement Request for Qualifications to complete this study. The firm will be experienced with detailed modeling of hydrologic and hydraulic systems, flood mitigation/response concept planning, and the permitting and construction concerns related to carrying out a proposed flood mitigation idea. The firm will have completed modeling studies for the County in the past and directly shown its expertise in modeling, production of deliverables, quality control, and communication skills.

Describe the expected use of the study results in the context of the local resilience plan or, in the case of regional plans, how the study improves any regional approach

Expected use of Study Results*:

The study will provide technical backing for potential future projects, offering technical support to enhance flood resilience within the study area. This aligns with the County's objective of safeguarding affected communities against flooding. In a larger context, this study could serve as a blueprint for tackling flood mitigation projects in Loudoun County and elsewhere. It provides a roadmap, outlining objectives, timelines, tasks, assumptions, and other crucial details that can guide similar studies in diverse locations, laying the groundwork for more resilient communities.

If applicable, describe how the study may improve Virginia's flood protection and prevention abilities in a statewide context (type N/A if not applicable)

Statewide Improvements*:

N/A

Provide a list of repetitive and/or severe repetitive loss properties. Do not provide the addresses for the properties, but include an exact number of repetitive and/or severe repetitive loss structures within the project area

Repetitive Loss and/or Severe Repetitive Loss Properties*: CID510090_Loudoun County_CFPF Repetitive Loss_Muddy Branch.pdf

Describe the residential and commercial structures impacted by this project, including how they contribute to the community such as historic, economic, or social value. Provide an exact number of these structures in the project area

Residential and/or Commercial Structures*:

There are 889 structures within the watershed, most of which are single-family residences (and associated residential structures) with some commercial establishments scattered throughout. Commercial establishments include daycare centers, utility repair shops, nonprofit organizations, and a variety of others. An elementary school parcel, including an associated playground and sports facilities, is located partially within the watershed.

If there are critical facilities/infrastructure within the project area, describe each facility

Critical Facilities/Infrastructure*:

Several types of critical infrastructure are located within the watershed. Sanitary sewer lines run along the tributary over nearly its entire length, and continued riparian erosion along the stream banks could threaten these lines. There are also fire hydrants that could be rendered inaccessible during flooding events, and roads like East Church Road have been documented as impassable for both private residents and emergency responders when heavy rainfall occurs.

Budget

Budget Summary

Grant Matching Requirement*: LOW INCOME - Flood Prevention and Protection Studies - Fund 90%/Match 10%

I certify that my project is in a low-income geographic area: Yes

Total Project Amount*: \$200,000.00

REQUIRED Match Percentage Amount: \$20,000.00

BUDGET TOTALS

Before submitting your application be sure that you meet the match requirements for your project type.

Match Percentage: 10.00% Verify that your match percentage matches your required match percentage amount above.

Total Requested Fund Amount: \$180,000.00

Total Match Amount: \$20,000.00

TOTAL: \$200,000.00

Personnel

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Fringe Benefits

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Travel

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Equipment

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Supplies

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Construction

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Contracts

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

Contracted Professional Engineer Modeling, Surveying, Permitting, Geotech Engineering, and Designs	\$180,000.00	\$20,000.00	County General Fund
	\$180,000.00	\$20,000.00	

Pre-Award and Startup Costs

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Other Direct Costs

Description	Requested Fund Amount	Match Amount	Match Source
-------------	-----------------------	--------------	--------------

No Data for Table

Supporting Documentation

Supporting Documentation

Named Attachment	Required	Description	File Name	Type	Size	Upload Date
Detailed map of the project area(s) (Projects/Studies)		CID#510090_Loudoun County - Muddy Branch Location	CID510090_Loudoun County_MuddyBranch_Location Map.pdf	pdf	889	10/19/2023 03:02 PM
FIRMette of the project area(s) (Projects/Studies)		CID#510090_Loudoun County - Muddy Branch FEMA Firm Maps	CID510090_Loudoun County_MuddyBranch_FEMA FIRMMaps.pdf	pdf	885	10/19/2023 03:03 PM
Historic flood damage data and/or images (Projects/Studies)		CID#510090_Loudoun County Muddy Branch Tributary Photos and Images	CID510090_Loudoun County_MuddyBranch_Tributary Modeling CFPF PhotosImages.pdf	pdf	5	11/09/2023 09:24 AM
Alink to or a copy of the current floodplain ordinance		Loudoun County Floodplain Overlay District	CID510090_Loudoun County_Floodplain Overlay District Ordinance.pdf	pdf	233	10/05/2023 08:03 AM
Maintenance and management plan for project						
Alink to or a copy of the current hazard mitigation plan		CID#510090 Loudoun County Northern Virginia Hazard Mitigation Plan (Regional)	CID510090_Loudoun County_Northern_Virginia_Hazard_Mitigation_Plan.pdf	pdf	9	10/09/2023 03:28 PM
Alink to or a copy of the current comprehensive plan		Loudoun County Comprehensive Plan	CID510090_Loudoun County_Comp Plan.pdf	pdf	39	10/05/2023 08:02 AM
Social vulnerability index score(s) for the project area		CID#510090_Loudoun County Muddy Branch Social Vulnerability Indices	CID510090_Loudoun County_MuddyBranch_Social Vulnerability Indices.pdf	pdf	869	11/03/2023 03:54 PM
Authorization to request funding from the Fund from governing body or chief executive of the local government		CID#510090 Loudoun County County Administrator Signed Authorization to Pursue Grant	CID510090_Loudoun County_Signed Authorization.pdf	pdf	269	10/24/2023 07:46 AM
Signed pledge agreement from each contributing organization						
Maintenance Plan						
<i>Benefit-cost analysis must be submitted with project applications over \$2,000,000. in lieu of using the FEMA benefit-cost analysis tool, applicants may submit a narrative to describe in detail the cost benefits and value. The narrative must explicitly indicate the risk reduction benefits of a flood mitigation project and compares those benefits to its cost-effectiveness.</i>						
Benefit Cost Analysis						
Other Relevant Attachments		1. CID#510090_Loudoun County_Median Household Income Comparison. 2. CID#510090_Loudoun County_Northern Virginia Hazard Mitigation Plan_2022 Loudoun County Annex	CID510090_Loudoun County_Other Relevant Documents.pdf	pdf	3	10/18/2023 03:06 PM

Letters of Support

Description	File Name	Type	Size	Upload Date
-------------	-----------	------	------	-------------

No files attached.

Loudoun County 2019 General Plan

Interim Final Version Only

Final Version pending edits and format design per Board of Supervisors Resolution
CPRV-2016-0001, Adoption of Loudoun County 2019 Comprehensive Plan

June 20, 2019

Amended through February 7, 2023

This page left blank for printing purposes.

Amendments

Loudoun County 2019 General Plan
Adopted June 20, 2019
Amended through February 7, 2023

Date Approved	Application No.	Application Name
December 1, 2020	CPAM-2020-0001	Public Facilities in the Rural Policy Area
January 17, 2023	CPAM-2021-0001	Airport Impact Overlay District Update
February 7, 2023	CPAM-2020-0002	Red Hill Community

For associated Comprehensive Plan Amendment (CPAM) documents, visit:
www.loudoun.gov/lola

This page left blank for printing purposes.

Errata Sheet

Errata Sheet for the Loudoun County 2019 General Plan
Adopted June 20, 2019

This errata sheet describes changes made to the Loudoun County 2019 General Plan to correct errors and provide clarification. Minor grammatical and typographical errors have been corrected but are not noted on this errata sheet.

Date	Chapter	Correction
July 11, 2019	Chapter 6 Strategy 3.1, iv.	Reference 3.1.K instead of 3.1.J
July 18, 2019	Chapter 3 Action 7.2.G	Reference Chapter 7 of the Loudoun County 2019 Countywide Transportation Plan instead of Chapter 8

This page left blank for printing purposes.

Chapters

Chapter 1 - Introduction

Chapter 2- Land Use

Chapter 3 - Natural, Environmental, and Heritage Resources

Chapter 4 - Housing

Chapter 5- Economic Development

Chapter 6 - Fiscal Management and Public Infrastructure

Chapter 7 – Implementation

Glossary

Appendix A

This page left blank for printing purposes.

Chapter 1 - Introduction

Table of Contents

Purpose and Definition	3
Loudoun County's Planning Approach	3
Loudoun County: Trends and Influences.....	6
Elements of the Loudoun County 2019 General Plan	9
Policy and Regulatory Context.....	10
Reference Maps	11

This page left blank for printing purposes.

Chapter 1 - Introduction

The *Loudoun County 2019 Comprehensive Plan* (Comprehensive Plan) is the culmination of a collaborative multiyear effort and an unprecedented public outreach campaign that brought together Loudoun's citizens, elected and appointed officials, stakeholders, and County staff to create a new comprehensive plan for the County. This planning process, known as *Envision Loudoun*, identified the community's desires for the future of Loudoun County as they relate to growth management, land use, place types, transportation, natural, environmental, and heritage resources, community facilities and amenities, economic development, and fiscal management.



Vision:

Loudoun County continues to flourish as a prosperous and inclusive community with a well-deserved reputation for great places – natural and built, as well as, historic and new – in a variety of settings. The County will foster economic innovation, fiscal strength, and sustainability.

The Envision Loudoun planning process began with a Charter adopted by the Board of Supervisors in April 2016. The Charter identified key issues to be addressed in the new comprehensive plan: Growth Management, Land Use, Transportation, Natural, Environmental, and Heritage Resources, Community Facilities and Amenities, Economic Development, and Fiscal Management. The Charter called for the formation of a 26-member committee of community stakeholders, convened a staff technical advisory committee from regional public agencies, and set forth a community engagement strategy to allow for multiple opportunities for public outreach throughout the process. To ensure the community was kept informed, a communications plan was deployed that utilized internet, social media, radio advertising, and print materials.

Envision Loudoun proved to be an unprecedented public engagement effort for the County. Between summer 2016 and spring 2018, the stakeholders committee and County staff held over 40 work sessions. The public participated in three sets of public outreach sessions – totaling 17 meetings – each at various locations throughout the County. An Envision Loudoun website was established and kept up-to-date with maps, process updates, and project documents. The website also provided a web interface for citizens to provide input regarding the key issues to be addressed in the new comprehensive plan. All told, approximately 3,000 people participated in the Envision Loudoun process.

Purpose and Definition

The Comprehensive Plan includes this *Loudoun County 2019 General Plan* (General Plan) and the *Loudoun County 2019 Countywide Transportation Plan* (2019 CTP), a document developed in close coordination with this General Plan. The Comprehensive Plan is not a development ordinance, but is instead a policy document that provides guidance for elected officials and other governmental decision-makers as to where and how the community will grow in the long-term.

A comprehensive plan provides an opportunity for a community to think collectively about its future and to develop a shared set of values and strategies intended to achieve a unified vision. A comprehensive plan is a critical tool for managing growth, the provision of capital facilities, and the fiscal health of communities. It is especially important for high growth communities like Loudoun County, where change can happen quickly, and a comprehensive plan is needed to guide that change. A comprehensive plan is not a static document. In accordance with the Code of Virginia it must be reviewed at least every five years.

Loudoun County's Planning Approach

The General Plan builds upon the County's strong foundation of growth management practices. The Loudoun County Board of Supervisors adopted the County's first zoning ordinance in 1942 and its first comprehensive plan in 1959. The County's 1991 general plan, *Choices and Changes*, was written when the County was largely undeveloped with an abundance of greenfield development opportunity in the eastern part of the County. By 2001, when the *Revised General Plan* was adopted, the County was feeling the effects of a 97 percent population increase since the adoption of *Choices and Changes*.

For decades, the County has supported the protection of its rural and agricultural areas to the west and focused development in suburban areas to the east. The County has accommodated growth near existing infrastructure to support development in a fiscally sound manner, where the market forces have been strongest for new residential and employment development. Loudoun's growth management policies have resulted in some of the most highly valued residential communities in the region, while also encouraging new business development.

The framework for land planning in Loudoun County consists of four types of policy areas – Urban, Suburban, Transition, and Rural – and several smaller planning areas designated as Joint Land Management Areas (JLMA) and Rural Historic Villages. These areas represent distinct planning communities with specific policies, strategies, and actions tailored to address the needs of each area.



Loudoun Station, a mixed-use town center development adjacent to the Silver Line Ashburn Station, is within one of the new Urban Policy Areas.

Urban Policy Areas

The Urban Policy Areas (UPA) represent a new planning area concept in Loudoun, encompassing approximately 2,600 acres in areas around the Silver Line Metrorail Stations. The two UPAs represent major growth opportunities for Loudoun with mixed-use and transit-oriented place types and development intensity not previously contemplated in the County. The Comprehensive Plan calls for complete urban communities that accommodate housing, employment, retail, education, and

entertainment in close proximity to Metrorail. These areas will facilitate opportunities for significant job creation and expansion of the County's tax base.

Suburban Policy Area

The 48,000-acre Suburban Policy Area (SPA) comprises the eastern third of the County and is where most of the residential and commercial growth has occurred since the 1960's. The SPA developed in a traditional suburban pattern with predominantly single-family neighborhoods. From 1990 to 2017, 102,905 housing units were built throughout Loudoun County and over 70 percent of those were built in the SPA. Route 28 and Loudoun County Parkway (Route 607) form the County's "data center alley," having evolved into an international leader for global data management, technology, and communications industries. More than 70 percent of all internet traffic is routed through data centers in this policy area. The area around Washington Dulles International Airport is also expected to continue to be a major factor as a key location for industrial uses, airport-related businesses, and data center development.



Much of Loudoun's residential growth has occurred in the easternmost part of the County. With decreasing undeveloped areas, the Loudoun County 2019 General Plan anticipates a more integrated mix of uses in this part of the County over the next two decades.



The Transition Policy Area is planned for a diversity of housing options in clustered patterns with substantial open space areas that provide recreational amenities and protect natural, environmental, and heritage resources.

entire County and help to maintain a visual distinction between the more densely populated east and the rural west.

Rural Policy Area

The western 230,000-acre RPA comprises nearly two-thirds of Loudoun's land area and contains twelve Rural Historic Villages (see Chapter 2). This area is planned for limited residential development and supports a robust rural economy. The General Plan includes policies that protect the landscape, economy, and the existing community character of the RPA, emphasizing the preservation of farmland; natural, environmental, and heritage resources; open space; and vistas that are vital aspects of Loudoun's identity.

Transition Policy Area

The Transition Policy Area (TPA) is a 24,000-acre area along the western edge of the SPA and is intended to be visually distinct from the SPA and Rural Policy Area (RPA). The area is planned for a diversity of large-lot and clustered residential uses with limited commercial uses to support residents and some industrial spaces focused on quarry activity and energy infrastructure. Public utilities are available in the TPA, though the transportation network is limited in certain places at present time. Large amounts of open space, trails, and parks provide recreational opportunities for residents of the



The Loudoun County 2019 General Plan recognizes the importance of protecting the pastoral landscapes and agricultural character of Loudoun's Rural Policy Area.



Loudoun County's western landscape is dotted with historic towns that serve as hubs for the rural community.

Towns and Joint Land Management Areas

Loudoun County's seven incorporated towns exercise planning and zoning controls within their corporate limits. In addition to the four policy areas, the County has partnered with several of its towns to develop JLMA around the edges of the towns. A JLMA is a planning area where the County and each respective town set the limits for potential municipal water and sewer extension. These JLMA planning areas effectively serve as a growth boundary for each town and are intended to manage new growth and expansion outward from the towns.

Loudoun County: Trends and Influences

Loudoun County has rapidly transformed from a farming community to one of the fastest growing counties in the nation, ranking fifth in the country for growth between 2000 and 2010. This growth has slowed somewhat as developable land in the eastern part of the County has become more constrained, but the County's high quality of life, strong economy, natural and historic assets, and proximity to Washington, D.C. will continue to drive market demand. The General Plan identifies a number of trends and influences, including population diversity, housing affordability, and land availability that will affect future demand for both residential and nonresidential products.

Loudoun by the Numbers

- **406,850:** Loudoun County's population.
- **121,299:** Number of households.
- **\$129,588:** Median annual household income.
- **41.5:** Percent of households with annual income above \$150,000.
- **2.8:** Percent of households with annual income below \$15,000.
- **35.8:** Loudoun County's median age
- **28.5:** Percent of population under 18 years of age.
- **8.9:** Percent of population 65 years and older.
- **31.4:** Percent of population that speaks a language other than English at home.
- **93.5:** Percent of population 25 years and over graduated from high school.
- **59.8:** Percent of population 25 years and over with a bachelor's degree or higher.
- **32.1:** Average number of minutes it takes commuters to get to work.

Source: U.S. Census Bureau 2019 Quickfacts; 2013-2017 American Community Survey 5-Year Estimates

People

Loudoun County's population has risen over the decades as the Washington, D.C., Metropolitan Area has grown and as Loudoun County has captured more of this regional growth. In 1940, the County's population was just over 20,000 people. Fifty years later, the population had quadrupled, totaling just over 86,000 people in 1990. Since 1990, the population quadrupled again with an estimated 406,850 people in 2018.¹ However, this exponential growth is projected to slow as Loudoun continues to mature, a trend that may already be occurring. From 2000 to 2010, Loudoun was the 5th fastest growing county in the nation, but dropped to the 20th fastest growing county from 2010 to 2015. Even with this slowdown, Loudoun's population is projected to increase to almost 694,911 by 2040.²

As Loudoun's population has grown, the community has also diversified. Between 2000 and 2018, the percentage of Loudoun's population identifying as Hispanic or Latino increased from 6.0 percent to 13.9 percent. During the same time period, the percentage of people identifying as Asian grew from 5.6 percent to 19.4 percent. The percentage of residents identifying as Black or African American is also growing, though at a much slower rate, increasing from 7.0 percent to 7.9 percent.³ Overall, Loudoun's foreign-born population has increased from 11.3 percent in 2000 to 23.9 percent in 2017.⁴ This growth has led to greater diversity in service demands, expanded retail and entertainment opportunities, changes in housing needs, and overall expanded economic growth of the community.

Housing

As of 2017, Loudoun ranked number one in the country for the highest median household income for the tenth straight year, yet housing affordability and attainability remain a significant challenge in the County and the region. Limited housing supply and high demand present difficulties for employers in attracting employees and contribute to workforce instability, especially in lower paying industries.

Over 82 percent of Loudoun's existing housing stock consists of traditional suburban single-family detached and single-family attached dwellings. Most of the housing stock is also considered large, with 80 percent of all dwellings containing three or more bedrooms. Conversely, studio and one-bedroom housing make up less than six percent of all housing in the County. National trends show that smaller households, such as aging seniors, couples without children, and single persons, may demand different housing types, public services, and lifestyle options than provided in the past. There is also a general national trend toward more people living in multigenerational households, which may require different types of housing options to help accommodate the needs of multiple generations living together.

The General Plan provides a renewed opportunity for the County to adopt a policy direction that promotes an inclusive, diverse, and flexible housing environment that aligns with the community's

¹ U.S. Census Bureau, Population Estimates Program (PEP), 2018

² University of Virginia Weldon Cooper Center, Demographics Research Group. (2017). Virginia Population Projections.

³ U.S. Census Bureau, Population Estimates Program (PEP), 2018

⁴ U.S. Census Bureau, 2013-2017 American Community Survey

larger land use and community development goals. The General Plan anticipates that new approaches to planned land use policies will facilitate market-driven increases in the variety of housing types developed, help fulfill the demand for market rate sales and rental units, and temper rising housing costs overall. A variety of existing and planned County, state, and federal initiatives and programs will continue to provide housing options for more vulnerable population groups.

The County anticipates continued high demand for new residential units over the next several decades, which could compound challenges related to both availability and affordability. With limited land available for residential development in the SPA and the County's desire to protect the character of the RPA, the General Plan emphasizes new opportunities to create places that will meet the needs of the growing and diversifying community.

The designation of new UPAs aims to provide high quantities of new housing in active, mixed-use, transit-oriented settings proximate to the planned Silver Line Metrorail stations. The General Plan also reimagines areas of the SPA and aims to provide more housing options through new opportunities for mixed-use development, compact neighborhoods on infill parcels, and innovative approaches to redeveloping maturing neighborhood centers. The General Plan also anticipates a mix of compact single-family and semi-attached housing products (e.g., duplex, triplex, and quadruplex) in targeted parts of the TPA. This multifaceted approach is intended to promote housing availability and affordability, increase the diversity of housing choices, and create new places that meet the County's evolving needs without compromising the quality of life for which Loudoun is known.

Transit

The County's connection to the regional Metrorail network through the Silver Line extension signals a new era for Loudoun, with significant impacts on transit options available to Loudoun's residents, workers, and visitors. Two Metrorail stations in Loudoun provide a gateway to Loudoun County from Washington, D.C., while also providing Loudoun's residents with an alternative method of commuting to the east. Access to the Silver Line creates the opportunity to develop vibrant, transit-oriented, mixed-use, urban environments around the Metrorail stations, where people can live and work in close proximity to regional transit.

The Washington Dulles International Airport will also continue to serve as a major transportation gateway to the country and the world. It provides a critical economic engine for leisure and business travel as well as cargo transport for the County and the larger Washington, D.C., region. In 2017, 265,025 flights operated out of Washington Dulles International Airport, serving nearly 22,800,000 passengers, including 7,744,586 international travelers.⁵ With its close proximity to the Metrorail stations and UPAs, Washington Dulles International Airport is well positioned to grow moving into the future, operating currently at approximately one-third of its ultimate capacity.

⁵ Metropolitan Washington Airport Authority, 2018

Economy

The General Plan acknowledges that local, regional, and national economic factors have changed significantly in the last two decades and includes new policies and strategies to continue Loudoun's remarkable success as an economic leader in the region. Employment in Loudoun County increased nearly 77 percent from 2000 to 2015, adding over 67,000 new jobs in a 15-year period.⁶ Momentum in Loudoun's job base is influenced by activity in the surrounding region, proximity to Washington Dulles International Airport, a growing information and communications sector, agritourism, and a robust increase in households requiring a wide array of services.

Loudoun's economy continues to diversify and the General Plan provides growth opportunities for this evolving economy. Employment uses adjacent to the future Metrorail Stations will also present new opportunities to attract employers who seek to locate in dynamic, urban communities with access to mass transit.

Elements of the Loudoun County 2019 General Plan

The General Plan begins with an overarching vision and goals; then sets forth policies, strategies, and actions for five elements: Land Use; Natural, Environmental, and Heritage Resources; Housing; Economic Development; and Fiscal Management and Public Infrastructure. An Implementation Matrix is provided to prioritize and track the execution of the *Loudoun County 2019 Comprehensive Plan* action items. In addition to this Introduction, the General Plan includes chapters associated with each of the five elements and the Implementation matrix:

- *Land Use.* Chapter 2 lays out the vision for Loudoun's future land uses, growth management, and built environment. It includes specific policy guidance for Quality Development, Infill and Redevelopment, and each geographic policy area. Place Types guide the intent, form, character, and anticipated uses within each policy area.
- *Natural, Environmental, and Heritage Resources.* Chapter 3 provides guidance for the protection, maintenance, and enhancement of the County's abundant natural, environmental, and heritage resources. The policy approach is applicable at multiple geographic scales, from initiatives that may affect these resources countywide, to management of specific watersheds and waterways, to site-level development considerations.
- *Housing.* Chapter 4 analyzes the current and anticipated housing environment in Loudoun County and includes policies aimed at ensuring the provision of a full housing continuum for the varied lifestyles, households, ages, cultures, market preferences, incomes, and abilities of Loudoun's residents.
- *Economic Development.* Chapter 5 examines the many challenges and opportunities facing Loudoun County in maintaining and advancing the County's diverse and globally competitive economy. The policies focus on targeted industries, investments, and County initiatives that contribute to Loudoun's world-class business environment and ties in land use considerations to sustain a diverse, adaptable, and dynamic County economy.

⁶ Loudoun County Department of Economic Development, 2018

- *Fiscal Management and Public Infrastructure.* Chapter 6 acknowledges the interrelatedness of land use, growth management, fiscal management, and facilities planning. The policy approach ensures the provision of public facilities and utilities, high-quality telecommunications networks, and passive and active recreational amenities in accordance with the County's larger planning and fiscal policies.
- *Implementation.* Chapter 7 compiles the individual Policies, Strategies, and Actions described throughout the *Loudoun County 2019 General Plan* and provides an Implementation Matrix that assigns responsibility for each action item.

In addition to the Place Types in Chapter 2, the General Plan's guidance is established through:

- Policy statements for each element that provide the approach to decision-making for specific topics or issues;
- Strategies providing more focused, measurable guidance for decision-making relative to each policy; and
- Actions that target specific steps to realize the Policies and Strategies and intent of the General Plan.

The five elements of the General Plan are interrelated and complementary, and Policies, Strategies, and Actions from multiple elements may apply when evaluating individual proposals or initiatives. The Policies, Strategies, and Actions are organized hierarchically; however, each category carries equal weight. As such, Strategies may apply to different Policies and Actions may apply to different Strategies than those under which they are nested.

Policy and Regulatory Context

Statutory Basis for the Comprehensive Plan

The basis for the Comprehensive Plan is rooted in Chapter 22, Article 3 of Title 15.2 of Code of Virginia. The County's Planning Commission is responsible for preparing and recommending a comprehensive plan to the Board of Supervisors, which adopts the plan. Subject to the requirements and limitations of state law, the County manages the physical development of territory within its jurisdiction in accordance with the policies of its comprehensive plan.

Relationship to Other Planning Documents

The Comprehensive Plan serves as the “umbrella” for the County’s planning efforts and consists of the General Plan and the 2019 CTP. The Comprehensive Plan supersedes the following previously adopted planning documents: the *Revised General Plan* (2001, as amended); the *Revised Countywide Transportation Plan* (2010, as amended); the *Bicycle and Pedestrian Mobility Master Plan* (2003); the *Greenways and Trails Policies* (1994); the *Toll Road Plan* (1995); the *Countywide Retail Policy Plan Amendment* (1997, as amended); the *Route 28 Keynote Employment Policies*, which includes the *Route 28 Corridor Plan* (2011); the *Arcola Area/Route 50 Corridor Plan* (2006); the *Leesburg Area Management Plan* (1982, as amended), the *Dulles North Area Management Plan* (1985, as amended), the *Dulles South Area Management Plan* (1993), the *Cub Run Area Management Plan* (1989), and the *Eastern Loudoun Area Management Plan* (1980, as amended).

The County will continue to apply the *Comprehensive Plan for the Town of Hamilton* (2003), the *Round Hill Area Management Plan* (1990, as amended), and the *Waterford Area Management Plan* (1987). The *Heritage Preservation Plan* (2003, as amended), *Route 50 Corridor Design Guidelines* (2007), and *Strategic Land Use Plan for Telecommunication Facilities* (1996) also remain in effect. The policies and guidelines in the Comprehensive Plan will supersede any conflicting policies and/or guidelines contained in any of the plans mentioned above.

The Comprehensive Plan anticipates the need for additional detailed planning efforts, such as community plans, to address the County's complex and evolving planning challenges and to better realize the County's long-range community development goals.

Relationship to Regulatory Documents

The General Plan sets forth the community-based vision for Loudoun's future and is a policy document that provides guidance to the County's decision-makers regarding land development, capital improvements, and public programs. Loudoun County's zoning ordinances are regulatory documents that establish the rules governing the use of land. The zoning ordinances specify permitted uses on properties, regulate the density and intensity of development, and establish design parameters for developments.

A new zoning ordinance will implement many of the Policies, Strategies, and Actions described in the General Plan. Parts of the General Plan also refer to other documents that regulate land development, including the *Loudoun County Facilities Standards Manual* and the *Loudoun County Land Subdivision and Development Ordinance*. Although the Comprehensive Plan provides guidance for potential revisions and amendments to various regulations, it does not replace or supersede the County's existing codes and ordinances, all of which remain in effect.

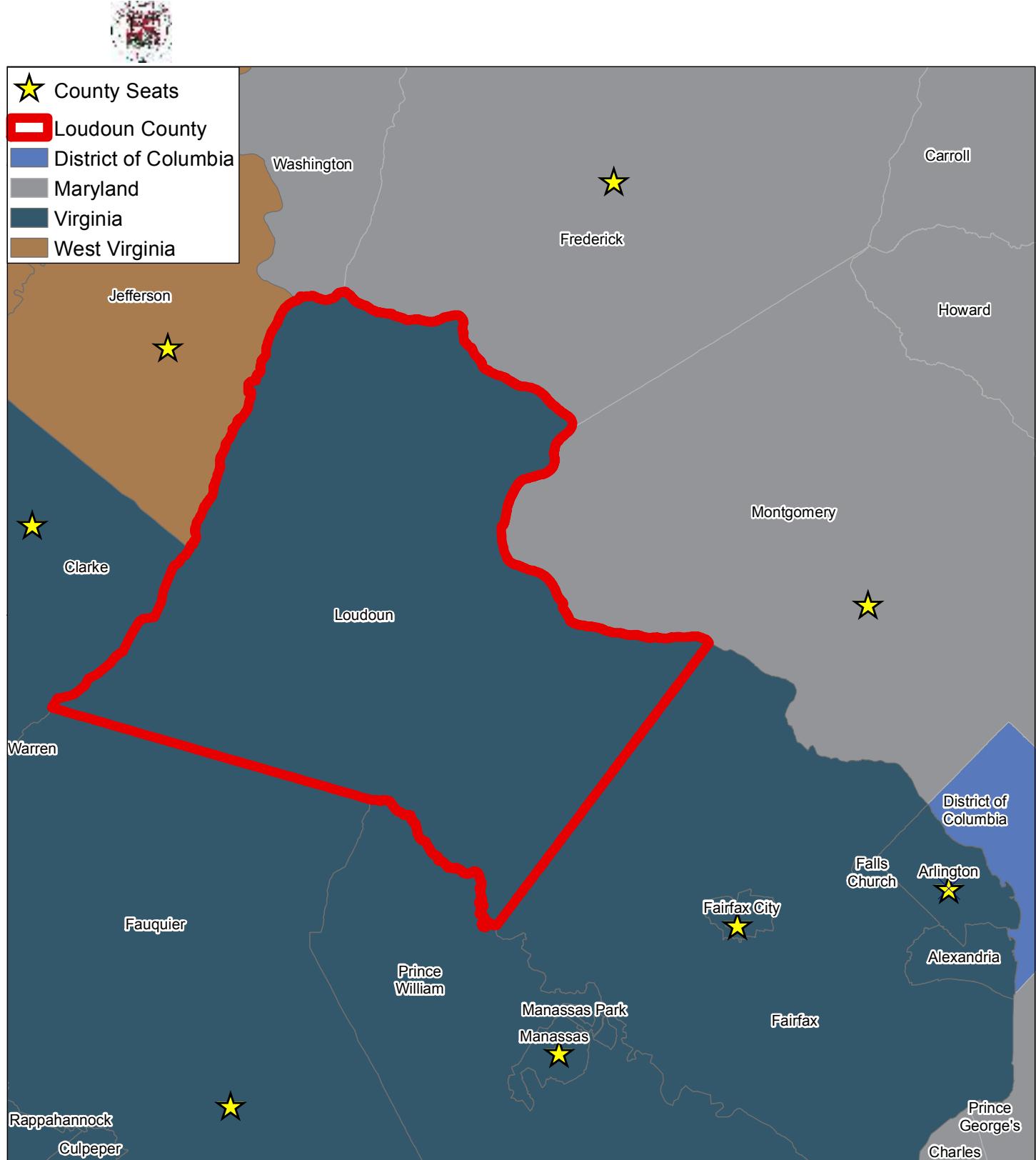
For the purpose of staff review of legislative applications, Policies, Strategies, and Actions that propose the development of new regulations, amendments to existing regulations, or the creation of new regulatory incentives will be treated as Comprehensive Plan policy guidance until implemented.

Reference Maps

Loudoun County and Surrounding Area (Map #2018-153)

Loudoun County
**Loudoun County and
Surrounding Area**

2019 General Plan



Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1.5 3 6 9 12 Miles
Map Number 2018-153

This page left blank for printing purposes.

Chapter 2 - Land Use

Table of Contents

Quality Development.....	5
Vision.....	5
Introduction.....	5
Expected Growth and Development Patterns	6
Place Types	7
Policies, Strategies, and Actions	12
Infill and Redevelopment.....	17
Vision.....	17
Introduction.....	17
Opportunities.....	19
Emerging Reinvestment Issues	19
Challenges.....	20
Policies, Strategies, and Actions	22
Urban Policy Areas	26
Vision.....	27
Introduction.....	26
Development Approach	26
Policies, Strategies, and Actions.....	27
Design Guidelines.....	29
Place Types	31
Suburban Policy Area	40
Vision.....	40
Introduction.....	40
Development Approach.....	41
Policies, Strategies, and Actions	44
Design Guidelines.....	47
Place Types	48
Transition Policy Area	66
Vision.....	66

Introduction.....	66
Background.....	67
Development Approach	68
Policies, Strategies, and Actions	69
Design Guidelines.....	73
Place Types	75
Rural Policy Area.....	92
Vision.....	92
Introduction.....	92
Rural Residential.....	94
Rural Economy	94
Farmland Preservation and Protection	96
Future of Rural Strategy.....	97
Policies, Strategies, and Actions.....	98
Design Guidelines.....	101
Rural Historic Villages	103
Vision.....	103
Introduction.....	103
Policies, Strategies, and Actions.....	104
Design Guidelines.....	105
Rural Policy Area Place Types	107
Towns and Joint Land Management Areas.....	115
Vision.....	115
Introduction.....	115
Development Approach	115
Policies, Strategies, and Actions.....	116
Leesburg.....	118
Hamilton	119
Hillsboro	121
Lovettsville	123
Middleburg.....	125
Purcellville	126

Round Hill.....	128
Design Guidelines.....	130
County/Town Annexation Agreement/Corporate Boundary Line Adjustment.....	131
Reference Maps	134
Place Types	149

This page left blank for printing purposes.

Quality Development

Vision

Loudoun will carry forth our successful land use and growth management policy while promoting the well-planned development of unique and appealing places providing a full spectrum of housing and employment options that are linked to supporting commercial, entertainment, educational, agricultural, and recreational activity.

Introduction

Loudoun County has accommodated a high rate of growth over the past decades, concentrating new development in the eastern portion of the County where utilities and roadways have been constructed to serve the population efficiently. Much of Loudoun's success is due to land use planning that has guided, managed, and directed growth to appropriate locations. Loudoun County's growth management strategy has comprised an approach that 1) focuses the location and intensity of development in eastern Loudoun and around towns, which maintains the agricultural character, pastoral landscapes, and natural resources of the County's rural areas; 2) uses service standards and development forecasting to plan the location and timing of investments in infrastructure, facilities and services; and 3) calculates a fair share contribution by new development towards associated capital facility impacts. This approach recognizes that more concentrated population centers better facilitate the provision of emergency response services, roads, utilities, and public facilities. Further, the location of such services and facilities often guide subsequent development patterns. By concentrating these services in the areas of the County where development has been planned and appropriately scaling their availability and levels of service in the less developed areas, the County facilitates growth patterns that help achieve long-term land use, environmental, economic, and fiscal goals.

Previous planning efforts in Loudoun County have focused on promoting quality of life by establishing and delivering a shared vision. The *Loudoun County 2019 Comprehensive Plan* (Comprehensive Plan) and, more specifically, the *Loudoun County 2019 General Plan* (General Plan) build upon previous efforts and encourage a range of priorities that will further enhance quality of life in the County through a renewed vision. To realize this vision, Quality Development addresses a range of topics important to future growth and development that will have a lasting and positive impact on current and future generations in the County. Quality Development represents a level of excellence and a commitment to inclusiveness in future planning efforts. It is a holistic approach that seeks to maintain and build upon the high quality of life that residents have grown to enjoy.

To further enhance and improve the quality of life in Loudoun County, this chapter presents countywide policies that will allow the County to address growth and development in future planning and implementation initiatives. The goal of Quality Development in Loudoun is to support these initiatives based on the following aspirations:

- Make great places through development that complements, strengthens, and benefits surrounding communities.

- Encourage a mix of complementary land uses and project designs that ensure the long-term sustainability, or environmental and economic health, of both the individual development and the broader community.
- Foster places with distinctive identities through the use of high-quality design, siting, landscaping, architecture, signage, sustainability, and other design elements.
- Integrate land use and transportation policies that prioritize development at the Metrorail Stations and provide the most compact and accessible development.

Quality Development also encompasses key qualities that will ensure future development positively contributes to the daily life of citizens by establishing and building upon traditional growth patterns and creating places that are conducive to a range of daily activities. Consideration of the following characteristics will help ensure future development and coordinated placemaking enhance quality of life in Loudoun:

- Sensitive integration of the natural and built environments,
- Context-sensitive site and building design between adjacent developments and land uses,
- Architecture that is appropriate for its context,
- Sustainable energy technology,
- Walkable and pedestrian-friendly environments that promote activity and connectivity in spaces between buildings and developments,
- Multi-modal choices that offer a range of transportation opportunities, and
- Accessible and connected parks and open spaces.

Emphasis on the incorporation of these characteristics in existing and future development is integral to Quality Development. Their thoughtful consideration will help ensure high-quality design and aid in the creation of communities that have distinctive identities.

Loudoun will continue to be an attractive place for development given its geographic location, school system performance, business-friendly practices, and notable quality of life. However, new policies and approaches in the General Plan provide guidance to address emerging issues and trends in the County and region. These emerging issues and trends, include a constrained land supply, the County's connection to the regional Washington Metropolitan Area Transit Authority (WMATA) Metrorail network through the Silver Line extension in 2020, availability and affordability of housing, and a growing demand for new development options. The Plan streamlines its presentation of design concepts, providing specific design guidelines for each policy area in subsequent sections of this chapter. Future implementation of the design policies in the General Plan will require thoughtful revisions to zoning regulations that will help accommodate the flexibility and adaptability of a new land use planning approach in Loudoun.

Expected Growth and Development Patterns

Building upon the County's successful planning policy, the General Plan is largely organized by geographic policy areas that serve to prioritize areas for new growth and development based on the availability of existing and planned infrastructure and public facilities. Accordingly, this chapter describes the policy areas that provide the geographic framework for the County's growth

management and land use strategies. Policy areas in the General Plan include the Suburban Policy Area (SPA), Transition Policy Area (TPA), Rural Policy Area (RPA), Towns & Joint Land Management Areas (JLMAs), and newly-established Urban Policy Areas (UPA).

The UPAs are intended to accommodate living, working, shopping, and playing in a dense urban environment, creating complete communities that will serve as centers of activity for the County. The Plan designates two areas around the Silver Line Metro stations as UPAs, envisioning these areas to develop as dense urban centers. Both areas represent major growth opportunities for the County and are planned to provide for walkable mixed-use and transit-oriented development that will more efficiently absorb much of the County's anticipated growth, offer a diversity of housing to meet changing housing needs, and offer flexible land use policies to allow for innovation and changing market demands.

The SPA continues to be planned for additional growth and development though at a lesser intensity than the Urban Policy Areas. However, rapid growth in the SPA in recent decades has significantly reduced the amount of developable land and subsequently reduced this area's capacity to accommodate substantial growth. This represents a significant juncture in the County's planning and development history as development efforts will increasingly emphasize infill development on the few remaining undeveloped parcels in the SPA as well as the redevelopment and adaptive reuse of existing buildings.

The TPA is intended to be visually distinct from the Suburban and Rural Policy Areas with a development pattern focused on retaining substantial open space within the context of an assortment of community designs. The open spaces serve as dominant landscape and development features that provide opportunities for public recreation and facilities interwoven through a land use pattern that is predominantly residential with limited commercial and industrial uses.

The RPA comprises nearly two thirds of Loudoun's land area in the western portion of the County and contains twelve historic Rural Villages. This area is planned as an enduring rural landscape of working agricultural lands, rural economy uses, and limited residential development. Protection of the RPA helps to ensure the preservation of farmland, natural, environmental, and heritage resources, open space, and vistas that are vital aspects of Loudoun's identity.

Place Types

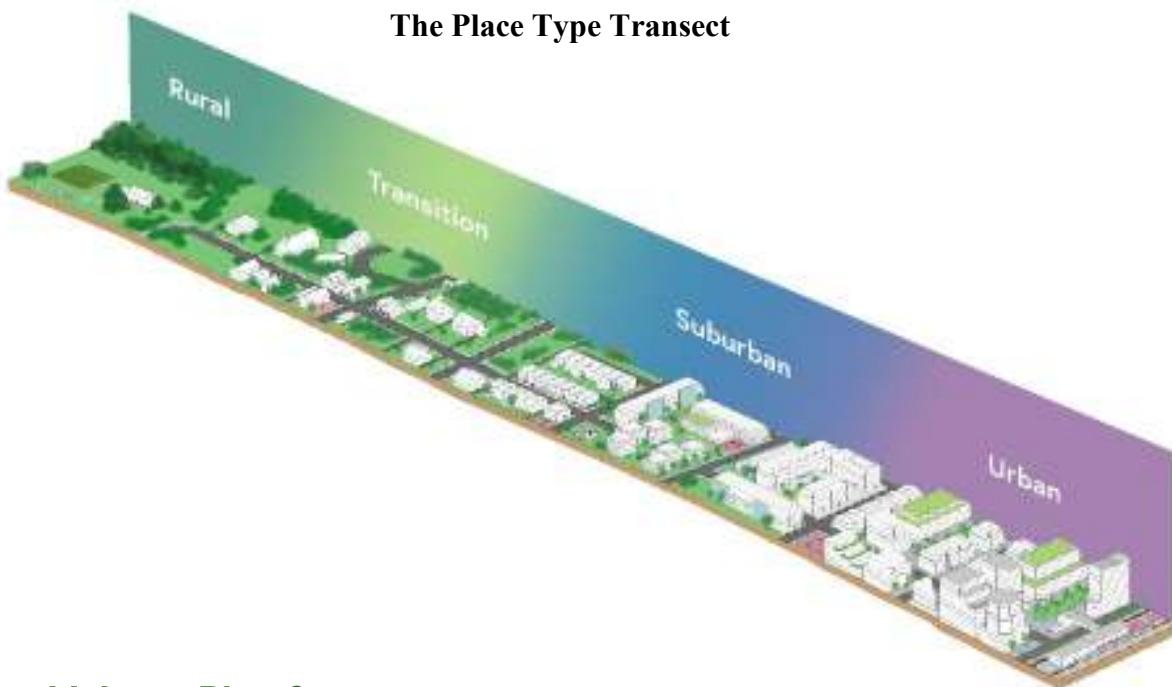
While the policy areas described in this chapter provide the geographic foundation for the County's growth management and land use strategies, the Plan refines the County's policies to better adapt to rapid changes in technology, demographics, and market factors without losing sight of the County's vision and goals. Central to this more adaptable, enduring approach to land use is the "place type" concept.

The place type approach differs from the County's previous approach to land use planning in that it provides a way to shape the future of Loudoun by concentrating on context – the look and feel of places, their form and their character – instead of focusing only on conventional land use categories and specific uses. Place type categories define not only the basic expected land uses for

specific areas in the County, but also preferred development patterns, streetscapes, and design features that make places and environments visually distinctive and functional for people.

The place type approach is intended to create distinct and “complete” residential neighborhoods, employment centers, open spaces, and other areas. By providing greater flexibility in development types and uses while providing additional guidance on design expectations, place types can also facilitate more dynamic, livable neighborhoods and allow for established areas to evolve and improve. In the next graphic you will find the transect of the County, which transitions from rural to increasingly urban place types. A transect defines a series of place types that transition from sparse rural farmhouses to the dense urban core. Each place type contains a similar transition from the edge to the center of the neighborhood. The transect does not show all place types found in the plan, but rather a few to show the transition at a higher level. Through the use of place types in the General Plan, the County aims to achieve Loudoun’s vision for a prosperous and inclusive community consisting of great places in a variety of settings.

The Place Type Transect



What Makes a Place?

Many characteristics of the natural and built environment contribute to an area's sense of place, or the impression a particular place leaves on residents and visitors. These factors include:

- The size, scale, and configuration of the buildings and the spaces between and surrounding them,
- The uses in the buildings (although these may change over time),
- The patterns of activity in the spaces between buildings,
- Views to and from the buildings and spaces, and
- Special details such as historic structures, landscape elements, and public artwork.

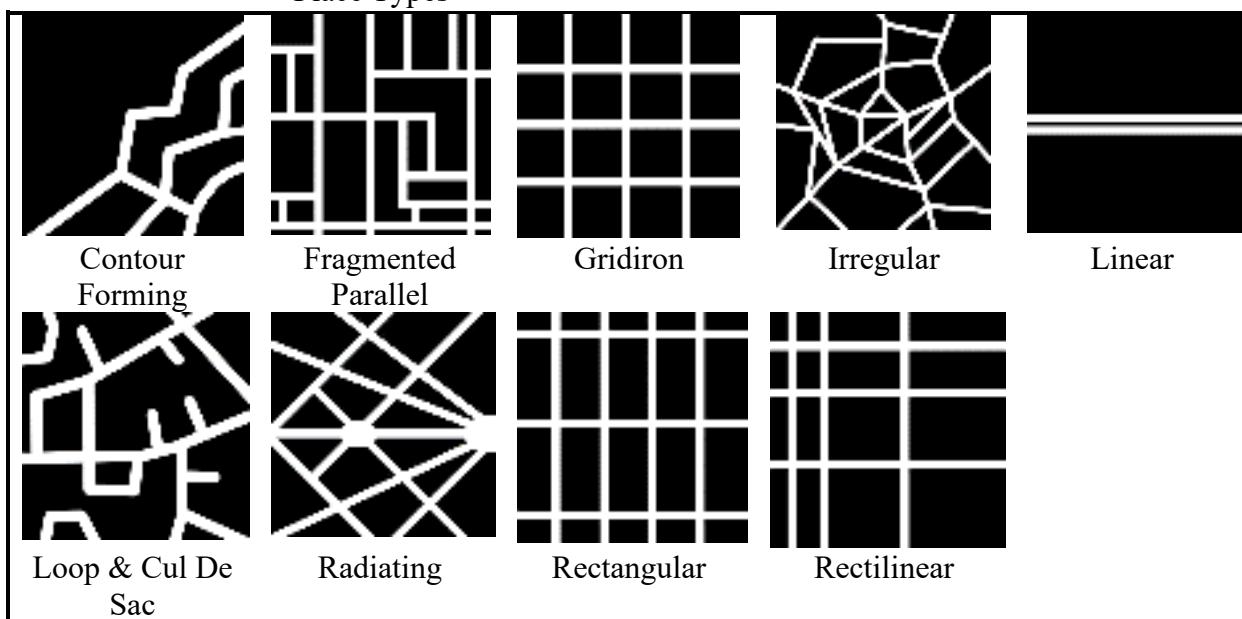
These elements help define a place in our minds and give it a distinct identity. It is this human dimension of place types – their relationship to the way we experience our environment – that makes them such a useful tool in describing the type of development desired in Loudoun County.

Using Place Types

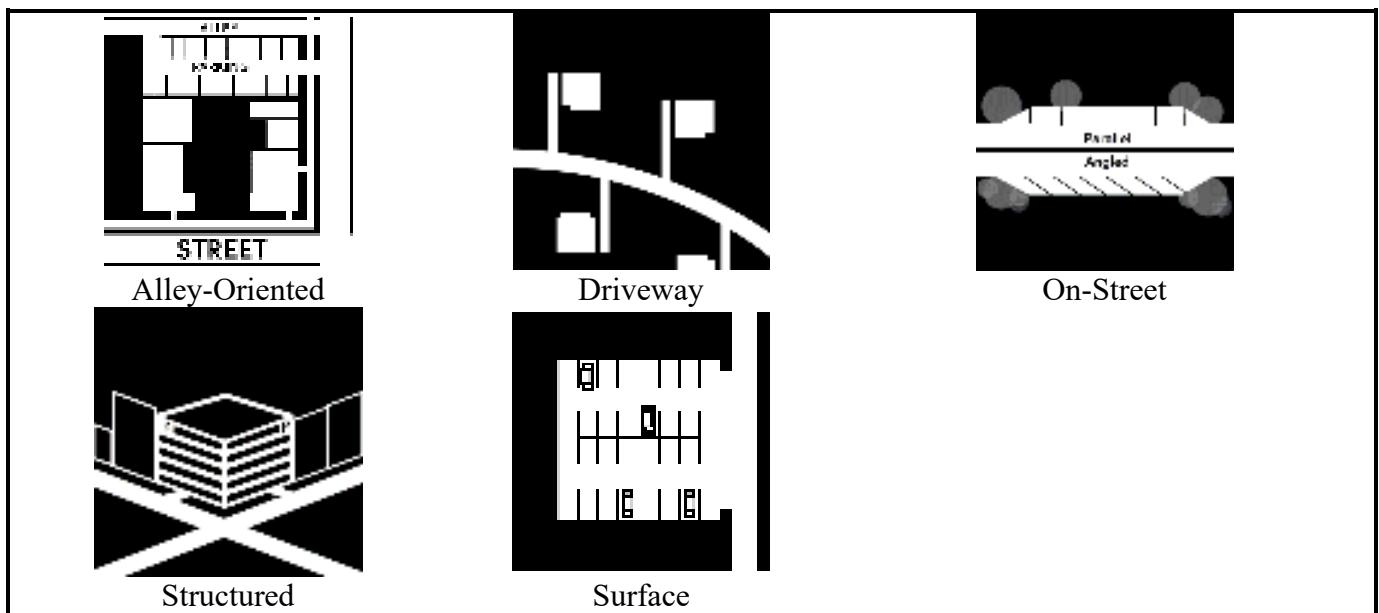
The Place Types described in this chapter have been carefully chosen to complement the current built and natural environment of the County while fulfilling the land use patterns and community characteristics envisioned for each policy area. Place types emphasize form and function in addition to expected land uses. This makes place types especially useful tools to guide future decisions regarding growth and development in each community, taking into account variable priorities such as: economic development, land preservation, protection of natural, environmental, and heritage resources, efficient transportation options, and the provision of public facilities and services.

Each of Loudoun's policy areas is divided into distinct place types that reflect their unique form and character. Collectively, the defined elements of each place type help to ensure that future development creates the desired character and function of each respective policy area. Each policy area section in the Plan provides a detailed description of each corresponding place type, including:

- A summary of the general development pattern, scale, form, function, and how the place type complements or fulfills the larger visions or policies described elsewhere in the Plan
- Use categories expected in the area
 - Including core and complementary uses that will fulfill the intent of the place type
 - Appropriate conditional uses
 - Special Activity and Parks and Recreation are listed as conditional uses in all place types and will be reviewed on a case by case basis
- The expected physical form of each place type in terms of
 - Street pattern—shown below are all configurations that will be found in the Place Types



- Block length consistent with the *Loudoun County 2019 Countywide Transportation Plan*
- Setbacks based on roads and pedestrian features
- Parking
 - Accessory – a parking facility that provides parking for a specific use or uses. The facility may be located on or off the site of the use or uses to which it is accessory.
 - Short-term – lots and/or spaces designed for people who are dropping off and picking up passengers and/or goods.
 - Shared – a parking facility that may have spaces reserved and other spaces open to another use
 - Garage – a building or room, common to single-family residential neighborhoods, used to park vehicles or store items. Garages can be attached to a residence or located in an adjacent standalone building, and are typically accessed via a residential driveway.
 - Shown below are other types of parking:



- Design amenities
 - Including sidewalks, street trees, street furniture, shade trees, bike racks, lighting, crosswalks, plazas, pedestrian malls, network of green space, and public art
- Retail and service
 - Retail commercial development in residential and employment place types will be designed to respond to the particular characteristics of the place type. In residential areas, retail and service uses will be characterized as Neighborhood or Community serving dependent upon the size of the area

being served and the characteristics of the site (i.e. access, location, function). They will be located internal to the areas that they serve and will provide convenience or routine shopping and personal services. Retail and service uses in the employment place types are intended to provide convenient retail and personal services supporting the employment uses and are based on a percentage of the uses they will serve.

- Open space in terms of the following
 - Recreational – for both passive and active recreation
 - Passive - trails (hiking, biking, walking, or equestrian), picnic, community gardens, camping, or fishing areas
 - Active - ballfields, tennis or basketball courts, swimming pools, tot lots, golf courses, dog parks, and other areas for recreational sports and games
 - Community – plazas, playgrounds, pocket parks, gardens, public art, amphitheater
 - Natural, Environmental, and Heritage – forests, stream valleys, wildlife habitats, floodplains and their buffers, steep slopes and ridge tops, meadows, hedgerows, wetlands, heritage resources, and land contributing to the context of heritage resources, which may be incorporated into publicly accessible parks and preserves.
 - Agricultural land including fallow land and working lands (agriculture, horticulture, and silviculture)
- The expected development intensity in terms of floor area ratio (FAR) and/or residential density (dwelling units per acre) to better define the anticipated massing, scale, and level of activity expected
- A discussion of how design elements, variations in land use, and changes in density can be applied to ease transitions among different place types and uses, ideally minimizing the need for intrusive screening or other structural mitigation measures

Place Type Implementation

Place types are not meant to directly parallel use-based zoning districts, but rather are a direct way of connecting the day-to-day experiences and preferences of the community with the more specialized and technical discipline of land use planning. The place types in the General Plan are:

1. Used to describe the desired future condition, environment, and development of our community's places;
2. Mapped similarly to a traditional future land use map and used to guide future development; and
3. Linked to a future comprehensive Zoning Ordinance revision, which will create enhanced design standards and may include new districts that better align with the desired character of the place.

See Appendix A for general place type considerations – prompts that should be considered while devising and developing a project to assess whether a proposal is compatible with the place type and improves the site and its surroundings.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply countywide.

QD Policy 1: Provide flexible design guidelines in all policy areas and in priority areas of the County to create more specific design guidelines that encourage innovation and appropriate architectural, site, and landscape design in all development.

Strategy

- 1.1. Identify and prioritize areas in the County where more specific design guidelines are desired.

Actions

- A. Develop user-friendly, illustrative design guidelines. The design elements will promote an overall sense of place through design elements that in-part relate to block size, circulation and connectivity, streetscape and street sections, building form, placement (setbacks), orientation, articulation, parks and open spaces, public and civic uses, landscaping, and sustainability that give a high quality form to the built environment.
- B. Create incentives that provide the opportunity to implement design guidelines.
- C. The County will consider the development of zoning regulations and design standards that implement the design guidelines of this plan and any design guidelines that may be created in the future.

Strategy

- 1.2. Encourage the submission of site development and architectural guidelines for new developments.

QD Policy 2: Where appropriate to the Place Type, create compact, walkable development patterns characterized by smaller blocks, shorter distances among uses, inter-parcel connectivity, greater diversity of uses on the same street, and connected open spaces that facilitate social interaction and offer affordable and convenient lifestyles.

Strategy

- 2.1. Ensure County guidelines, zoning regulations, and design standards encourage a compact, walkable development pattern in areas where pedestrian activity should be welcomed.

Action

- A. Develop and implement zoning regulations or design guidelines that support a

compact, walkable development pattern in areas that are appropriate for pedestrian activity.

QD Policy 3: Provide diverse environments and experiences in all development.

Strategy

- 3.1. Ensure that context and development potential are considered by integrating uses with the natural environmental features of the site.

Actions

- A. Develop flexible guidelines, regulations, and design standards that support diverse environments and experiences.
- B. Create incentives to ensure a mix of environments and experiences within a development.
- C. Use a design process that integrates natural environmental features into the development.

QD Policy 4: When appropriate for the Place Type, design spaces to maximize pedestrian, bicyclist, and other multimodal activity, comfort, and convenience.

Strategy

- 4.1. Development must ensure pedestrian and bicyclist connectivity and safety in areas appropriate for multi-modal activity while pursuing high-quality design to include establishing easements and right of ways.

Actions

- A. Create guidelines, zoning regulations, and/or design standards that ensure bike lanes, shared spaces, and paths of travel are created in areas where multimodal activity should be encouraged.
- B. Create guidelines, zoning regulations, and/or design standards that ensure traffic calming designs.

QD Policy 5: Ensure greater interaction between activity inside buildings and the public realm where appropriate to the Place Type.

Strategy

- 5.1. Ensure that design emphasizes the quality of the pedestrian experience in public spaces within mixed use developments and residential communities.

Action

- A. Develop design guidelines, zoning regulations and/or design standards, and additional design elements that contribute to the quality of the human experience in the built environment.

QD Policy 6: Within mixed use developments and residential communities, promote high-quality design and a mix of uses to encourage activity and longer stays in spaces, in order to create vibrant areas and a sense of place.

Strategy

- 6.1. Ensure the development of inviting public spaces that encourage longer stays and increase the vibrancy of the area, such as public/civic gathering spaces, outdoor rooms, public art spaces, and passive/active recreation spaces.

Action

- A. Create guidelines that address public seating, art, landscaping, outdoor rooms, safety, and other innovative elements that can maximize opportunities for the public.

QD Policy 7: Ensure high quality development where the natural and built environment contribute to an area's "sense of place."

Strategy

- 7.1. Ensure the place types complement the current built and natural environment of the County, while fulfilling the land use patterns and community characteristics envisioned for each policy area.

Actions

- A. The density or development potential of a place type designated for a site will be defined by gross area of the site. Development potential can be transferred within a project to protect natural and cultural features and to meet the design objectives of the place type. When density is based on floor area ratio (FAR), the buildable area as used in the FAR calculation does not include portions of land for roadways, wetlands, floodplains, and buffers.
- B. Structured parking and open space areas are not included within the floor area ratio of a site when assessing it by the designated place type.
- C. The open space requirement for each respective place type will be measured as a percentage of gross area.
- D. The three use lists of a place type are a guide where: core uses are most prevalent in the place type, complementary uses support the core uses, and conditional uses are to be considered on a case-by-case basis.
- E. Follow the preferred mix of uses for each place type which is an approximate amount that would be needed to achieve the full intent of the place type. Allow the use mix of a development to differ from the preferred ranges noted in the place type, when street and open space network, project size, surrounding context or other factor supports flexibility to achieve the development objectives of the Plan.
- F. Amend zoning regulations and design standards to implement place types. It may be necessary to utilize incentive provisions in order to achieve the maximum development

- intensity or residential density stated in this Plan for any individual place type.
- G. Within the Urban Policy Area, projects less than 5 acres in size will not be strictly held to the use mix specified for that place type if the effect of the proposed development is to shift the use mix for an area within $\frac{1}{4}$ mile of its boundaries closer to the preferred mix for the place type. Such projects will be evaluated by Policy 3, Strategy 3.1 in the Infill and Redevelopment section.
- H. Within the Suburban Policy Area, projects less than 20 acres in size will not be strictly held to the use mix specified for that place type if the effect of a proposed development is to shift the use mix for an area within $\frac{1}{2}$ mile of its boundaries closer to the preferred mix for the place type. Such projects will be evaluated by Policy 3, Strategy 3.1 in the Infill and Redevelopment section.
- Strategy
- 7.2. Consider allowing interim uses that contribute to the community and are planned to efficiently and easily evolve to more intense uses called for by *the Loudoun County 2019 Comprehensive Plan*, when market forces support additional development.
- Actions
- A. Ensure interim development uses, design, locations, ownership, or intensities are not a deterrent or barrier to implementing the long-term community vision for Loudoun County, as well as the policies and objectives of the *Loudoun County 2019 Comprehensive Plan*.
- B. Require projects that are proposing a phased development program or an interim use to commit to a plan that achieves the ultimate development of the site, consistent with the intent of *the Loudoun County 2019 Comprehensive Plan*.
- C. Require development proposals for interim uses to design and build infrastructure, buildings, parking lots, and parks and landscaped areas to support the ultimate, higher density development.
- D. Determine acceptability of interim development phases and land uses against:
- i. Location, site constraints, relationship to surrounding uses,
 - ii. How well the interim use complements and supports community life and activity of the surrounding development, and
 - iii. How well the project retains the capacity to achieve the ultimate development pattern and meet the policies and objectives of the *Loudoun County 2019 Comprehensive Plan*.
- E. Encourage development in its ultimate condition to rely on structured parking but consider a mix of structured parking, on-street parking, and surface parking as an interim land use.

QD Policy 8: Development should utilize universal design principles to increase functionality, usefulness, and marketability to persons with diverse abilities.

Strategy

- 8.1. Promote equitable access to streets, sidewalks, public and private buildings, civic spaces, and transportation facilities.

Actions

- A. Amend zoning regulations and design standards to require the provision of continuous, accessible, step-free paths of travel throughout new employment, retail, and mixed use development proposals.
- B. Amend zoning regulations and design standards to incorporate accessible and inclusive design features into public and civic spaces such as community centers, parks, plazas, and playgrounds.
- C. When reviewing new proposals, favor accessibility features that encourage universality of access and utility as seamlessly as possible.
- D. Review and revise county sign regulations to facilitate signage and way-finding at appropriate heights that incorporate Braille, tactile markings, and other accessibility improvements.

Strategy

- 8.2. Promote the use of universal design features at the site and building level.

Actions

- A. Incentivize the use of design mechanisms that ensure universal functionality within new construction.
- B. Examine the feasibility of establishing a technical and financial assistance program that assists property owners and tenants of older structures in removing impediments to accessibility and incorporating universal design elements into renovation projects.

Infill and Redevelopment

Vision

A community where careful public investment in services, facilities, and growth management can maintain neighborhood vitality; reinvest in underused areas; and facilitate complete, connected, and distinct communities.

Introduction

Loudoun County is a maturing community. For the last several decades, the approach to planning and zoning focused on managing and directing rapid suburban growth to primarily undeveloped land, or greenfields, in eastern Loudoun County – areas designated for growth in the *Revised General Plan*. Today, much of the Suburban Policy Area (SPA) has been developed and there is a limited supply of land remaining for new greenfield development, creating new planning challenges and opportunities in this area.

Some existing neighborhoods, commercial developments, and employment centers are aging or underutilized, and thus vulnerable to disinvestment and decline. Other newer developments that never realized their full commercial potential present additional opportunities for redevelopment. As these maturing commercial centers and neighborhoods evolve over the next two decades, the *Loudoun County 2019 Comprehensive Plan* (Comprehensive Plan) seeks to ensure that they do so in a way that meets the County's long-term land use, housing, economic development, and public infrastructure goals.

This section focuses on several interrelated concepts that are integral to successful projects and initiatives in previously developed areas: redevelopment, infill, adaptive reuse, and reinvestment. Table 1 provides a definition of each of these terms, the intent and goals of each, and the kinds of locations in the County where their use may be most appropriate. These are not mutually exclusive concepts, and a project or initiative may include elements of one or more of them. Generally speaking, redevelopment describes the conversion of any existing developed property into other uses or a different intensity of use. Adaptive reuse is a form of redevelopment that repurposes existing, oftentimes obsolescent or historically significant structures for new uses. Infill refers to the development of substantially undeveloped or underutilized properties that exist in otherwise built areas with existing or planned infrastructure and service capacity to handle more intensive land uses. Although not a form of redevelopment by definition, infill may be coordinated with redevelopment projects to better realize the planning vision for a particular area, sometimes as a part of a larger reinvestment program. Reinvestment aims to encourage new vitality and economic activity in a community. Reinvestment programs may include smaller-scale redevelopment efforts or infill development, but often feature more targeted programs to improve building facades, beautify streetscapes, and generate investment through incentive-based economic development tools.

Table 1. Infill and Redevelopment Terms and Concepts

	Definition	Intent and Goals	Primary Locations
<i>Redevelopment</i>	The rehabilitation, removal and replacement, or adaptive reuse of existing structures or uses. This includes any development project that significantly modifies an existing developed site resulting in changes to its design, use, and/or intensity. Projects may involve razing existing structures and constructing completely new buildings and may require mitigation or remediation of the impacts of previous uses.	To achieve land uses that are more economically beneficial, more compatible with existing or anticipated surrounding land uses, and align uses with the long-term vision of the Plan.	Any existing built property where conversion to a new use better achieves the economic development, housing, land use, and public infrastructure policies of the Plan.
<i>Infill</i>	Establishment of a new use on a site that may be undeveloped or underutilized but is located in an area of established, stable development where roads, water, sewer, and general services are available or planned. Infill sites are often small (less than 25 acres), and their development should complement or complete a larger development area.	To optimize infrastructure investments, leverage existing service capacity, and reduce development pressure on areas not designated for growth.	Undeveloped areas otherwise served by public infrastructure and utilities. These may include brownfield and greyfield sites.
<i>Adaptive Reuse</i>	Repurposing of an existing structure in order to accommodate new uses while preserving the structure. This often involves improving existing buildings to allow for modern design and building program preferences.	To prolong building lifespans, encourage reuse of existing resources, facilitate market alternatives, and encourage preservation of historic structures through appropriate renovation.	Existing buildings where prior uses are obsolete or economically infeasible. Appropriate building stock is in sound structural condition and provides flexibility for retrofitting for new uses. Context-sensitive reuse can be an important tool for preservation of historic structures.
<i>Reinvestment</i>	Reestablishing the economic and social vitality of an area through a combination of targeted efforts and investments that may be coordinated with redevelopment, infill, and adaptive reuse projects.	To instill vitality and economic activity through small-scale redevelopment, renovation, beautification, and incentive-based economic development tools.	Existing neighborhoods with declining commercial activity but with a baseline of housing or commercial building stock that does not require wholesale redevelopment.

The *Loudoun County 2019 General Plan*'s (General Plan) planning approach reflects a greater emphasis on redevelopment of aging areas, infill development on the few remaining undeveloped parcels, and adaptive reuse of existing buildings, complemented with reinvestment initiatives as needed. These types of development bring unique challenges and opportunities inherently different from greenfield development. The policies and implementation steps of this section are intended to support these development types.

Opportunities

With redevelopment, infill development, and adaptive reuse come opportunities. Redevelopment offers communities the opportunity to reimagine underutilized or underperforming sites to create unique places and provide amenities desired by residents. Other redevelopment projects may maximize commercial potential, increasing neighborhood commerce and enhancing property values. Infill development can maximize the use of public investments and existing infrastructure, create opportunities to achieve more cohesive development patterns, encourage reinvestment, and better connect neighboring developments. Adaptive reuse projects can support historic preservation goals, generate activity within vacant buildings and underutilized areas, and preserve iconic or prominent buildings exemplifying community character while maintaining compatibility with the surrounding neighborhood. Each can also provide opportunities to diversify housing stock. However, these projects can upgrade or retrofit older or substandard infrastructure for the site and surrounding area, which generally increases the value of a property and contributions to the tax base.

Emerging Reinvestment Issues

Most of Loudoun County's suburban development is relatively new, but as Loudoun's communities continue to age, County policies and initiatives to support and enhance these neighborhoods and commercial centers will be increasingly important.

The Potomac and Sterling communities are two of the oldest and most diverse communities in Loudoun County. With neighborhood development beginning in the 1960s, the communities are mostly built-out. Housing stock has been in place for approximately 50 years and a need for reinvestment has emerged. The 2007 recession also significantly affected Potomac and Sterling. The largest concentration of foreclosures and subsequent vacancies in the County occurred in these communities, compounding the area's challenges.

Recognizing the need for reinvestment in Potomac and Sterling, the Loudoun County Department of Planning and Zoning undertook a community outreach project in 2008. During the outreach, residents identified needs and desires to help encourage reinvestment areas of the community. Community members expressed concerns that poor neighborhood maintenance created blight conditions and contributed to an increase in crime. Furthermore, residents worried that their neighborhoods lacked law enforcement personnel, neighborhood volunteer watch groups, and teen programming. The General Plan's more flexible, incentive-based regulatory approach is intended to encourage private interests to undertake a range of context-sensitive redevelopment, infill, and

reinvestment projects with support from County programs and targeted planning and community outreach efforts.

In recent years, Loudoun County undertook certain recommendations originating from the Potomac and Sterling community outreach project. To address the foreclosure issue and the deterioration of housing, the County made considerable investment of Community Development Block Grants (CDBG), tax dollars, and Neighborhood Stabilization funds; provided grants to non-profit housing providers to purchase and renovate homes to sell to low and moderate income families; and provided direct loans and grants to qualified residents through several programs. The County also revised the Zoning Ordinance to address community aesthetics, began proactive code enforcement, and established a full service Eastern Loudoun Sheriff's Substation in Sterling Park.

As other neighborhoods continue to mature, the County will look to emulate and improve upon past public engagement efforts and collaborative planning solutions. It is important, however, that the County considers the diverse needs, desires, and vision of each affected area. Some smaller scale projects, such as incorporating a mix of residential and new retail uses into a declining strip commercial center, may be appropriately handled through the rezoning process, which provides for public hearings before the Board of Supervisors and Planning Commission. Larger scale infill or redevelopment projects that are likely to displace large numbers of business or residential tenants may warrant a more in-depth, collaborative public input process. The Policies, Strategies, and Actions of this section are intended to clarify the County's interest in redevelopment and reinvestment and the planning tools and processes available to encourage and shape these efforts.

Challenges

Redevelopment, infill development, and adaptive reuse projects may also face or present different challenges than greenfield developments, including:

- Land development regulations that are generally designed to guide greenfield development and lack the flexibility needed to facilitate redevelopment, adaptive reuse, or infill development projects.
- Redevelopment sites and adaptive reuse projects may require infrastructure improvements and experience other fiscal challenges that result in costlier projects than greenfield development.
- Sites that are often owned or leased by multiple entities, making it difficult to craft a unified vision and project.
- Potential opposition from the community for redevelopment, infill development, and adaptive reuse projects.
- Redevelopment projects that may displace populations because market-provided affordable housing is demolished or rents and property taxes increase due to the new development.
- Redevelopment projects that may displace established employment uses, adversely affecting the diversity of the County's commercial tax base.

Considering the complexity of challenges related to these projects, developing a community vision that anticipates redevelopment, infill development, and adaptive reuse projects is critical. The County should take a leading role in developing this community vision by identifying and prioritizing areas that would benefit from redevelopment and reinvestment, and by conducting proactive planning efforts to establish this vision. In addition, Loudoun County should require developers to consider and include community input for significant infill and redevelopment projects, especially those that are most likely to displace established residents and tenants. A community vision endorsed by the locality provides assurances to both developers and the community. It also identifies the locality's role in advancing such projects.



Addison McDonald residential development is an example of infill development in Brambleton. Two parcels, each with a residence, and totaling approximately 7 acres will be developed with 39 townhouses surrounding a village green and will be annexed into the neighboring Homeowners Association (HOA).



Luckett's Community Center. Loudoun County has adaptively reused several historic schools for community centers in rural villages, providing gathering places while protecting iconic buildings and community character.

Redevelopment, infill development, adaptive reuse, and reinvestment projects within the County should result in great places that complement, strengthen, and benefit surrounding communities. Such projects should enhance the quality of life and help build a strong sense of community, where people feel connected to each other and to places that are expressions of community character. The following Policies, Strategies, and Actions of the General Plan will foster this vision of compatible infill development within existing neighborhoods, and quality redevelopment and reinvestment of

aging or underutilized commercial and employment areas. They encourage efficient use of land and maximizing the use of existing infrastructure, public facilities, and community amenities, while benefiting established communities and alleviating development pressure outside of planned growth areas.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply countywide.

IR Policy 1: Ensure reinvestment initiatives and redevelopment, infill development, and adaptive reuse projects will enhance quality of life and neighborhood character, fulfill community needs, and improve economic opportunities.

Strategy

- 1.1. Where infill development, redevelopment, and reinvestment initiatives could affect established neighborhoods, facilitate community engagement to address County and community concerns and build support for future projects.

Actions

- A. Develop criteria to identify and prioritize areas for redevelopment, infill development, adaptive reuse, and reinvestment, with the Priority Commercial Redevelopment Areas Map serving as the source for initial areas of focus.
- B. Create a common vision and objectives for areas identified for redevelopment, infill development, adaptive reuse, and reinvestment through a public process.
- C. Address redevelopment, infill development, adaptive reuse, and reinvestment as part of community plans. Pay particular attention to a community's historic assets and function in areas with under recognized historic resources or limited historic resources protections, such as the legacy village cores of Ashburn, Arcola, and Old Sterling (see Legacy Village Cores Map).
- D. Identify methods for ensuring developers will follow through on commitments to communities that are products of a facilitated engagement process between the developer and the surrounding neighborhoods and developments.
- E. Evaluate the creation of overlay districts to encourage reinvestment in priority/targeted areas where there is community support and buy-in.

Strategy

- 1.2. Support projects that provide community amenities, fulfill community needs, and benefit the surrounding communities.

Actions

- A. Conduct analysis of local market demands to determine what is needed to foster successful redevelopment.
- B. Identify priority redevelopment areas and targeted strategies through the community planning process.

- C. Ensure residential and mixed-use projects increase and diversify housing opportunities when in conformance with other Plan policies.
- D. Require redevelopment projects to replace, at a minimum, market-provided affordable units lost through a redevelopment process.
- E. Develop strategies to address displacement and housing affordability, when redevelopment occurs.
- F. Require the provision of comparable community amenities to any lost through a redevelopment process.
- G. Encourage annexation of residential projects into adjoining homeowners' associations (HOAs) to make the provision of amenities more economical.
- H. Develop criteria, such as site constraints, important resources, and community amenity gaps, to identify infill sites appropriate for use as park, civic, and open space rather than private development.
- I. Promote the development of interim uses on underutilized properties that are compatible with the surrounding development pattern, such as community gardens, playgrounds, park-and-ride lots, and farmer's markets

Strategy

- 1.3. Enhance established residential communities specifically in need of reinvestment through methods that will not involve a redevelopment project.

Actions

- A. Identify and prioritize neighborhoods with an emerging need for reinvestment and work with these communities to identify needs and desires and build support for reinvestment.
- B. Identify strategies to preserve and enhance a community's sense of place, social fabric, and historic assets and functions.
- C. Identify, and include in the Capital Budget, capital facilities improvements necessary to support reinvestment in targeted areas.
- D. Identify and utilize funding sources for community reinvestment strategies.
- E. Educate the community about funding sources for home improvement and repair.
- F. Facilitate the provision of community amenities, such as pedestrian/bicycle facilities, sidewalks, traffic calming, street lighting, bus stops, cultural centers, and community gathering places.
- G. Develop incentives that encourage the private sector to improve retail and commercial establishments in targeted areas.
- H. Provide resources for community-based initiatives, such as neighborhood volunteer watch groups and teen programming.

Strategy

- 1.4. Facilitate redevelopment, infill development, and adaptive reuse projects through technical assistance, an improved regulatory framework, and streamlined review processes.

Actions

- A. Provide general project guidance, such as best practices, tool kits, examples of “approvable” development types, and profiles of successful projects.
- B. Develop and maintain a redevelopment webpage with information and resources for residents and developers.
- C. Develop flexible zoning regulations and design standards that account for existing conditions, allow for creative design and emerging development types, and provide certainty and clear direction for developers.
- D. Develop creative incentive programs for projects located within the priority areas for redevelopment identified on the Priority Commercial Redevelopment Areas Map and other qualifying projects, such as increases in permitted density where infrastructure is available, reduced fees, or expedited review processes.

Strategy

- 1.5. Incentivize redevelopment, infill, and adaptive reuse projects, and reinvestment efforts in priority areas to be established by the County, using the Priority Commercial Redevelopment Areas Map to determine initial priority areas.

Actions

- A. Evaluate and implement the use of fiscal tools to incentivize redevelopment, such as tax increment financing (TIF) and public improvement districts (PID).
- B. Evaluate entering into public-private-partnerships to initiate redevelopment and adaptive reuse efforts and reduce development risks in priority areas.
- C. Direct public investment and resources to priority areas to facilitate redevelopment.
- D. Establish programs to assist in business retention, expansion, and recruitment when commercial redevelopment projects occur.

Strategy

- 1.6. Achieve unified site design, efficient use of existing infrastructure, and maximum land development potential through the consolidation of small, adjacent, underutilized properties.

Actions

- A. Facilitate redevelopment of multi-ownership sites through a planning process that engages owners and the larger community in the creation of a shared vision for the area.
- B. Create incentives for parcel assembly and funding opportunities for infrastructure improvements associated with redevelopment projects to alleviate private sector risk and costs.

Strategy

- 1.7. Ensure that projects proposed for eastern Loudoun's legacy village cores – including Ashburn, Arcola, and Old Sterling – complement the scale, form, and historic land use patterns of these areas (see Legacy Village Cores Map).

Actions

- A. Develop zoning regulations and design standards that emulate existing lot patterns in the village cores of Ashburn and Arcola with buildings oriented to the street, encouraging pedestrian activity.
- B. Develop zoning regulations and design standards that promote a mix of land uses including residential, retail, office, institutional, public facilities, parks, playgrounds and other uses in the village cores where such uses do not otherwise conflict with existing uses or anticipated noise impacts from Washington Dulles International Airport.
- C. Develop or maintain zoning regulations and design standards for the legacy village core of Ashburn that limit residential densities to four (4) units or fewer per acre.
- D. Develop zoning regulations and design standards that limit commercial, flex, or industrial building footprints to 10,000 SF and building heights to three (3) stories.
- E. Develop zoning regulations and design standards that discourage new automobile-oriented retail uses in the village cores.
- F. Where compatible with surrounding land uses, allow residential or mixed-use development in areas of the Arcola village core that fall outside the Ldn (day-night average noise level) 65 or higher aircraft noise impact area of Washington Dulles International Airport, applying the standards of the Suburban Neighborhood Place Type.
- G. Encourage residential development above first floor retail or employment uses in the village cores.
- H. Use the community planning process to develop a unified planning vision and targeted implementation actions for Ashburn, Arcola, and Old Sterling.

Strategy

- 1.8. Promote the retention or development of small-scale industrial, employment, and manufacturing uses in order to promote local provision of jobs and services and maintain a diversified commercial tax base.

Actions

- A. Develop zoning regulations and design standards that discourage the displacement of legacy flex, industrial, and employment uses by new large-scale uses.
- B. Develop zoning regulations and design standards that expand opportunities for small-scale manufacturing in place types allowing flex, light industrial, industrial, and employment uses.
- C. Amend zoning use definitions in industrial, flex, and employment-centered zoning districts to accommodate makerspaces, emerging small-scale manufacturing sectors,

and the marketing and retail of goods produced on-site.

IR Policy 2: Recognize adaptive reuse of existing unused or underutilized buildings as an opportunity to establish or reinforce a community's identity and sense of place.

Strategy

- 2.1. Support adaptive reuse projects that provide cultural activities and community gathering places.

Actions

- A. Use the *Heritage Preservation Plan* to guide the adaptive reuse of historic resources.
- B. Establish collaborative programs and partnerships for adaptive reuse projects to foster entrepreneurship and encourage innovative ways to reuse buildings and sites.

Strategy

- 2.2. Prioritize adaptive reuse of existing buildings with historic significance or importance to a community over demolition.

Action

- A. Consult with communities to ensure all unused or underutilized buildings representing their history and character are identified, protected, and adaptively reused.

Strategy

- 2.3. Revise County regulations to accommodate creative adaptive reuse designs.

Action

- A. Review zoning regulations, design standards, and building code regulations to identify regulatory encumbrances to adaptive reuse projects.
- B. Develop zoning regulations and design standards that provide ample flexibility for adaptive reuse projects without compromising the health, safety, or welfare of users.

IR Policy 3: Promote redevelopment and infill projects that balance compatibility and integration with new housing choices and creative designs.

Strategy

- 3.1. Redevelopment and infill projects will be evaluated based on compatibility and the integration of the development within the context of the surrounding development patterns.

Actions

- A. Ensure redevelopment and infill development is compatible with the surrounding development. As appropriate, elements of the Place Types should be incorporated to the fullest extent possible.
- B. Ensure residential development on infill sites is designed to fit into the surrounding context.

Urban Policy Areas

Vision

The Urban Policy Areas (UPA) will be the target area for much of Loudoun's future growth in the immediate future. UPA communities will accommodate living, working, shopping, learning, and playing in dense urban environments of walkable mixed use and transit oriented development. These areas will possess high-quality public environments with accessible and connected places, and a rich mix of uses that establish a distinctive sense of place. UPA communities are envisioned to support development types, patterns, and densities that will create jobs, grow the tax base, and be fiscally sustainable.

Introduction

The new UPAs are planned and designed to be strong, diverse regional activity centers and economic drivers. As such, UPAs will provide new opportunities for regional employers to locate near complete urban communities with multiple transit options and access to Washington Dulles International Airport. The UPA has been in the making since the *Toll Road Plan*, with transit-oriented nodes and then building upon them in the *Revised General Plan* with Transit-Oriented Development areas in the Suburban Policy Area. The UPAs encompass areas around three Metrorail Stations: Innovation Center (in Fairfax County), Loudoun Gateway, and Ashburn (for reference, see Urban Policy Areas Place Types map). The areas around the Metrorail Stations are envisioned as transit-oriented communities with a dense urban core consisting of the greatest intensity of development in the County. These areas emphasize mixed-use development throughout and are the highest priority growth areas in the County. Due to their current suburban nature, the process of transitioning these areas to walkable communities may involve partial infill and redevelopment as described in the Infill and Redevelopment section of this chapter.

The expansion of Metrorail service into Loudoun County presents an unprecedented opportunity to create dynamic urban places that respond to the community's evolving needs and demands. The *Loudoun County 2019 Comprehensive Plan* (Comprehensive Plan) integrates multimodal transit options with high quality urban and environmental design guidelines to shape livable, vibrant, and active UPA neighborhoods with a balance of business, commercial, and residential uses. The UPA communities will provide a variety of housing choices that offer diverse options for families, empty-nesters, individuals, couples without children, and seniors across socioeconomic groups, helping to provide the housing continuum described in Chapter 4. They will be communities that are rich in amenities including networks of publicly accessible green spaces, such as the Broad Run Stream Valley Park and Trail, that simultaneously protect valuable environmental resources.

Development Approach

The *Loudoun County 2019 General Plan*'s (General Plan) design policies and guidelines recognize that urban form is essential to creating places that are functional and attractive to a diversity of users. Urban design characteristics in the UPA speak to the design of individual structures and spaces, the spatial relationship among structures, the relationship of buildings to the streetscape

and other public places, and transitions between areas of differing densities or intensities. Building façades set at the back of the sidewalk and ground floor retail uses with transparent façades will help activate the streetscape. The guidelines also encourage the development of distinctive public places that promote culture and the arts. Street furniture, public art, water features, and distinctive landscaping will create visually appealing streetscapes that encourage street-level activity and public interaction.

All UPA communities will include transportation hubs that offer a wide array of transportation mode choices including walking, biking, driving, and transit. The UPA is a place where walking and bicycling can be convenient travel modes, diversity of use is nurtured, and public places are aesthetically pleasing, safe, and accessible. Attractive grid-form street networks will prevent traffic congestion, maximize travel choices, and safely and efficiently move individuals throughout the area. Small, tree-lined blocks will enhance the pedestrian experience and encourage non-vehicular travel. Contiguous, linear green spaces that accommodate both passive and active recreation will encourage alternative means of travel.

The Comprehensive Plan envisions a certain level of activity and intensity of development in the UPAs, which is necessary not only to create vibrant, viable transit-oriented communities, but also to protect their long-term tax revenue generation potential. Therefore, land uses that do not meet the minimum bulk and/or density guidelines envisioned in the UPA Place Types should be avoided. Interim uses may be appropriate, if it can be demonstrated that they will evolve to an ultimately desired use that aligns with the long-term vision of the General Plan.

The County's ongoing collaboration with the Metropolitan Washington Airports Authority (MWAA) regarding future land use planning around Washington Dulles International Airport's northern border is essential to the success and economic viability of the Loudoun Gateway Metrorail Station. The County will continue its partnership with MWAA and explore mutually beneficial land use alternatives that realize greater tax revenue while supporting current and planned airport operations. This collaborative planning will ensure that the Loudoun Gateway Metrorail Station develops as a walkable place with job opportunities, amenities, pocket parks, transit options, and nearby housing without compromising Washington Dulles International Airport's long-term viability.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply only within the UPA.

UPA Policy I: Ensure walkable development and connectivity to the community throughout the UPA as it is important to foster the urban character found in the Place Types.

Strategy

- 1.1. Development designed to provide for a walkable mixed-use environment that supports multi-modal transportation choices and fosters substantial pedestrian activity within the half-mile area and to surrounding areas.

**Strategy**

- 1.2. Support walkability in the half-mile buffer area by providing pedestrian and bicycle commuter connectivity to the core of the Metrorail stations and surrounding neighborhoods as well as enabling future connections from undeveloped parcels.

Strategy

- 1.3. Support a high level of pedestrian connectivity including connected street grid patterns with sidewalks, short block lengths, and connected trails and pathways providing connections to surrounding neighborhoods.

Strategy

- 1.4. The Ashburn and Loudoun Gateway Metrorail Stations will serve as transit and commuter hubs while providing an urban walkable environment. Development proposals provide a balance between the needs of commuters with the desire to create a walkable urban environment.

Strategy

- 1.5. Accommodate a long-term vision with an appropriate mix of residential and non-residential uses that fulfill daily needs and convenience of its residents and employees.

Actions

- A. Mixed-use neighborhoods should accommodate infrastructure plans for near-term and long-term transit circulator service.
- B. Community facilities like schools, community centers, and libraries should be located to allow as many residents as possible to be within a short walking distance.
- C. Larger developments should provide pedestrian access within their development and possible shuttles to connect to the Metrorail stations.

Strategy

- 1.6. Discourage single-story buildings in the UPA to promote compact, pedestrian-oriented spaces except when such buildings are integrated into a plaza or other public gathering space and are no larger than 2,000 square feet.

Strategy

- 1.7. Ensure that any drive-through retail uses are incorporated within mixed-use buildings.

UPA Policy 2: Provide dynamic and diverse public places and amenities within proposed UPA communities.

Strategy

- 2.1. Densities in the area are expected to sustain an urban development pattern with pedestrian activity.



Strategy

- 2.2. The County should promote concepts like outdoor dining, event space, street fairs, and public art within compact, walkable non-residential areas.

Action

- A. Development design should accommodate walkable features and amenities like centralized activity areas such as shopping and dining areas with wide sidewalks, more narrow pedestrian-oriented streets, transit stops, and community gathering places (e.g., parks and plazas).

UPA Policy 3: Provide a diverse mix of choices in all development.

Strategy

- 3.1. Accommodate office developments and/or high-employment generating uses that conform to the overall vision for a walkable urban development pattern.

Action

- A. Create partnerships with universities and private sector companies to foster growth of an Innovation District at the Loudoun Gateway Metrorail Station that supports workers and students in the advanced technology and science industries.

Strategy

- 3.2. Ensure that development within a half-mile of the Loudoun Gateway Metrorail Station reflect the General Plan's and station area's long-term vision of a global destination, activity center, and leader in innovation and entrepreneurship.

Strategy

- 3.3. Accommodate diverse housing options in all development.

Action

- A. Achieve smaller average unit sizes for residences within the urban area.

Design Guidelines

The Design Guidelines are to build upon our current high standard of development in a manner that allows innovative design and new responses to the market. The Design Guidelines are not

meant to be prescriptive and are not intended to be treated as a checklist, but are instead meant to provide a framework for how the desired character of the UPA can be achieved, with the acknowledgement that other methods could achieve the intended results. The Design Guidelines do not supersede or otherwise limit the application of adopted zoning regulations, ordinances, building codes, proffers, or any other design standards or regulations administered by Loudoun County.

All applications for development in the UPA are expected to include project specific design guidelines, site plans, illustratives, landscape plans, building elevations, and other similar graphics that demonstrate consistency with the UPA Design Guidelines and planning principles in this document.

When using the guidelines, make sure to analyze the impact that a potential development may have on the landscape, considering not only appearance, but practical considerations such as proximity to utilities, community amenities, jobs, and housing, in order to maximize the use of existing infrastructure and reduce travel distances. Development should contribute to creating places within the UPA by working with existing topography and site features, responding to the local context, and reinforcing the compact walkable character, rather than simply attempting to place suburban design onto the urban landscape.

The goals of the UPA Design Guidelines are to:

- Promote accessibility and establish links to transit,
- Promote walkability,
- Encourage human activity between buildings and streets,
- Establish “human scale” of buildings at street level (first floor of a multi-story building),
- Create visually compatible buildings and site designs that use building form, materials, fenestration, repetition, rhythm, color, and architectural variety to foster the blending of form, volumes, textures, and colors in the various neighborhoods,
- Create inviting spaces for varied activities, and
- Create a sense of place and uniqueness.

(See Appendix A for Design Guidelines for the UPA)

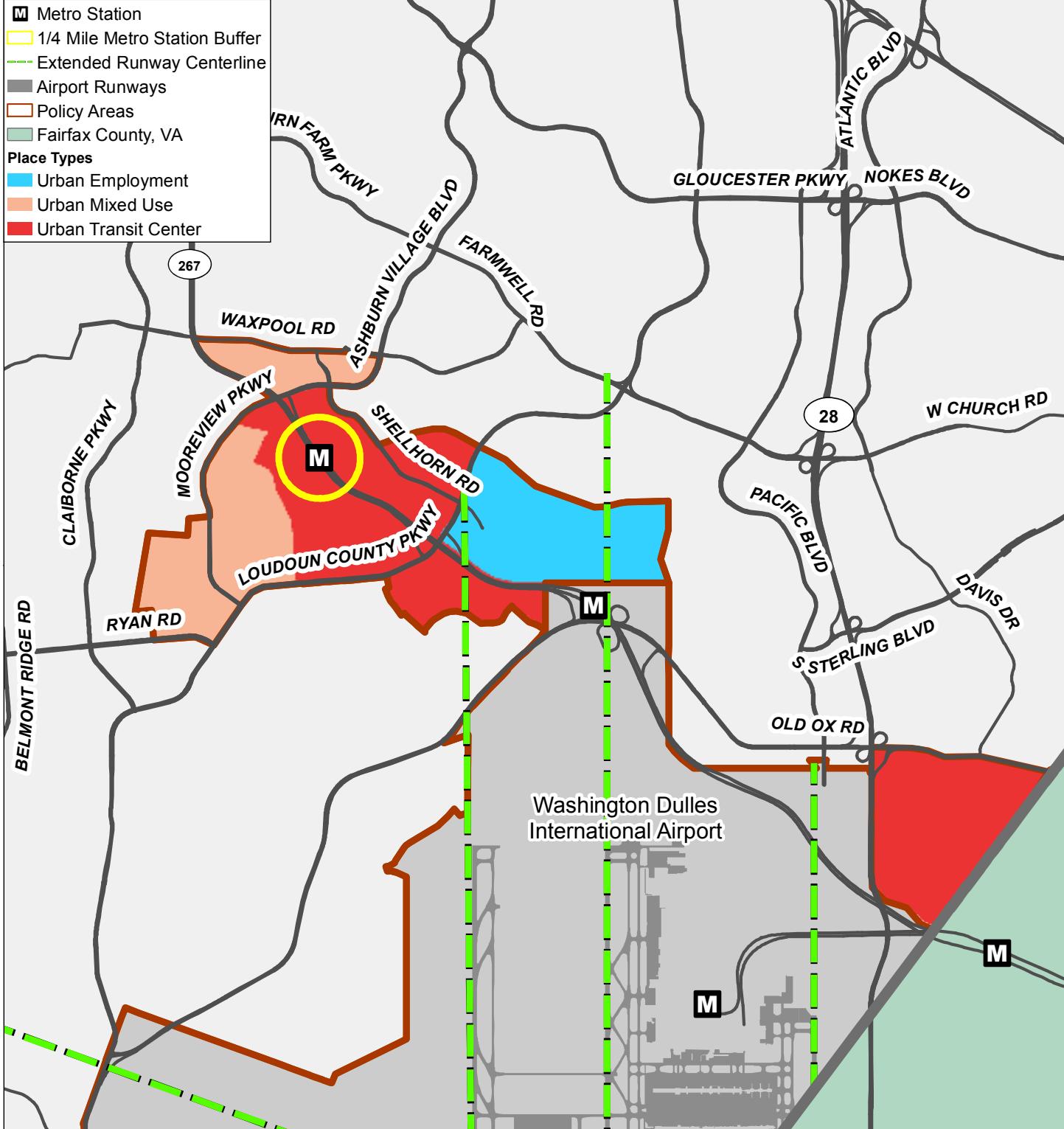
Place Types

As described in the beginning of this chapter, the following Place Types have been designated for specific locations as displayed on the accompanying map. The Place Types will work in concert with the Design Guidelines and Policies, Strategies, and Actions of the UPA to fulfill the land use patterns and community characteristics intended for the area.

Loudoun County
Urban Policy Areas

Place Types

2019 General Plan



Loudoun County IS NOT LIABLE for any use or reliance upon this map or any information contained herein. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for use of any purpose.

0 0.25 0.5 1 1.5 2 Miles

Map Number 2018-150

CHAPTER 2-31

Urban Transit Center



Urban Transit Center areas take advantage of proximity to transit to provide opportunities for dense urban development and a host of economic, entertainment, and community activities. Each area serves as a gateway to the County from the greater region and as a major destination in its own right. The Urban Transit Center has two focus areas: within $\frac{1}{4}$ mile of the Metrorail Station and outside of $\frac{1}{4}$ mile. Development within a $\frac{1}{4}$ mile of the station will have smaller average unit sizes, a higher minimum FAR, and a more equal mix of residential and non-residential development. Multifamily Residential is the only residential use listed for this place type and is envisioned only as apartments and residential condominiums.

Core Uses	Complementary Uses	Conditional Uses												
<ul style="list-style-type: none"> • Multifamily Residential • Office • Retail & Service Commercial <p>*Residential restrictions in noise-sensitive areas located within 65 Ldn noise contours</p>	<ul style="list-style-type: none"> • Entertainment Commercial • Civic, Cultural, & Community • Public Facilities 	<ul style="list-style-type: none"> • Sports Arena/Training Facility • Conference Center • Full Service Hotel • Institutional • Special Activities • Parks & Recreation 												
Preferred Mix of Uses														
<p>Within $\frac{1}{4}$ Mile</p> <table> <tr> <td>Possible Ranges:</td> <td> <ul style="list-style-type: none"> • Res: 40-60% • Non-Res: 40-60% • Public/Civic: 5%+ </td> </tr> </table>		Possible Ranges:	<ul style="list-style-type: none"> • Res: 40-60% • Non-Res: 40-60% • Public/Civic: 5%+ 	Outside $\frac{1}{4}$ Mile										
Possible Ranges:	<ul style="list-style-type: none"> • Res: 40-60% • Non-Res: 40-60% • Public/Civic: 5%+ 													
<table> <tr> <td>Residential</td> <td>50%</td> </tr> <tr> <td>Non Residential</td> <td>45%</td> </tr> <tr> <td>Public/Civic</td> <td>5%</td> </tr> </table>		Residential	50%	Non Residential	45%	Public/Civic	5%	<table> <tr> <td>Residential</td> <td>70%</td> </tr> <tr> <td>Non Residential</td> <td>25%</td> </tr> <tr> <td>Public/Civic</td> <td>5%</td> </tr> </table>	Residential	70%	Non Residential	25%	Public/Civic	5%
Residential	50%													
Non Residential	45%													
Public/Civic	5%													
Residential	70%													
Non Residential	25%													
Public/Civic	5%													

DESIGN CHARACTERISTICS

Context

Vertically mixed-use buildings that are integrated in a walkable street pattern around the Metro station.

Street Pattern:

Gridiron

Block Length:

Within ¼ Mile: 200-400 feet*

Outside ¼ Mile: 200-660 feet*

*When measuring block lengths, pedestrian walkways through the development will be used to mark the start or terminus of a block

Building Setback:

None to shallow

Parking:

Structured, on-street, accessory, short-term, alley-oriented

Design Amenities:

Sidewalks, street trees, street furniture, shade trees, bike racks, lighting, crosswalks, plazas, pedestrian malls, network of green space, public art

Open Space:

10% of the site - Recreational (Active & smaller scale Passive), Community, and/or Natural, Environmental, and Heritage



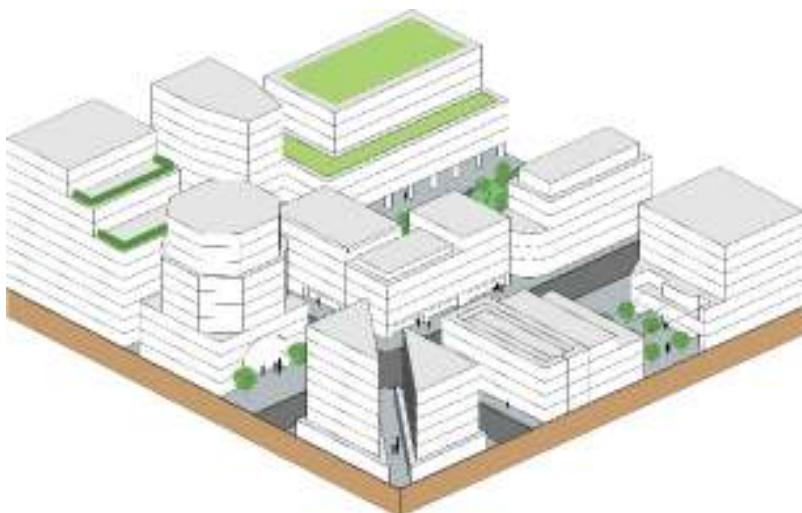
An example plan view of Urban Transit Center

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Within ¼ Mile

Total FAR: Minimum 2.0



USE	Number of Stories (Average height is 12 feet)
Multi-Family Residential	8+
Office	8+
Retail & Service Commercial	8+

*Buildings must not adversely affect airport operations. Maximum building heights must not create flight obstructions or otherwise impede flight operations at Dulles Airport.

Outside ¼ Mile

Total FAR: Minimum 1.4



USE	Number of Stories (Average height is 12 feet)
Multi-Family Residential	6+
Office	6+
Retail & Service Commercial	6+

*Buildings must not adversely affect airport operations. Maximum building heights must not create flight obstructions or otherwise impede flight operations at Dulles Airport.

Transition

Given the small block sizes and mix of different uses, transitions between uses and developments are critically important in the Urban Transit Center Place Type. Development should transition from eight stories or more near the Metrorail Station to six or more stories outside of the ¼ mile. Development outside of the ¼ mile of the station may have a lower FAR minimum and lower building height minimum when considered as a transition area between existing residential neighborhoods and sites proposed for redevelopment. Changes in height or building character, where allowed, should occur mid-block to promote balanced streetwalls where both sides of the street appear similar in height. Larger developments near smaller residential dwellings should step down appropriately to respect these neighbors.

Urban Mixed Use



Urban Mixed Use areas take advantage of their fringe proximity to the Metro stations to provide opportunities for dense urban residential development with a mix of commercial uses. The Urban Mixed Use areas will develop as high-density walkable urban neighborhoods that encourage social connections because their mix of uses, multimodal infrastructure, and public spaces create vibrant public realms.

Urban Mixed Use areas provide opportunities for a mix of housing types that meet the housing needs for all ages, abilities, and socioeconomic groups. Multifamily residences, townhouses, duplexes, triplexes, quadruplexes, and small-lot patio homes are designed to fit within or adjacent to a traditional single-family style neighborhood. Accessory residential units are also appropriate for the area and may consist of apartments in the principal structure, garage apartments, or other outbuildings approved by the County. Development will have slightly larger average unit sizes than in the Urban Transit Center and a large amount of residential development. Small scale office, retail, and service uses should be integrated into the neighborhood.

Core Uses	Complementary Uses	Conditional Uses								
<ul style="list-style-type: none"> Multifamily Residential Single Family Attached Residential <p>*Residential restrictions in noise-sensitive areas located within 65 Ldn noise contours</p>	<ul style="list-style-type: none"> Office Retail & Service Commercial Active Adult Retirement Communities Civic, Cultural, & Community Institutional Entertainment Commercial 	<ul style="list-style-type: none"> Public Facilities Accessory Residential Units Small Lot Single Family Detached Residential Special Activities Parks & Recreation 								
Preferred Mix of Uses										
<p>Possible Ranges:</p> <ul style="list-style-type: none"> Res: 70-90% Non-Res: 10-30% Public/Civic: 5%+ <table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>80%</td> </tr> <tr> <td>Non Residential</td> <td>15%</td> </tr> <tr> <td>Public/Civic</td> <td>5%</td> </tr> </tbody> </table>			Category	Percentage	Residential	80%	Non Residential	15%	Public/Civic	5%
Category	Percentage									
Residential	80%									
Non Residential	15%									
Public/Civic	5%									

This Place Type encompasses a wide array of commercial designs that create a unique sense of place and complement surrounding developments. Urban Mixed Use developments are oriented toward the street, and those with larger format retail commercial establishments should also include smaller commercial establishments without substantial surface parking lots. These developments should be designed to provide direct access to adjacent neighborhoods with which they blend seamlessly. Parking should be predominantly structured with accommodations for on-street parking and limited surface lots.

DESIGN CHARACTERISTICS

Context

Vertically mixed use buildings as well as multi-story single-use buildings that are integrated in a walkable street pattern in the fringe of the Metro station area.

Street Pattern:

Rectilinear, Gridiron

Block Length:

200-660 feet

Building Setback:

Shallow setbacks at sidewalks, Residential can be setback near sidewalk

Parking:

Structured, on-street, accessory, short-term, alley-oriented parking

Design Amenities:

Sidewalks, street trees, street furniture, shade trees, bike racks, lighting, crosswalks, plazas, pedestrian malls, network of green space, public art

Open Space:

10% of the site - Recreational (Passive, Active-dog parks, tennis or basketball courts, tot lots), Community, and/or Natural, Environmental, and Heritage



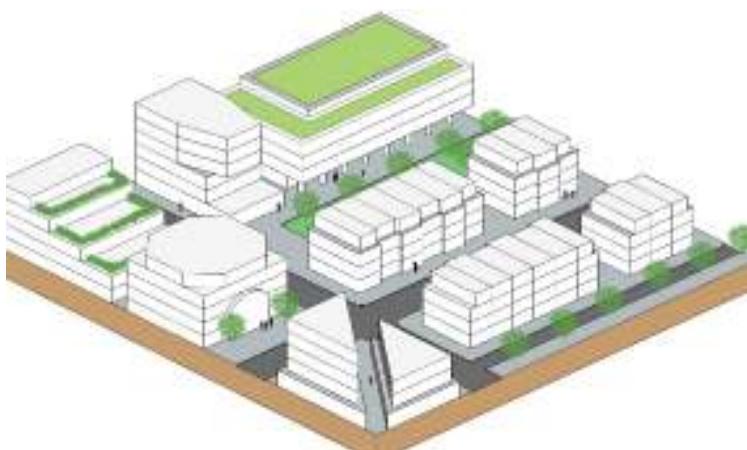
An example plan view of Urban Mixed Use

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total FAR: Maximum 1.5*

*Additional density (up to 2.0 FAR) may be achieved through the provision of one or more of the following project elements that go above and beyond required development standards to further the County's comprehensive planning goals: affordable housing units, building techniques that exceed industry energy efficiency standards, additional community amenities and pedestrian connections, and/or beneficial revitalization/redevelopment in priority areas.



USE	Number of Stories
Multi-Family Residential	4-8
Single Family Attached	2-4
Office	4-8
Retail & Service Commercial	4-8

Transition

Small block sizes and a mix of different uses make transitions between uses and developments important in the Urban Mixed Use Place Type. Changes in height or building character, where allowed, should occur mid-block to promote balanced streetwalls where both sides of the street appear similar in height. Larger developments near smaller residential dwellings should step down appropriately to respect these neighbors. Developments should transition from taller buildings at the center to heights generally no more than a story taller than adjoining adjacent development consisting of less intensive uses. The predominant residential use type is multi-family and single family attached; however, a very limited portion of the development within the Urban Mixed Use Place Type may be developed with small-lot single family detached residential as a transitional use between Place Types.

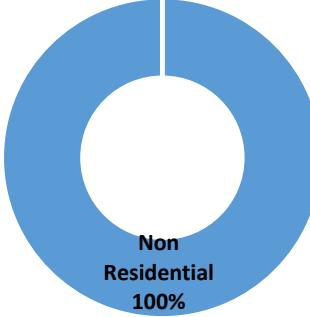
Urban Employment



Urban Employment areas provide opportunities for a broad array of employment uses within an environment that provides gathering spaces and opportunities for synergies among businesses. These offer prime locations for office and flex space uses as well as startups and established businesses. Appropriate uses do not generate excessive noise or air pollutants or require outdoor storage. First floor retail that supports predominant uses is appropriate.

Parking should generally be located behind the building to ensure that buildings are the predominant visual feature when viewed from roadways and adjacent properties.

Although civic or recreation space is not expected, required open space in Urban Employment developments should include areas for use by customers and employees.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Office • Research & Development • Data Centers 	<ul style="list-style-type: none"> • Retail & Service Commercial • Entertainment Commercial 	<ul style="list-style-type: none"> • Flex Space • Institutional • Civic, Cultural & Community • Public Facilities • Special Activities • Parks & Recreation
Preferred Mix of Uses		
<div style="text-align: center;">  Possible Ranges: <ul style="list-style-type: none"> • Res: 0% • Non-Res: Up to 100% • Public/Civic: 0%+ </div>		

DESIGN CHARACTERISTICS

Context:

Separate and mixed employment uses that are integrated within a walkable, employment-based environment.

Street Pattern:

Rectilinear, Gridiron

Block Length:

300-800 feet

Building Setback:

Short to medium

Parking:

Structured, on-street, accessory, or short-term

Design Amenities:

Sidewalks, street trees, shade trees, bike racks

Open Space:

10% of the site - Recreational (trails), Community (outdoor seating, plazas, gardens, public art), and/or Natural, Environmental, and Heritage

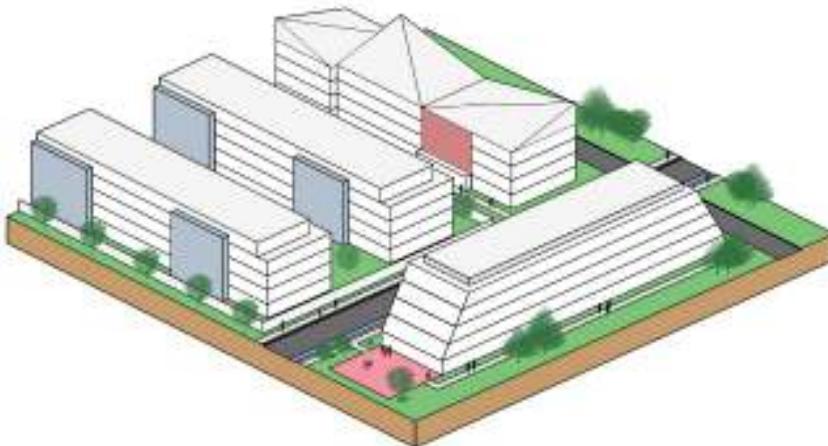
Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total FAR: Min. 1.0

Building Height: 3 to 8 stories

(Average story height is 12 feet)



Transition

Transitions between Urban Employment uses and other developments, adjacent residential neighborhoods in particular, are vitally important. In Urban Employment areas that adjoin less intensive uses, building heights should transition by stepping down from the center of the more intensive development, to heights that are generally within one story of structures in the less intensive development.

Suburban Policy Area

Vision

The Suburban Policy Area (SPA) contains self-sustaining communities where one can live, work, learn, and play. The SPA will have a mix of residential, commercial, and employment uses; a full complement of public services and facilities; amenities that support a high quality of life; and a design that incorporates a holistic approach to maintaining and improving community character through compatible development.

Introduction

The 48,000-acre SPA is located in the easternmost portion of the County, in close proximity to the job centers and activity areas located east of Loudoun. The Suburban Policy Area is defined on the north by the Potomac River and on the south by Braddock Road. Its eastern edge is the Fairfax County line, and its western edge begins at the Potomac River and follows a southerly path along the Goose Creek just east of Leesburg, the Goose Creek and Beaverdam Reservoirs, and a combination of property lines, roads, and power line easements. The earliest planned development occurred within the Potomac and Sterling communities during the 1960s signaling the beginning of the transformation of eastern Loudoun County from farmland with a centuries old rural heritage to the suburban area that it is today.

The SPA is designated as one of the growth areas of the County and has accommodated most of the residential and commercial development over the past decades due to the presence of central water and sewer utilities and an expanded road network. Two major events helped to open the SPA to residential development: 1) the construction of Washington Dulles International Airport, and 2) the construction of a major sewer line that accommodated the airport and improvements to Route 7 and Route 28.



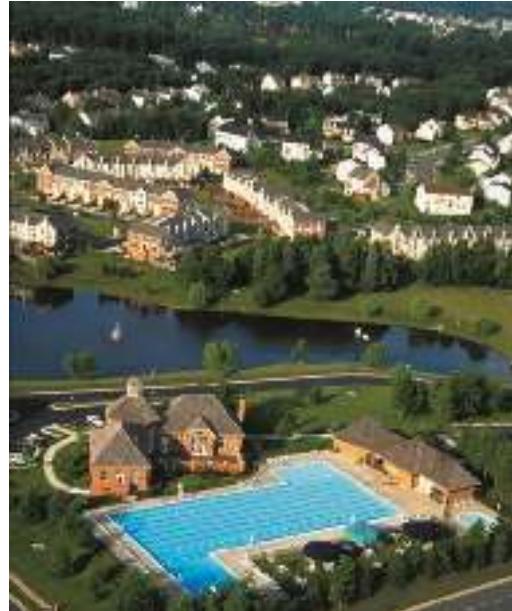
Washington Dulles International Airport

Route 7 and Route 28 have evolved into critical transportation corridors that are contributing to Loudoun County's reputation as an international center for technology, communications, and global data management sectors. Given its connection to the Washington Dulles International Airport, Route 28 continues to play a major economic role for Loudoun County as a key location for on-going development. The County is committed to the continuing growth of and need for an economically vibrant Route 28 corridor, and the [Route 28 Highway Transportation Improvement District](#), aids in accomplishing this goal by levying additional tax assessments on commercial and industrial properties to finance transportation improvements to Route 28. Additionally, the SPA surrounds the Urban Policy Area near the Silver Line Metro Stations that will include new dense, urban, transit-oriented types of development.

Background

The SPA consists of a mix of commercial areas and neighborhoods that provide a broad range of quality environments. The commercial areas of the SPA are focused areas for employment uses within a variety of commercial and workplace environments, including traditional office and industrial parks, mixed use centers, and neighborhood-serving commercial centers.

Residential neighborhoods in the eastern corner of the County were built between 1960 and 1990, while neighborhoods built in the western area of the SPA were built in the early 1990s or later. The older neighborhoods commonly reflect the housing styles and neighborhood designs that were prominent in the era they were developed and provide a more limited mix of housing types (primarily single-family) while relying on neighborhood commercial developments located on major roads like Route 7 for easy access to amenities. The master planned developments west of Route 28 include a variety of housing types organized around neighborhood centers designed as the focal point of the community and provide easy access to daily needs. Parks, greenways, and open space frame developments and link neighborhood residents to nature, neighborhood destinations, and beyond in both the western and eastern neighborhoods.



Suburban Neighborhood

Development Approach

The County will focus efforts on fostering and maintaining community identity within the SPA and its communities. The SPA is not and should not be one homogenous area. Many existing neighborhoods in Eastern Loudoun are becoming increasingly diverse, bringing a new set of expectations and attitudes to these communities. As new development continues in this area, the roads are becoming increasingly congested, and the lack of transit access and safe pedestrian connections is a mounting concern. Continuing the County's goal to create communities with unique community visions would help identify and strengthen the creation of distinct places within the SPA; ensure that they are well designed and serviced; and that they provide diverse and stimulating social, cultural, recreational, and livable environments for their residents. Policies below address ways to improve livability through: 1) protecting and enhancing elements of Natural, Environmental, and Heritage Resources, including open space and pedestrian connections; 2) ensuring compatible and complementary infill development; and 3) reinvesting in existing neighborhoods in a way that protects and enhances our existing communities. The concept of creating Community Plans is one that offers tremendous potential to ensure that the vision of the SPA is fully achieved and to guide the remaining build-out of each area.

Rapid growth in the County, with the majority occurring in the SPA, has increased development pressure outside of the SPA. Today there is little undeveloped land remaining in the SPA as most

land has already been developed or is approved for development. With limited developable land in this area, the County is at a juncture in its planning efforts for greenfield development. Redevelopment and infill will soon begin to play an increasing role in development decisions within the SPA, which will mark a significant shift in the county's planning and development activities (see the Infill and Redevelopment section). Because much of the SPA is currently developed, most new projects will be smaller in scope and need to be evaluated based on how they can be integrated into the surrounding community. The amount of limited land available and the added growth from redevelopment and infill will make adding public facilities to the SPA a challenge. Public facility standards may need to change to continue to adequately address the needs of the population. As the primary location for suburban-scale residential and nonresidential development, the manner of growth and redevelopment in the SPA is of vital importance.

The demographic, market and land use trends of the past decades have led to greater demand for mixed-use and urban environments. National trends show that changes in typical households (for example millennials, seniors, empty nesters) may demand different housing types, public services, and lifestyle options than provided in the past. To attract top talent, many employers are focusing on employee satisfaction when considering locations and designs of office space. Employers in professional services, technology, and innovation sectors are shifting away from traditional suburban offices towards urban “live, work, learn, play” environments to enhance quality of life. While the County previously established an overall land-development strategy that encouraged compact, mixed-use development providing people with the opportunity to live, work, learn, recreate, and shop in a pedestrian-friendly environment, the development that has occurred in Loudoun has largely remained single-use and automobile-oriented.



Mixed Use Development

Loudoun County continues to be an attractive place for residential development given its geographic location in the region, school system performance, and notable quality of life measures. Demand for residential product will need to meet a wide variety of preferences, driven by attractiveness for families, young adults forming new households, and downsizing occurring in the Baby Boomer generation. Demand for non-residential development will be driven by the addition of new households, the County's assets, infrastructure, and the County's technology sector. Retail users will

follow new residential development, seeking locations that offer accessibility and visibility to an expanding customer base. Other employers seeking office and industrial space will locate in areas that serve their target needs.

The County previously designated land along its primary transportation corridors for “Keynote Employment” areas to provide locations for corporate campus style office development; however,

new suburban-style office developments are no longer envisioned in these areas due to declining demand and concerns about the sustainability of single-use development patterns.

It is expected that mixed-use developments will be the most attractive environments for retail and office uses in the coming years. To provide alternative means of addressing office development and land uses along Route 7, Loudoun County Parkway, and Route 28, this Plan replaces the “Keynote Employment” planned land use designation with a number of designations. To continue to maximize the commercial development potential within the Route 28 corridor, the Suburban Employment and Suburban Mixed Use Place Type designations offer planned land uses that reflect the full economic potential of properties and provide employment settings that reflect the kind of environments sought by business users.

Changes in technology over the past decade have contributed to the escalated development of data centers within the County. To date, there are approximately seventeen million square feet of data center facilities completed, under construction, or planned. Future demand for data centers will need to be accommodated in places that have access to utilities, including electricity, water, and fiber. The supply of industrial and flex space is being outpaced by demand, resulting in low vacancy rates. As available greenfield sites in eastern Loudoun County become more limited, targeting key tracts of land for employment uses will be critical to ensure future economic growth.

The Suburban Employment and Suburban Industrial/Mineral Extraction Place Type designations provide guidance to develop a pattern of office, commercial, and industrial uses by allocating sufficient land for all employment in an amount which realistically anticipates market demands and provides the necessary services to support their development. While industrial and certain commercial uses are not typically an integral part of a mixed-use development, they offer employment opportunities to residents of the County and should be designed as independent developments that achieve the goal of creating thriving areas of commerce which are characterized by convenient access to transportation, an attractive appearance, and compatibility with adjacent land uses.

Overall, the County’s approach is to ensure that future development is complementary to the existing development pattern of the SPA while supporting the necessary flexibility in form and use that will be needed to create vibrant mixed-use environments and maintain the supporting



Community Character

Community character is the aggregate of features and traits that form the individual nature and uniqueness of a community. It includes the constructed and natural landmarks and surroundings that cause someone to identify with a particular place or community. This character is shaped by natural, cultural, societal, historic, and economic forces.



employment areas. As each new development is absorbed into the SPA's built environment, it will be viewed in the context of the larger community with an emphasis placed on the character of the development and how it contributes to the needs and overall identity of the SPA and Loudoun County.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply only within the SPA.

SPA Policy I: Foster community identity within the Suburban Policy Area.

Strategy

- 1.1. Create new Community Plans and other appropriate plans that address the particular needs and guide the remaining build-out, reinvestment, and/or redevelopment of specific areas within the Suburban Policy Area, particularly federally designated Opportunity Zones.

Actions

- A. Establish design principles for individual communities within the Suburban Policy Area which ensure a high quality of development and redevelopment is achieved.
- B. Ensure development and redevelopment proposals conform to the applicable Design Guidelines of this plan.
- C. Use the Infill and Redevelopment polices to maintain neighborhood vitality, reinvest in underused areas, and facilitate complete, connected, and distinct communities.
- D. Identify and protect environmental features and design developments to follow, to the extent possible, the natural topography.
- E. Promote a natural, environmental, and heritage resources approach to residential and commercial place types.

Strategy

- 1.2. Integrate new development within the Suburban Policy Area with the existing development pattern that surrounds it.

Action

- A. Evaluate the appropriateness of a proposed use or development with the surrounding community.

Strategy

- 1.3. Design and develop Suburban Policy Area communities as walkable and interconnected places.

Actions

- A. The County, in collaboration with other governmental agencies and the private sector, will ensure through a variety of measures that all public spaces in residential and commercial areas are accessible by pedestrians.

- B. Retail and office development proposals will combine open and civic space in features such as pedestrian promenades and plazas, public art, entrance features, linear parks and trails, outdoor seating, lawns and greens, and similar design features that invite pedestrian activity.
- C. Require convenient access by foot and bicycle for residential, office, institutional, civic, and retail areas. Areas including light and heavy industrial uses will be evaluated on the appropriateness of access by foot and bicycle due to security and/or public safety issues.
- D. The *Loudoun County 2019 Countywide Transportation Plan* provides additional transportation policy direction for the transportation network (walkability, multimodal, connectivity) in the Suburban Policy Area.

SPA Policy 2: Create environments where individuals can work, live, learn, and have convenient access to services, shops, and recreation.

Strategy

- 2.1. Allow a mix of uses or uses that complement and complete existing communities.

Actions

- A. Provide incentives for redevelopment, infill development, and adaptive reuse projects that will enhance quality of life and neighborhood character, fulfill community needs, and improve economic opportunities (see Infill and Redevelopment section).
- B. Allow new multi-family residential units to be located within existing commercial centers to allow for more walkable, mixed use communities.
- C. Promote residential and office uses above first floor retail.
- D. Allow flexibility in the development phasing for mixed-use projects while establishing a build-out relationship between the residential and non-residential components that ensures a mix of uses is achieved and to best balance the fiscal costs and benefits of the project.
- E. Promote high quality site and building design, landscape design and buffering in employment areas that reflect their function as a gateway to the Urban Policy Areas and location along major vehicular thoroughfares (see Quality Development section).
- F. Accommodate transit infrastructure in Employment and Mixed Use Areas (see *Loudoun County 2019 Countywide Transportation Plan*).



- G. Provide pedestrian and bicycle connectivity to surrounding networks and transit nodes within employment areas.
- H. Create a regulatory framework that limits bed count and/or square footage of new housing to achieve affordability by design.
- I. Consider allowing limited areas otherwise designated as the Suburban Neighborhood or Suburban Mixed Use place type to develop according to the Suburban Compact Neighborhood place type if the following criteria are satisfied:
 - i. The proposal includes housing units that address unmet housing needs that exceed the applicable regulatory requirements;
 - ii. The site is located at the periphery of a mixed use development or along a major transportation corridor;
 - iii. Transit options are available within the direct vicinity;
 - iv. The site is proximate to employment options and a complementary mix of uses (e.g., neighborhood serving retail and services);
 - v. The site is proximate to public facilities with existing or planned capacity to serve the proposed development;
 - vi. The proposal conforms to the transition techniques and guidelines of the originally designated place type and any adjacent place types; and
 - vii. The proposal demonstrates innovation in design, including techniques that result in a perceived density that complements the scale of the surrounding built environment.

SPA Policy 3: Support the Route 28 Highway Transportation Improvement District, established by the State as a means of providing additional local revenue to pay for improvements to Route 28.

Strategy

- 3.1. Ensure protection of the [Route 28 Highway Transportation Improvement District](#) as an important economic key of attracting major national and international corporations, and ensuring the long-term viability of Washington Dulles International Airport.

Actions

- A. Encourage non-residential development within the Route 28 Highway Transportation Improvement District.
- B. Limit residential development in the Route 28 Highway Transportation Improvement District except when allowing residential units will directly catalyze the commercial development potential of land in the District and result in an overall positive fiscal impact to the County's Route 28 Highway Transportation Improvement District debt obligations.
- C. Consider residential development on a case by case basis that results in a net positive impact to the County

- D. Establish an “opt-in” period to encourage owners of property in the Route 28 Highway Transportation Improvement District to opt into the updated/new Loudoun County Zoning Ordinance that is planned to be adopted to implement the *Loudoun County 2019 Comprehensive Plan*.

Design Guidelines

The Design Guidelines are to build upon our current development patterns in a manner that allows innovative design and new responses to the market. The design guidelines are not meant to be prescriptive and are not intended to be treated as a checklist, but are instead meant to provide a framework for how the desired character of the SPA can be achieved, with the acknowledgement that other methods could achieve the intended results. The Design Guidelines do not supersede or otherwise limit the application of adopted zoning regulations, ordinances, building codes, proffers or any other design standards or regulations administered by Loudoun County.

The goals of the SPA Design Guidelines are to:

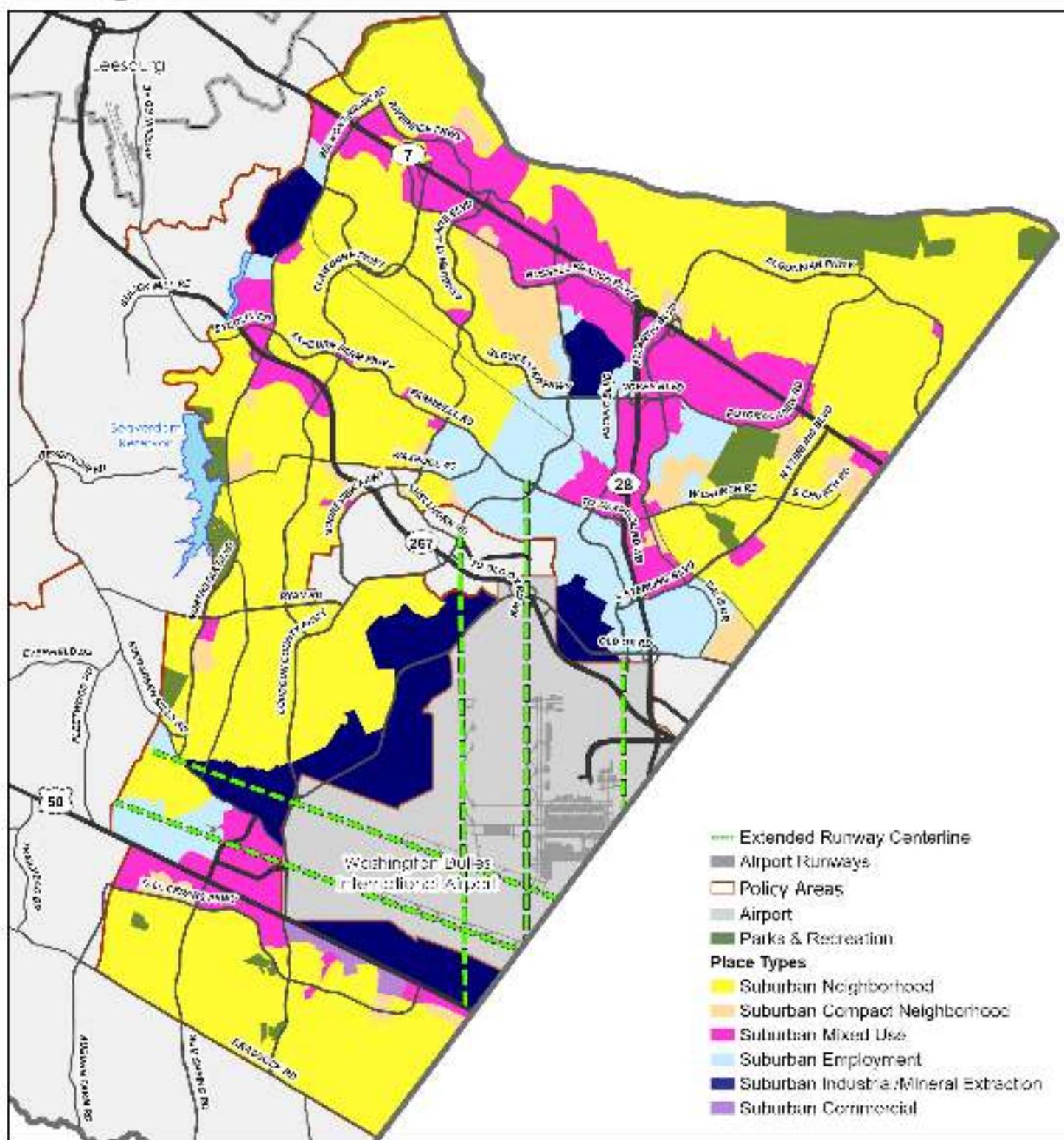
- Create visually interesting and compatible buildings and site designs that use building forms, materials, fenestration, repetition, rhythm, color, and architectural variety resulting in blends of form, volumes, textures, and colors in the various neighborhoods;
- Create inviting spaces for varied activity; and
- Create a sense of place and uniqueness.

When using the guidelines make sure to analyze the impact a potential development may have on the urbanizing landscape, considering not only appearance, but practical considerations - such as proximity and quality of connections to community amenities, jobs, and housing to maximize the use of existing infrastructure and limit travel distances. The County encourages the use of a design process when planning development in the SPA that conserves natural, environmental, and heritage resources and incorporates any such features into the site design. Development should contribute to creating unique places within the Suburban Policy Area by working with existing topography and site features, responding to the local context, and reinforcing the regional character. Sustainability requires maximum consideration for using the landscape for benefits like solar heat gain or shelter from wind, as well as building designs that incorporate energy efficient and green building technologies. The bulk of the design should be consistent with the function of the development. (See Appendix A for Development Criteria and Design Guidelines for the SPA)

Place Types

As described in the beginning of this chapter, the following Place Types have been designated for specific locations as displayed on the accompanying map. The Place Types will work in concert with the Design Guidelines and Policies, Strategies, and Actions of the SPA to fulfill the land use patterns and community characteristics intended for the area.

Gaithersburg
Suburban Policy Area
Place Types
2019 Census Data



Gaithersburg Suburban Policy Area
This map displays the Suburban Policy Area of Gaithersburg, Maryland, as defined by the County's 2019 Census data. The boundaries of the Suburban Policy Area are indicated by the black line on the map. The map shows the locations of various place types, including Suburban Neighborhoods, Suburban Compact Neighborhoods, Suburban Mixed Use, Suburban Employment, Suburban Industrial/Mineral Extraction, and Suburban Commercial. The map also shows major roads such as MD 355, MD 28, and I-270, as well as the Washington Dulles International Airport. A green dashed line represents the Extended Runway Centerline, and a grey shaded area represents the Airport Runways. The map also shows Policy Areas, an Airport, and Parks & Recreation areas.

0 0.5 1 2 3 4 Miles
Page Number 2023-027

Suburban Neighborhood



Suburban Neighborhood areas include Loudoun's master planned neighborhoods of predominantly residential uses arranged on medium-to-large lots. Accessory residential units can be appropriate for the area and may consist of apartments in the principal structure, garage apartments, or other outbuildings approved by the County. Retail and service uses that serve the routine shopping needs of the immediate neighborhood (e.g., grocery stores, gas stations, drive-throughs, drycleaners, etc.) should be integrated into the area at significant intersections and along major roads.

Limited areas otherwise designated as Suburban Neighborhood on the Place Type map may be allowed to develop according to the Suburban Compact Neighborhood Place Type if the locational and design criteria of SPA Action 2.1.I are satisfied.

Core Uses	Complementary Uses	Conditional Uses								
<ul style="list-style-type: none"> Single Family Detached Residential Single Family Attached Residential Civic, Cultural, & Community 	<ul style="list-style-type: none"> Retail & Service Commercial Active Adult Retirement Communities Multi-Family Residential Accessory Residential Units 	<ul style="list-style-type: none"> Office Public Facilities Special Activities Parks & Recreation 								
Preferred Mix of Uses										
<table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>80%</td> </tr> <tr> <td>Non-Residential</td> <td>10%</td> </tr> <tr> <td>Public/Civic</td> <td>10%</td> </tr> </tbody> </table> <p>Possible Ranges:</p> <ul style="list-style-type: none"> Res: 75-90% Non-Res: 0-15% Public/Civic: 10%+ 			Category	Percentage	Residential	80%	Non-Residential	10%	Public/Civic	10%
Category	Percentage									
Residential	80%									
Non-Residential	10%									
Public/Civic	10%									

DESIGN CHARACTERISTICS

Context

Primarily single family detached and attached residential uses that are integrated in a walkable street pattern.

Street Pattern:

Fragmented Parallel, limited Loop and Cul-de-sac

Block Length:

600-1,500 feet

Building Setback:

Shallow to medium

Parking:

Driveway, garage, or on-street

Design Amenities:

Sidewalks, street trees, lighting, crosswalks, common open spaces

Retail and Service:

Neighborhood - individual uses under 5,000 or small center up to 30,000 square feet

Community- individual uses under 30,000 or center between 30,000-150,000 square feet

Open Space:

30% of the site- Recreational (active and passive), Community, and/or Natural, Environmental, and Heritage



An example plan view of a Suburban Neighborhood

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: Up to 4 du/ac; Up to 6 du/ac for infill development

Non-Residential FAR: Up to 1.0

Building Height: Up to 4 Stories



Transition

Transitions should be gradual, particularly where natural or man-made buffers are not available. New developments within Suburban Neighborhood areas adjacent to lower-density residential uses should create transitions in building scale and incorporate design elements that soften those transitions. Higher-density residential development can serve as a transitional land use between nonresidential uses and lower-density residential areas. Appropriate transitional techniques include variations in building orientation, height step down, and creative and extensive use of landscaping and natural features. Fencing or other barriers should not be used as the sole means of screening and buffering.



Suburban Compact Neighborhood



Suburban Compact Neighborhood areas provide opportunities to develop neighborhoods that can take advantage of small infill parcels near traditional suburban neighborhoods or high-density walkable urban neighborhoods, depending on the context of their location. They provide opportunities for a mix of housing types including small-lot patio homes, townhomes, duplexes, and multifamily residences. Accessory residential units are also appropriate for these areas and may consist of apartments in the principal structure, garage apartments, or other outbuildings approved by the County. Open space areas such as parks, trails, community courtyards, and small public plazas should be integrated into individual site plans. Small-scale offices as well as retail and service uses serving the immediate or routine shopping needs of the immediate neighborhood (e.g., grocery stores, drycleaners, etc.) could be integrated into these neighborhoods. Auto-oriented uses, such as gas stations, car washes, and drive-throughs, would be located along streets primarily designed for the automobile. Development within this Place Type should include a public and civic component or be located within walking distance of public and civic amenities.

Core Uses	Complementary Uses	Conditional Uses		
<ul style="list-style-type: none"> Single Family Attached Residential Single Family Detached Residential Multi-Family Residential 	<ul style="list-style-type: none"> Active Adult Retirement Communities Accessory Residential Units Retail & Service Commercial 	<ul style="list-style-type: none"> Office Civic, Cultural, & Community Public Facilities Special Activities Parks & Recreation 		
Preferred Mix of Uses				
<table border="1"> <tr> <td>Non Residential 10%</td> <td>Residential 90%</td> </tr> </table>			Non Residential 10%	Residential 90%
Non Residential 10%	Residential 90%			
Possible Ranges: <ul style="list-style-type: none"> Res: 85-100% Non-Res: 0-15% Public/Civic: 0%+ 				

DESIGN CHARACTERISTICS

Context

Compact residential development providing opportunities for a variety of unit types that can be designed to fit within or adjacent to surrounding neighborhoods.

Street Pattern:

Rectilinear Grid

Block Length:

200-660 feet

Building Setback:

Shallow setbacks

Parking:

On-street, accessory, alley-oriented parking

Design Amenities:

Sidewalks, street and shade trees, lighting, street furniture, bike racks, crosswalks

Retail and Service:

Neighborhood - individual uses under 5,000 or small center up to 30,000 square feet

Community- individual uses under 30,000 or center between 30,000-150,000 square feet

Open Space:

15% of the site-Recreational (Passive and Active), Community, and/or Natural, Environmental, and Heritage



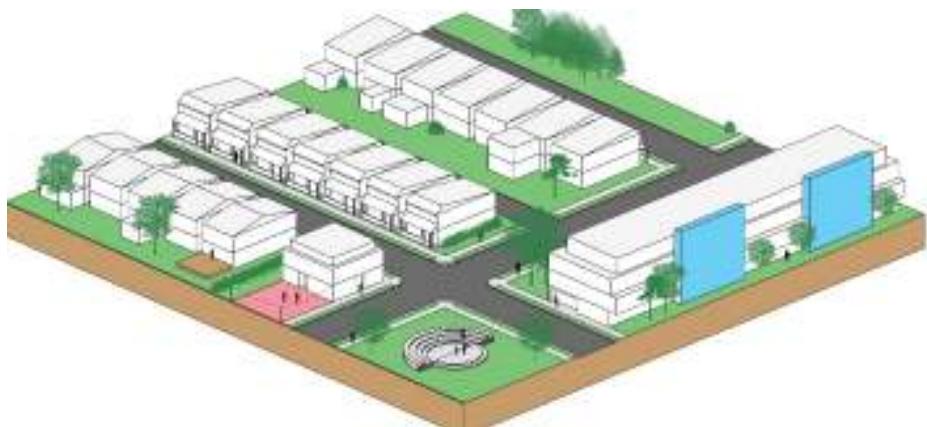
An example plan view of a Suburban Compact Neighborhood

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: 8-24 du/ac
Building Height: Up to 4 stories

Total Nonresidential FAR: Up to 1.0



Transition

Appropriate transitional methods should be implemented where new development abuts more intensive nonresidential uses or less intensive residential uses. New high-density and large-scale infill within Suburban Compact Neighborhood areas adjacent to lower density residential uses should create transitions in building scale and incorporate design elements that soften those transitions. Appropriate transitional techniques include variations in building orientation, height step-down, and creative and extensive use of landscaping and natural features.



Suburban Mixed Use

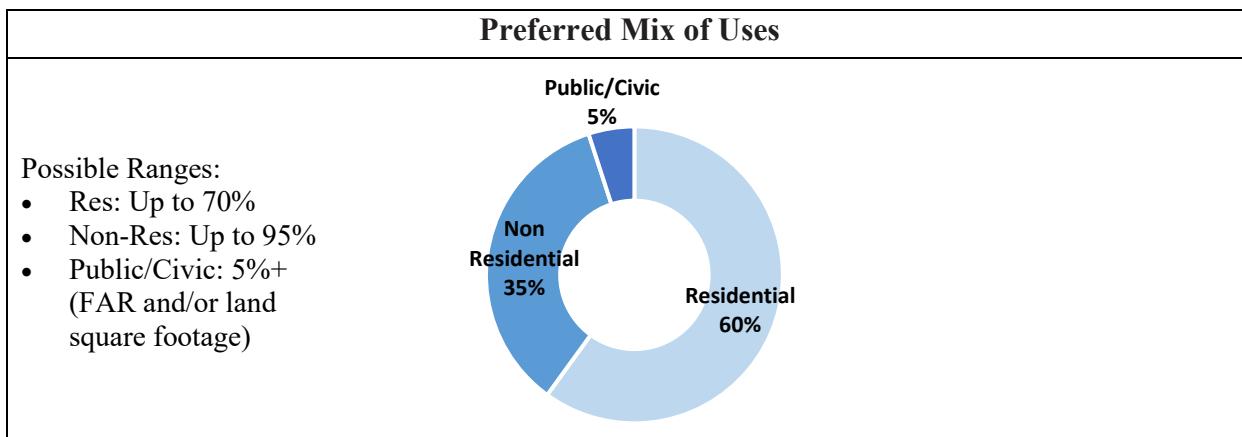


Suburban Mixed Use areas provide compact, pedestrian-oriented environments with opportunities for a mix of residential, commercial, entertainment, cultural, and recreational amenities. Although this area provides for residential uses, commercial and entertainment uses are the primary draw to the mixed-use center. Some areas within Suburban Mixed Use will not include a residential component, but will rather provide opportunities for non-residential uses that support the surrounding adjacent neighborhoods or provide a transition between larger mixed use developments that contain residential uses.

Reducing the distance between home, work, and entertainment/retail destinations, Suburban Mixed Use areas serve as logical locations for transit stops. Accessory residential units are also appropriate for the area and may consist of apartments in the principal structure, garage apartments, or other outbuildings approved by the County. In such specialized designs, office and residential parking structures, gas stations, car washes, drive-throughs, and other auto-related functions would be located along streets primarily designed for the automobile. Office, multifamily buildings and store entrances would be located along streets designed primarily for pedestrians.

Over time, existing commercial developments within Suburban Mixed Use areas should be redeveloped with a vertically integrated mix of uses on the site. Multi-family residential can also be introduced into the design of existing suburban-style commercial developments as an initial step toward creating vibrant, walkable mixed-use communities. Limited areas otherwise designated as Suburban Mixed Use on the Place Type map may be allowed to develop according to the Suburban Compact Neighborhood Place Type if the locational and design criteria of SPA Action 2.1.I are satisfied.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Retail & Service Commercial • Office • Entertainment Commercial • Multifamily Residential • Institutional • Hotel <p>*Residential restrictions in noise-sensitive areas located within 65 Ldn noise contours</p>	<ul style="list-style-type: none"> • Small Lot Single Family Residential Attached • Active Adult Retirement Communities • Civic, Cultural, & Community • Accessory Residential Units 	<ul style="list-style-type: none"> • Small Lot Single Family Residential Detached • Public Facilities • Conference Center • Special Activities • Parks & Recreation



DESIGN CHARACTERISTICS

Context

A mix of uses, which may be provided through mixed-use buildings and multi-story single-use buildings that may be integrated in a walkable street pattern.

Street Pattern:

Rectilinear, Gridiron, Linear

Block Length:

200-660 feet

Building Setback:

Shallow setbacks at sidewalks

Parking:

On-street, accessory, short-term, alley-oriented, structured, surface

Design Amenities:

Sidewalks, street trees, street furniture, shade trees, bike racks, lighting, crosswalks, plazas, pedestrian malls, network of green space, public art

Retail and Service:

Single-story individual retail buildings shall not be permitted greater than 2,000 square feet and must be integrated into the compact, pedestrian-oriented environment. Drive-through retail uses shall be incorporated within mixed-use buildings.

Neighborhood (allowed only within Single Family residential areas) – single-story individual uses under 5,000 or small center up to 30,000 square feet

Open Space:

10% of the site-Recreational (passive and active), Community, Public and Civic, and/or Natural, Environmental, and Heritage



An example plan view of Suburban Mixed Use

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total FAR: Up to 1.0*

Building Height: Up to 5 stories

* Additional density (up to 1.5 FAR) may be achieved through the provision of one or more of the following project elements that go above and beyond required development standards to further the County's comprehensive planning goals: affordable housing units, building techniques that exceed industry efficiency standards, additional community amenities and pedestrian connections, and/or beneficial revitalization/redevelopment in priority areas.



Transition

Small block sizes and a mix of different uses make transitions between uses and developments important in the Suburban Mixed Use Place Type. Changes in height or building character, where allowed, should occur mid-block to promote balanced streetwalls where both sides of the street appear similar in height if possible. Larger developments near smaller residential dwellings should step down appropriately to respect these neighbors. Developments should be transitioned from taller buildings at the center to heights generally no more than a story taller than adjoining adjacent development consisting of less intensive uses. The predominant residential use type is multifamily; however, a very limited portion of the development within the Suburban Mixed Use Place Type may be developed with small-lot single family residential as a transitional use between Place Types.



Suburban Commercial



Suburban Commercial developments provide opportunities for larger format retail commercial establishments and smaller commercial establishments within a “main street” style environment. These developments should be designed to provide access to adjacent neighborhoods and to patrons living in the larger Loudoun community. Generally, these areas tend to be located next to major roads or existing residential neighborhoods. The predominant uses are community-serving retail commercial and “big box” commercial. This place type encompasses a wide array of commercial designs.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Retail & Service Commercial • Office • Research and Development • Entertainment Commercial 	<ul style="list-style-type: none"> • Civic, Cultural, & Community • Hotel • Conference Center 	<ul style="list-style-type: none"> • Active Adult Retirement Communities • Institutional • Special Activities • Parks & Recreation • Public Facilities
Preferred Mix of Uses		
<p>Possible Ranges:</p> <ul style="list-style-type: none"> • Res: 0% • Non-Res: Up to 100% • Public/Civic: 0%+ <div style="text-align: center;"> </div>		

DESIGN CHARACTERISTICS

Context

It is desirable for buildings in this place type to be organized to create a pedestrian-friendly streetscape with building frontages and landscaping strategically placed so that parking is not the predominant feature. Big box retail uses and pad sites should be integrated into the design of the

site through the use of similar architectural elements, varying block sizes, parking and landscaping. Structures in Suburban Commercial areas should be compatible in size, roof type/pitch, architecture, and lot coverage with the surrounding residential uses.

Street Pattern:

Rectilinear, Gridiron, Linear

Block Length:

300-800 feet

Building Setback:

Shallow to medium setbacks at sidewalks

Parking:

On-street, accessory, short-term, surface, structured

Design Amenities:

Sidewalks, street trees, street furniture, shade trees, bike racks, lighting, crosswalks, plazas, pedestrian malls, network of green space, public art

Retail and Service:

Convenience - individual under 5,000 or small center up to 30,000

Neighborhood - individual uses under 5,000 or small center up to 30,000 square feet

Community - individual uses under 30,000 or center between 30,000-150,000 square feet

Open Space:

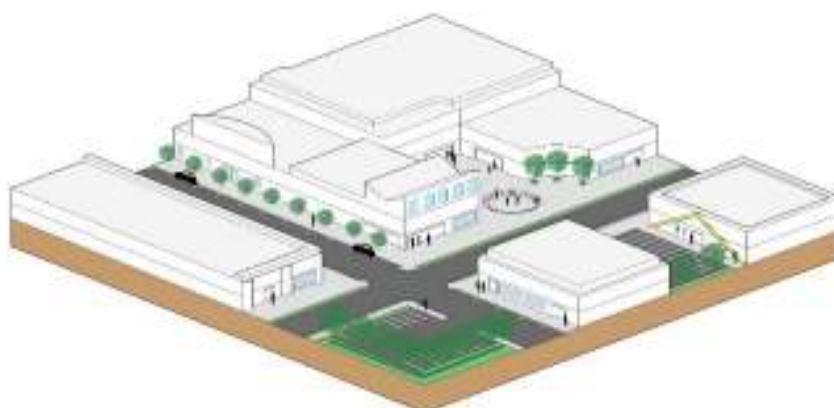
10% of the site - Recreational (passive and active), Community, and/or Natural, Environmental, and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total FAR: Up to 1.0

Building Height: Up to 5 stories



Transition

Changes in height or building character, where allowed, should occur mid-block to promote balanced streetwalls where both sides of the street appear similar in height if possible. Developments should be transitioned from taller buildings at the center to heights generally no more than a story taller than adjoining adjacent development consisting of less intensive uses.

Suburban Employment



Suburban Employment areas provide opportunities for a broad array of employment uses within an environment that provides gathering spaces and opportunities for synergies among businesses. These offer prime locations for office, production, flex space, and warehousing uses as well as startups and established businesses. Appropriate uses do not generate excessive noise or air pollutants or require outdoor storage. Limited first floor retail that supports predominant uses is appropriate.

Parking should generally be located behind the building to ensure the buildings are the predominant feature when viewed from roadways and adjacent properties. Although civic or recreation space is not expected, required open space in Suburban Employment developments should include areas for use by customers and employees.

For secure employment campuses, deviations from the applicable base design standards may be considered on case-by-case basis in order to accommodate security elements such as greater building setbacks, secured perimeters, or controlled site access.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Light Production • Office • Research & Development • Contractor without Outdoor Storage • Flex Space 	<ul style="list-style-type: none"> • Retail & Service Commercial 	<ul style="list-style-type: none"> • Institutional • Civic, Cultural & Community • Public Facilities • Special Activities • Parks & Recreation • Data Centers • Warehousing
Preferred Mix of Uses		
<div style="text-align: center;"> Possible Ranges: <ul style="list-style-type: none"> • Res: 0% • Non-Res: Up to 100% • Public/Civic: 0%+ </div>		

DESIGN CHARACTERISTICS

Context:

Separate employment uses that are integrated within a walkable, employment-based environment.

Street Pattern:

Rectilinear, Gridiron, or Fragmented Parallel

Block Length:

300-1,000 feet

Building Setback:

Short to medium; greater if flex use

Parking:

Structured, surface, on-street, accessory, or short-term

Design Amenities:

Sidewalks, street trees, shade trees, bike racks, plazas, public art

Retail and Service:

Employment Supportive-Limited to support the predominate use. Generally 10% of the gross FAR of the employment uses.

Open Space:

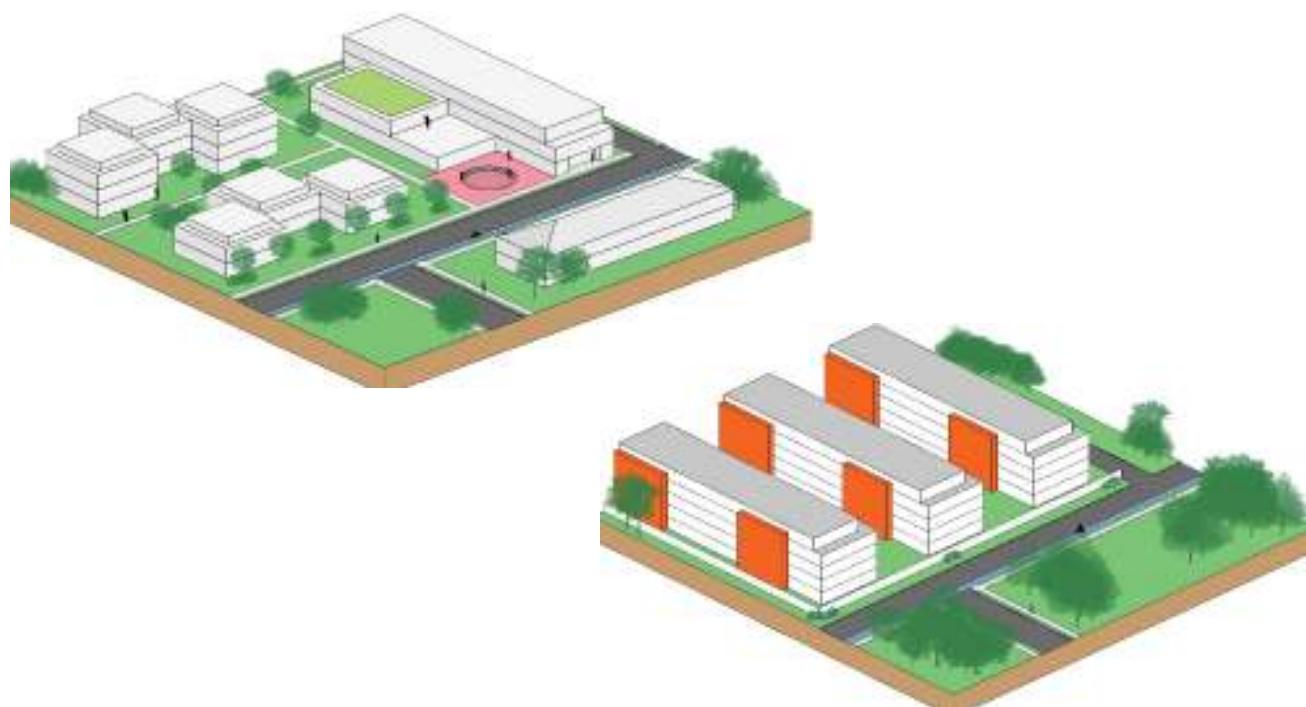
30% of the site- Recreational (trails), Community (outdoor seating, plazas, gardens, public art), and/or Natural, Environmental, and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total FAR: Up to 1.0

Building Height: 2 to 8 stories



Transition

Transitions between Suburban Employment uses and other developments, in particular adjacent residential neighborhoods, are vitally important. Building heights should step down appropriately to less intense residential uses. In developments adjoining less intensive uses, building heights should decrease moving outward from the center of the development, stepping down to heights generally within one story of adjacent structures.

Certain employment uses that may not be compatible with adjacent residential uses, such as data centers, should have transitional uses located in between.



Suburban Industrial/Mineral Extraction



Suburban Industrial/Mineral Extraction areas consist of large manufacturing, contractor with outdoor storage, and other productive uses. Streets in this district are typically designed to accommodate freight ingress and egress. This Place Type also includes mineral extraction areas such as quarries and mines. Industrial and mineral extraction uses are incompatible with residential uses due to the prevalence of outdoor storage and the emissions of noise, odor, and vibrations. Buffers between these uses and residential uses are necessary to ensure compatibility and maintain commercial viability.

For secure employment campuses, deviations from the applicable base design standards may be considered on a case-by-case basis in order to accommodate security elements such as greater building setbacks, secured perimeters, or controlled site access.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> General and Heavy Manufacturing and Assembly Warehousing Contractor with Outdoor Storage Data Centers Fleet & Equipment Sales & Service Research & Development Outdoor Storage Public Utilities Quarry Outdoor Manufacturing 	<ul style="list-style-type: none"> Retail & Service Commercial Flex Space Light Production 	<ul style="list-style-type: none"> Office Public Facilities Special Activities Parks & Recreation
Preferred Mix of Uses		
<div style="text-align: center;"> <p>Possible Ranges:</p> <ul style="list-style-type: none"> Res: 0% Non-Res: Up to 100% Public/Civic: 0%+ </div>		

DESIGN CHARACTERISTICS

Context

Primarily one-to-two-story buildings used for warehousing, data centers, contractor services, or manufacturing.

Street Pattern:

Irregular

Block Length:

300-1,000 feet

Building Setback:

Deep, varying with use

Parking:

Surface

Design Amenities:

Sidewalks, street trees, shade trees

Retail and Service:

Employment Supportive-Limited to support the predominate use. Generally 5% of the gross FAR of the employment uses.

Open Space:

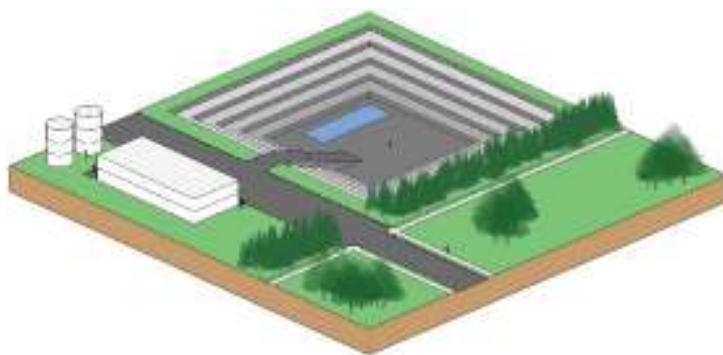
30% of the site-Recreational (sidewalks or trails), Community (outdoor seating area), and/or Natural, Environmental, and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total FAR: Up to 0.6

Building Height: Up to 4 stories



Transition

Transitions between Suburban Industrial/Mineral Extractive uses and other developments, in particular adjacent residential neighborhoods, are critically important to the viability of long-term industrial operations. Setbacks, buffering, and natural open space can reduce impacts by blending the edges of Industrial/Mineral Extraction developments with surrounding developments, providing softer transitions than structural buffers. Storage and loading areas are to be oriented away from and screened from streets and adjacent uses.

Transition Policy Area

Vision

The Transition Policy Area (TPA) is visually distinct from adjoining policy areas, providing expansive open space with publicly accessible recreational opportunities while accommodating a residential development pattern, consistent with the appropriate place types, that promotes environmental protection, housing diversity, quality design, economic growth, and protection of natural, environmental, and heritage resources.

Introduction

The TPA provides a distinct development pattern focused on retaining substantial open space to frame a unique built environment accommodating a variety of communities. The open spaces serve as dominant landscape, providing significant opportunities for public recreation and facilities within the context of an assortment of community designs. TPA communities range from rural estate developments to compact residential neighborhoods that can provide a variety of housing options and protect natural, environmental, and heritage resources.

The *Loudoun County 2019 Comprehensive Plan* proposes that, in order to sustain a healthy economy and to provide greater opportunities for attainable housing, the County seek to accommodate a share of the anticipated regional housing demand. Anticipated high density development in the Urban Policy Area (UPA) will help meet the important multifamily component of the housing demand. The *Loudoun County 2019 Comprehensive Plan* also proposes increased density in areas of the Suburban Policy Area (SPA) and the integration of new residential uses into areas previously planned for commercial or employment uses. These approaches notwithstanding, there is not adequate capacity in these areas to address the County's housing demands. The Towns and Rural Policy Area (RPA) are not anticipated to absorb a significant portion of future housing demand. Infrastructure limits and community desires to maintain small-town community character are the primary constraints in the Towns. The RPA has land, but the limitations of onsite wells and septic systems, country roads, distance to services, and a strong community desire to preserve the rural character of western Loudoun all serve to limit growth capacity.

In light of these constraints, the *Loudoun County 2019 Comprehensive Plan* acknowledges the key benefits of accommodating additional housing in the TPA, including access to central utilities, an improving transportation network, proximity to the services and amenities of the SPA, and large, undeveloped tracts of land that will allow for inclusive community designs. The fundamental goal of this new development pattern will be to accommodate residential products and neighborhoods that will help meet the needs and desires of the County's growing and diversifying populace. Evaluation of new development proposals will focus on design concepts that conserve and incorporate environmental and heritage resources, offer housing that is affordable to a range of incomes, retain significant open space to protect resources, provide space for public and civic facilities and parks, and conceal the intensity of new development within a landscape of forests,

hedgerows, and tree stands. Residential developments will be expected to support a continuum of housing options and prices. Three commercial centers will offer local services and amenities so that the TPA will become a more self-sustaining community. Natural open spaces will continue to be the predominant visual element and create a contiguous network of green spaces.

The *Loudoun County 2019 Comprehensive Plan* reaffirms a growth boundary (GB) beyond which central water and wastewater systems are not allowed. Beginning in the north, the GB follows the SPA boundary to the point where it meets the TPA. The GB then follows the western edge of the TPA to meet the Prince William County boundary line in the south.

Background

Between 1991 and 2001, the Board of Supervisors changed the policy direction for the TPA four times. Until 2001, the area was planned as part of the SPA or a phased expansion of the SPA. In 2001, the Board established the TPA as a separate policy area along with the Suburban, Rural and Joint Land Management Area (JLMA) policy areas:

- In 1991, the area was planned for suburban development that was to be phased with ultimate development expected to occur by 1995.
- In 1993, the Dulles South Area Management Plan added Upper Broad Run to the Dulles South suburban area at densities between 3 and 6 units per acre and added the Upper and Lower Foley and Lower Bull Run areas at densities between 1 and 3 units per acre.
- In 1997, the Dulles South Plan reestablished a suburban development phasing boundary west of Northstar Boulevard. The phasing area was then subject to the policies of the RPA until the County chose to expand the SPA.
- In 2001, the TPA became a distinct policy area in the *Revised General Plan* between the SPA and RPA. Six subareas of the TPA were established, each with density and open space requirements.
- In 2004, the Board of Supervisors amended the *Revised General Plan* and extended central water and wastewater systems throughout the TPA, establishing the western edge of the TPA as the County's Urban Growth Boundary¹.

Although the TPA is predominantly residential, the *Loudoun County 2019 Comprehensive Plan* designates limited areas for industrial development in the northern portion of the TPA in close proximity to planned improvements to Sycolin Road and existing industrial land south of the Leesburg JLMA. Limited retail commercial development can be found along John Mosby Highway (Route 50) and the Board of Supervisors previously approved other retail space along Braddock Road (Route 620).

¹ In the *Revised General Plan*, the Urban Growth Boundary represented the full extent of central sewer and water service except to resolve an existing public health issue. The *Loudoun County 2019 Comprehensive Plan* uses the term "growth boundary" for the same purpose.

Important drinking water resources are located within the TPA, and watershed protection extends across significant portions of the Goose Creek and the Beaverdam Reservoir to help protect these resources. Conservation easements, proffered open space, and development setbacks provide a 300-foot buffer adjoining Goose Creek (see Chapter 3: Natural, Environmental, and Heritage Resources, Action 2.5.A). Loudoun Water owns the land surrounding Beaverdam Reservoir, while the County and NOVA Parks own parkland adjacent to the reservoir.

Development Approach

While continuing to focus growth in the UPAs and SPA, the *Loudoun County 2019 Comprehensive Plan* acknowledges the limited amount of land available for development in the SPA and proposes new approaches in the TPA to accommodate some of the County's needs. These needs include accommodating additional housing to support the County's economic development goals, ensuring high quality community design, preserving open space, and maintaining a quality of life that hinges on a healthy and vibrant natural environment. There are several factors that enable the County to accommodate new growth in the TPA while protecting key environmental resources and protecting the RPA from encroachment of suburban development.

A number of existing neighborhoods along the western side of the TPA and rural villages just west of the TPA have already established a low density development pattern with significant areas of permanently protected open space, which creates a distinct edge to the TPA. Future TPA developments will still be required to preserve large open space areas that are a hallmark of the TPA's character and distinguish it from the SPA, where the Plan does not anticipate as much land dedicated as open space. The open space requirement will also require a more compact development pattern, resulting in smaller single family lots and a combination of detached and attached residential products.

Transportation projects in the eastern TPA, including improvements to Ryan Road (Route 772) and Sycolin Road (Route 625), and the completion of Shreveport Drive (Route 621 relocated) and Creighton Road (Route 774), will provide better connections to the east without necessarily adding to the congestion of Route 50. The *Loudoun County 2019 Comprehensive Plan* proposes to concentrate future development proximate to existing and planned transportation improvements where capacity exists. Large tracts of undeveloped and underdeveloped land south of Braddock Road and east of Northstar Boulevard are in close proximity to the SPA immediately to the north, yet are separated by several miles from the RPA farther to the west. This southeast portion of the TPA is also adjacent to Prince William County across the Bull Run to the south and Fairfax County to the east. The principal constraining factor in this area is the current lack of traffic capacity on existing roads and, while major roads are planned, new development will need to be timed to occur in conjunction with the availability of additional road capacity.

The 2004 extension of central water and wastewater utilities throughout the TPA enabled more compact development than previously planned, when the TPA was only served by wells and septic systems. Select areas of higher intensity development interspersed among lower density projects and with substantial open spaces that offer screening, separation, and recreation can be compatible with existing development.

The *Loudoun County 2019 Comprehensive Plan* examined specific areas of the TPA that were not already developed or committed to development. The potential for redevelopment was not considered in the development forecasts for the area. Areas subject to environmental constraints, such as conservation easements, steep slopes and floodplain, were excluded from development potential. Two areas of the RPA were added to the TPA because of the increasingly intense development that is occurring around them.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply only within the TPA.

TPA Policy I: Ensure that the Transition Policy Area retains the visual character established by extensive natural open space by using compact development concepts with substantial open space requirements, and low profile construction to minimize visual intrusion into the natural environment.

Strategy

- 1.1 Accommodate new more affordable and innovative residential communities in compact development patterns, while preserving open space, natural, environmental, and heritage resources, and other valued features that may exist on site.

Actions

- A . Encourage a variety of housing within individual developments by permitting small and large lot single-family detached, duplex, triplex, quadruplex, accessory dwelling, and other housing unit types to expand housing options and thus affordability opportunities, and support the lifestyle preferences of a diverse community.
- B . Develop zoning regulations and design standards to accommodate Transition Community Centers and Transition Compact Neighborhood Place Types to expand housing diversity and improve commercial viability.
- C . Require new development to connect to Loudoun Water's central water and wastewater systems and encourage existing development to connect.
- D . Continue to define the TPA by seven subareas to implement the Transition Large Lot Residential Neighborhood development pattern as identified on the Transition Policy Area Place Types Map.
- E . Continue to support agriculture-related businesses including equine uses, agritourism, commercial nurseries, and similar uses throughout the TPA.
- F . Continue to define the western edge of the TPA as the full extent of central sewer and water and the western edge of the growth boundary, pursuant to 15.2-2232.
- G . Ensure that open space within developments creates or enhances the following:
 - i. The 300-foot buffer and 200-foot transitional area along the Bull Run in the

- Upper and Lower Foley and Lower Bull Run subareas,
 - ii. The 300-foot buffer and 1,000-foot voluntary open space area along the Goose Creek, Goose Creek Reservoir, and Beaverdam Reservoir in the Lower Sycolin and Middle Goose subareas,
 - iii. A contiguous network of green spaces to supplement the natural and heritage resources connecting communities and natural resource areas, and
 - iv. A public trail and park network to destinations throughout the area.
- H. Continue to perform watershed management plans to determine appropriate water quality and quality controls.
- I. Consider adoption of reservoir protection overlay districts that provide buffering and storm water quality controls.

TPA Policy 2: Offer safe and accessible parks and recreation opportunities that provide diverse activities for all ages, interests, and abilities.

Strategy

- 2.1 Provide a network of protected open space that maintains natural, environmental, and heritage resources and reinforces the TPA's unique character.

Actions

- A. Develop a Master Plan for parks, open space, and trails in the TPA that: 1) builds on and links current planned shared-use trails and park areas, and 2) places greater emphasis on quality, connected, usable, and publicly accessible open space.
- B. Protect the drinking water resources of the Occoquan, Beaverdam, and Goose Creek Reservoirs with natural stream and reservoir buffers, improved stormwater management, and other means.
- C. Retain 50 percent open space throughout the TPA, unless otherwise called for by the applicable place type or in the Lower Bull Run subarea where 70 percent open space is required for residential development to protect drinking water source watersheds, and seek to reserve publicly usable, accessible, and interconnected open space.
- D. Establish programs and regulatory mechanisms to increase publicly accessible open space, consistent with County facilities plans, through easements, land dedications, and purchase.
- E. Require Open Space Plans with individual development applications to illustrate proposed use, public accessibility, resource protection, and connection with other open space.
- F. Take advantage of existing or planned parks, stormwater ponds, and stream valley corridors, particularly the Goose Creek and Bull Run corridors, to create a linear park network linking larger park facilities and destinations.
- G. Pursue connected linear trails, parks and open space accessible to the public when considering development applications.

TPA Policy 3: Target specific areas of the TPA for higher density residential and mixed-use development to create affordable and diverse housing opportunities in compact communities reflective of the historic development pattern of villages and towns in Loudoun.

Strategy

- 3.1 Establish guidelines to accommodate compact communities that provide sustainable and affordable housing.

Actions

- A. Create new Community Plans and other appropriate plans which address the particular needs and guide development within the Transition Policy Area.
- B. Support Transition Compact Neighborhoods in areas specified on the Transition Policy Area Place Types Map provided they comply with the Place Type standards and incorporate the following features:
 - i. A combination of housing types, including detached, duplex, triplex, quadruplex, and/or accessory units.
 - ii. Housing units that are smaller and more affordable and that address the County's unmet needs.
 - iii. Discernible variations in lot shape and building setbacks along residential street frontages, in a manner reflective of traditional villages and towns, to visually differentiate individual residential structures.
 - iv. Design concepts within units and neighborhoods that allow residents at different stages of their lives to remain in the community.
 - v. A walkable community design emanating from one or more community greens with minimal use of cul-de-sac streets and easy access to parks, playgrounds and amenities.
 - vi. Public trails and parks internal to the neighborhood and connecting to adjacent communities and public facilities.
 - vii. Extensive buffers screening the intensity of the development from surrounding roads and communities through the use of dense vegetation, earthen berms, and/or natural topography.

TPA Policy 4: Non-residential uses will include uses that are compatible with resource protection, desired development patterns, and the rural landscape.

Strategy

- 4.1 Provide for development of commercial, employment, and public uses in areas specified on the Transition Policy Area Place Types Map that achieve the desired development patterns and the character of the TPA.

Actions

- A. Require Industrial uses to:

- i. Be located only in locations consistent with the Place Types Map.
 - ii. Be visually concealed from adjacent roads and residential areas by siting buildings and uses to avoid ridgetops and high visibility areas and enclosing buildings and uses within a substantial, undisturbed, vegetated perimeter.
 - iii. Minimize the effects of noise, vibration, and odor.
 - iv. Have access to adequate infrastructure and roads.
 - v. Identify and protect environmental features and to follow, to the extent possible, the natural topography.
 - vi. Enhance water quality protection when near water supply reservoirs and associated streams.
- B. Continue to protect the extractive industry by maintaining a quarry notification overlay zoning district.
- C. Establish zoning regulations and design standards that ensure new development does not hinder the operation of quarries.
- D. Support Transition Community Centers in areas specified on the Transition Policy Area Place Types Map provided they are consistent with the Place Type standards and offer the following features:
- i. Small footprint retail uses and no “big box” commercial retailers with the exception of grocery or drug stores.
 - ii. A compact pedestrian shopping and entertainment environment including active streets featuring relationships between interior and outdoor spaces, outdoor restaurant seating and vendor shopping on the street, complementary ground floor uses (such as retail rather than offices), and a high level of transparency and window space.
 - iii. Convenient and safe pedestrian connections to adjacent neighborhoods and public facilities.
 - iv. Extensive landscaping, particularly at the perimeter, to screen the project intensity from adjacent roads and communities.
 - v. Outdoor activity and community space.

TPA Policy 5: Ensure that adequate infrastructure (e.g., including roads, utilities, and public facilities) and services are available to meet increased demands of new development.

Strategy

5.1 Ensure adequate public facilities and services are available as demand is generated by new development.

Actions

- A. Evaluate residential development proposals against the available and forecasted capacity of public schools and other facilities and services through the projected buildout period of the application.
- B. Phase higher density residential development to allow the County to plan for facility

- and infrastructure needs before the demand occurs, and help direct development to the areas of the County that offer greater fiscal and economic benefits.
- C. Precede each phase of development with a Comprehensive Plan Amendment or a community planning exercise to determine timing, appropriate land use changes, and/or public facility needs.
 - D. Until such time as a subsequent phase is amended by adopting a Comprehensive Plan Amendment or a community planning exercise is completed for areas, as appropriate, all residential areas outside of the Phase 1 area shall be developed under the Transition Large Lot Place Type.
 - E. Schedule the phasing in the following sequence unless determined otherwise in a Comprehensive Plan Amendment:
 - i. Phase 1: Lower Sycolin and Middle Goose Creek policy subareas; portions of the Lower Foley policy subarea designated for Transition Compact Neighborhood and Transition Community Center on the Transition Policy Area Place Type Map.
 - ii. Phase 2: Upper Broad Run and Red Hill policy subareas.
 - iii. Phase 3: Upper Foley and Lower Bull Run policy subareas; remaining portions of the Lower Foley policy subarea.

TPA Policy 6: The Board of Supervisors encourages no further expansion of the TPA boundaries beyond that included with the adoption of the Loudoun County 2019 Comprehensive Plan.

Design Guidelines

The Design Guidelines are to build upon our current development patterns in a manner that allows innovative design and new responses to the market. The Design Guidelines are not meant to be prescriptive and are not intended to be treated as a checklist, but are instead meant to provide a framework for how the desired character of the TPA can be achieved, with the acknowledgement that other methods could achieve the intended results. The Design Guidelines do not supersede or otherwise limit the application of adopted zoning regulations, ordinances, building codes, proffers or any other design standards or regulations administered by Loudoun County.

The goals of the TPA Design Guidelines are as follows:

- Development should create attractive places within the TPA by working with existing topography and site features, responding to the local context, and reinforcing the landscape's character, rather than simply attempting to place suburban design onto the landscape.
- Development should use the landscape for benefits such as solar heat gain or shelter from wind.

- Buildings should be treated as parts of the landscape and attention given to their form and scale relative to their surrounding environment.

When using the guidelines care should be taken to analyze the impact a potential development may have on the landscape. Considerations should include both appearance and practical considerations such as proximity and quality of connections to utilities, community amenities, jobs, and housing to maximize the use of existing infrastructure and limit travel distances. The County encourages the use of a design process when planning development in the TPA that conserves and incorporates natural, environmental, and heritage resources into the site design. (See Appendix A for Design Guidelines for the TPA)

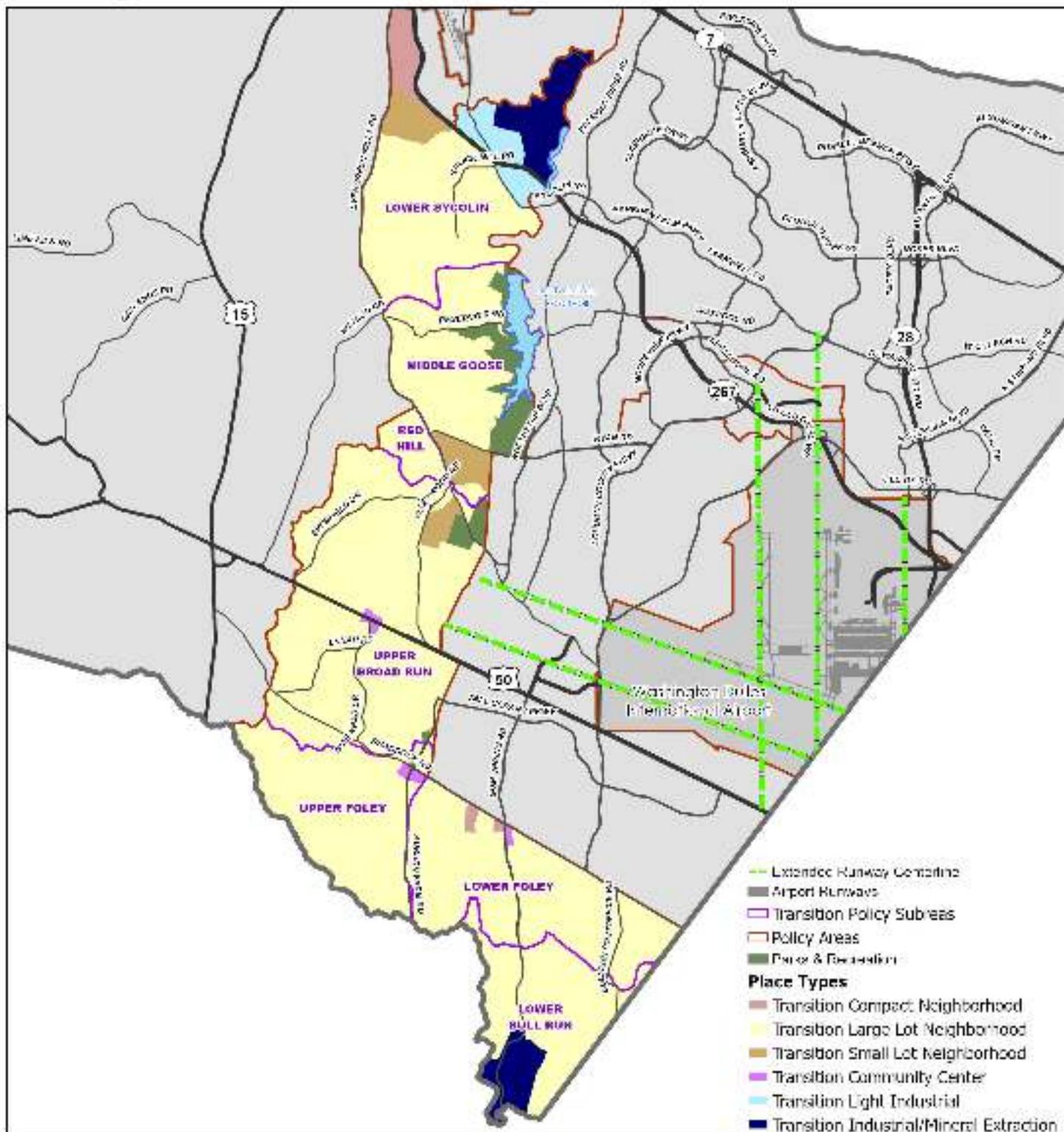
Place Types

As described in the beginning of this chapter, the following Place Types have been designated for specific locations as displayed on the accompanying map. The Place Types will work in concert with the Design Guidelines and Policies, Strategies, and Actions of the TPA to fulfill the land use patterns and community characteristics intended for the area.

Madison County
Transition Policy Area

Place Types

2012 General Plan



Madison County 2012 General Plan
Transition Policy Area Map
This map is a general plan map and is not to be used for
development decisions. It is for informational purposes only.
The information contained herein has been provided by
various county departments and is believed to be accurate.
However, no guarantee is made as to its accuracy or completeness.
Users are responsible for verifying the accuracy and
completeness of the information before relying on it for
any purpose.

0 0.5 1 2 3 4 Miles
Map Number 0002-041

Transition Large Lot Neighborhood



Transition Large Lot Neighborhoods include projects such as Willowsford, Red Cedar and Evergreen, which offer detached homes and substantial open space in low-density communities. Agriculture and related uses are encouraged on these open spaces. Neighborhoods should offer a variety of house styles and sizes and, similarly, a variety of lot sizes and configurations. Development layouts follow land contours, incorporate natural features into the development, and protect sensitive resources. Extensive open space should partially conceal views of the new residential development from perimeter roadways and adjacent development and protect natural and cultural resources.

Core Uses	Complementary Uses	Conditional Uses								
<ul style="list-style-type: none"> • Large Lot Residential • Clustered Residential Subdivision • Accessory Residential Units 	<ul style="list-style-type: none"> • Agriculture • Agricultural Supportive Businesses • Equine Facilities • Agritourism • Parks & Recreation 	<ul style="list-style-type: none"> • Civic, Cultural, & Community • Public Facilities • Special Activities 								
Preferred Mix of Uses										
<p>Possible Ranges:</p> <ul style="list-style-type: none"> • Res: 85-95% • Non-Res: 0 - 10% • Public/Civic: 5%+ <table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>90%</td> </tr> <tr> <td>Non Residential</td> <td>5%</td> </tr> <tr> <td>Public/Civic</td> <td>5%</td> </tr> </tbody> </table>			Category	Percentage	Residential	90%	Non Residential	5%	Public/Civic	5%
Category	Percentage									
Residential	90%									
Non Residential	5%									
Public/Civic	5%									

DESIGN CHARACTERISTICS

Context

Low-density residential neighborhoods with significant open spaces allowing agricultural uses and the protection of adjacent environmentally sensitive areas such as the reservoirs and stream corridors.

Street Pattern:

Contour forming, Irregular, Fragmented Parallel

Block Length:

Varies

Building Setback:

Varies

Parking:

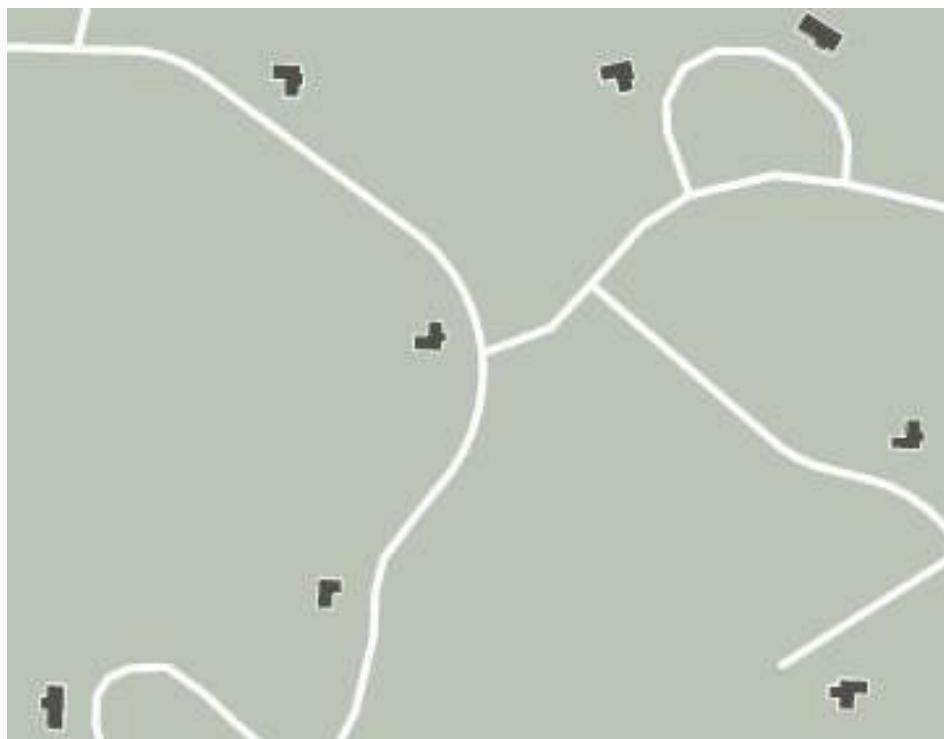
Driveway, garage, or on-street

Design Amenities:

Trails, street trees, common open spaces

Open Space:

50% of the site-Recreational, Agricultural, and/or Natural, Environmental, and Heritage. In the Bull Run policy subarea, 70% of a site shall be retained as open space.

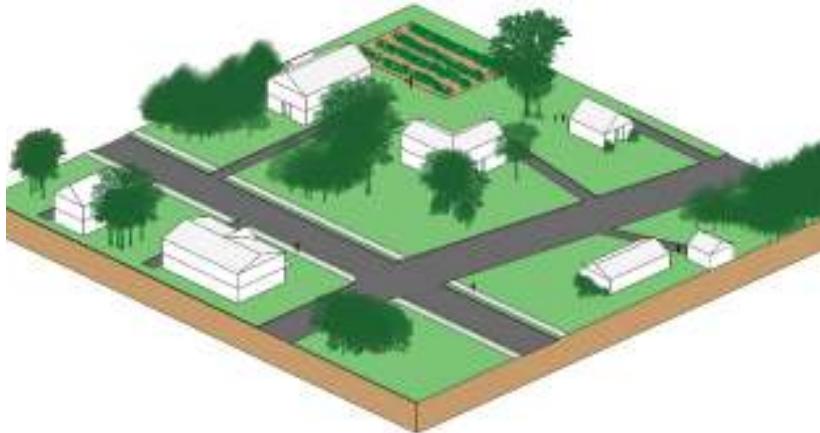


An example plan view of a Transition Large Lot Neighborhood

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total Nonresidential FAR: Up to 0.1



Building Height: 1-3 stories

Target Residential Density	
Lower Sycolin	1 du/10 ac
Middle Goose Creek	1 du/10 ac
Red Hill	1du/3 ac
Lower Bull Run	1 du/3 ac
Upper Broad Run	1 du/1 ac or 1 du/3ac
Upper Foley	1 du/3 ac
Lower Foley	1 du/3 ac

Transition

Transition Large Lot Neighborhood projects should be surrounded by natural buffers that visually screen the development from view of surrounding roads and from other developments.



Transition Small Lot Neighborhood



Transition Small Lot Neighborhoods include residential neighborhoods arranged in a cluster arrangement that includes a focal point such as a civic use, park, or green. The predominant use is single family detached housing. The lot pattern within each community should align with the topography and key environmental features to minimize the visibility of the structures. Open space and natural vegetation are the dominant visual features and provide public and private trails, passive and active recreation, and significant perimeter and environmental buffers.

Core Uses	Complementary Uses	Conditional Uses								
<ul style="list-style-type: none"> Single Family Detached Residential 	<ul style="list-style-type: none"> Agriculture Agricultural Supportive Businesses Equine Facilities Live/Work Units Accessory Residential Units Parks & Recreation 	<ul style="list-style-type: none"> Retail & Service Commercial (supportive) Institutional Civic, Cultural, & Community Public Facilities Special Activities 								
Preferred Mix of Uses										
<p>Possible Ranges:</p> <ul style="list-style-type: none"> Res: 85-100% Non-Res: 0 - 10% Public/Civic: 5%+ <table border="1"> <thead> <tr> <th>Use Type</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Residential</td> <td>90%</td> </tr> <tr> <td>Non Residential</td> <td>5%</td> </tr> <tr> <td>Public/Civic</td> <td>5%</td> </tr> </tbody> </table>			Use Type	Percentage	Residential	90%	Non Residential	5%	Public/Civic	5%
Use Type	Percentage									
Residential	90%									
Non Residential	5%									
Public/Civic	5%									

DESIGN CHARACTERISTICS

Context

Neighborhoods offering assorted lot configurations, sizes, and shapes with substantial open space, offering easy access to trails and natural areas internal to the neighborhood and connecting adjacent communities. The community is to be surrounded by extensive wooded buffers maintaining the rural appearance of surrounding roads.

Street Pattern:

Fragmented Parallel, Contour Forming, Irregular

Block Length:

Varies

Building Setback:

Medium to deep

Parking:

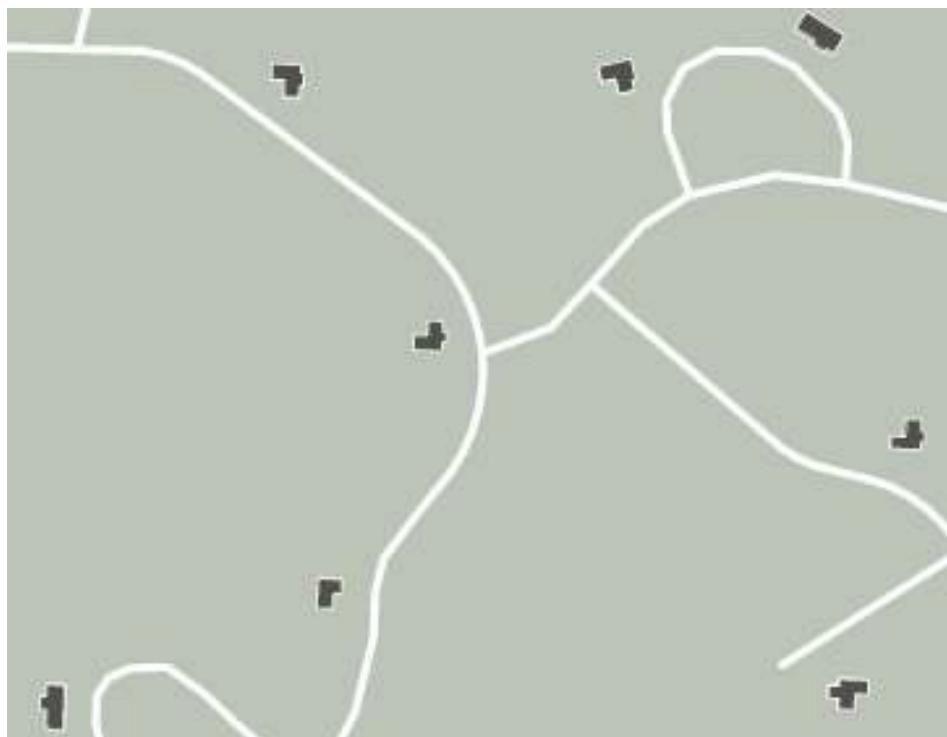
Driveway, garage, or on-street

Design Amenities:

Sidewalks, street trees, community greens, gardens, playgrounds other common open spaces

Open Space:

50% of the site-Recreational (passive and active) and/or Natural, Environmental and Heritage



An example plan view of a Transition Small Lot Neighborhood

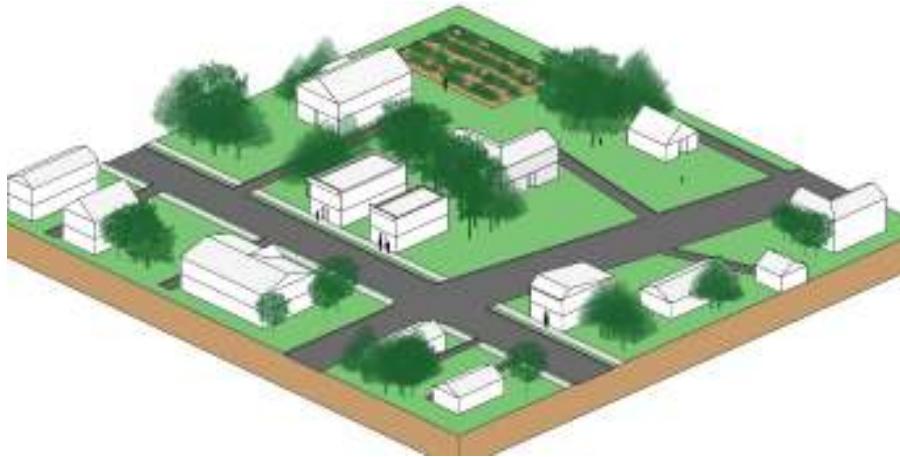
Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: Up to 4 du/ac

Total Nonresidential FAR: Up to 0.2

Building Height: 1-3 stories



Transition

Transition Small Lot Neighborhood projects should be surrounded by natural buffers that visually screen them from view of surrounding roads and from other developments.

Transition Compact Neighborhood



Transition Compact Neighborhoods include a variety of single family detached, duplex, triplex and accessory dwelling unit homes arranged around a focal point such as civic use, park, green or small commercial center. Duplex, triplex, and quadruplex housing should be designed to be compatible with – and should be dispersed throughout – the single family detached residences. If included, neighborhood-serving retail or employment space (such as shared office space) should be situated in conjunction with civic space or a central park or green to create a neighborhood core or focal point.

The lot pattern within each community should primarily consist of small lots, and a mix of housing types along each street frontage and within each block. A pattern of interconnected streets is intended to provide a walkable community. Open space and natural vegetation are the dominant visual features with significant perimeter and environmental buffers and should provide publicly accessible trails and passive and active recreation opportunities.

Core Uses	Complementary Uses	Conditional Uses						
<ul style="list-style-type: none"> Single Family Detached Residential Single Family Attached Residential (duplex, triplex, quadruplex) 	<ul style="list-style-type: none"> Civic, Cultural, & Community Entertainment Commercial Office Accessory Residential Units Parks & Recreation 	<ul style="list-style-type: none"> Retail & Service Commercial Public Facilities Special Activities 						
Preferred Mix of Uses								
<table border="1"> <tr> <td>Possible Ranges:</td> <td>Res: 80-90%</td> </tr> <tr> <td></td> <td>Non-Res: 0-10%</td> </tr> <tr> <td></td> <td>Public/Civic: 10%+</td> </tr> </table>			Possible Ranges:	Res: 80-90%		Non-Res: 0-10%		Public/Civic: 10%+
Possible Ranges:	Res: 80-90%							
	Non-Res: 0-10%							
	Public/Civic: 10%+							

DESIGN CHARACTERISTICS

Context

Neighborhoods providing assorted lot configurations, sizes and shapes, and smaller, intermixed housing types and styles, characteristic of historic towns and neighborhoods. Communities are to be walkable and residents and the public are to have easy access to parks, playgrounds, and trails internal to the neighborhood and connecting adjacent communities. The community is to be surrounded by extensive wooded buffers maintaining the rural appearance of surrounding roads.

Street Pattern:

Rectilinear Grid, Fragmented Parallel, and Contour Forming

Block Length:

400-800 feet

Building Setback:

Varies

Lot Sizes:

Less than 10,000 square feet

Parking:

Garage, on-street, or alley-oriented

Design Amenities:

Sidewalks, street trees, common open spaces

Retail and Service:

Neighborhood - individual uses appropriately sized to serve the surrounding community.

Open Space:

50% of the site-Recreational, Community, and/or Natural, Environmental and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: 3-5 du/ac

Total Nonresidential FAR: Up to 0.2

Building Height: 1-3 stories



An example plan view of a Transition Compact Neighborhood

Transition

Where the Compact Neighborhood is adjacent to less intensive residential uses, Compact Neighborhoods should use large setbacks to separate uses or create natural and landscape transitions.

Transition Community Center



Transition Community Centers consist of a pedestrian-scale commercial development that provides retail sales, entertainment, and civic functions. The commercial center will feature a walkable street pattern to create a pedestrian shopping and entertainment environment with convenient and safe pedestrian and vehicular connections to adjacent neighborhoods, extensive landscaping at the perimeter, and outdoor activity and community space. Any residential component will consist of multifamily units over commercial uses. Auto-oriented uses would be located away from pedestrian areas unless incorporated into the mixed-use buildings. Primary entrances and exits for automobiles are restricted to main road corridors and not residential streets.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Retail & Service Commercial • Civic, Cultural, & Community • Entertainment Commercial • Public Facilities 	<ul style="list-style-type: none"> • Office • Institutional • Multi-Family Residential (over ground floor commercial; live/work units) • Parks & Recreation 	<ul style="list-style-type: none"> • Special Activities
Preferred Mix of Uses		
 Possible Ranges: <ul style="list-style-type: none"> • Res: 0-25% • Non-Res: 70-95% • Public/Civic: 5%+ 		

DESIGN CHARACTERISTICS

Context

Pedestrian-focused retail centers with small footprint retail uses, active street frontages and outdoor activity. No “big box” retailers, with the exception of grocery or drug stores. Potential for residential over commercial uses, with live/work spaces.

Street Pattern:

Rectilinear Grid

Block Length:

200-800 feet

Building Setback:

Minimal but may vary

Parking:

Surface or structured, on-street, or alley-oriented

Design Amenities:

Sidewalks, street furniture, street trees, lighting, common open spaces

Retail and Service:

Two and three-story buildings with active ground floor retail and entertainment uses, few single story buildings integrated into the compact, pedestrian-oriented environment.

Open Space:

50% of the site- Recreational, Community, and/or Natural, Environmental and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total FAR: Up to 0.3

Building Height: 1-3 stories



Transition

The Transition Community Center, should complement and link via sidewalks and trails to adjacent residential neighborhoods. A substantial part of the required open space should provide perimeter screening such as a park or recreation area against other communities and adjacent roads. Transitions should be gradual, particularly where natural or man-made buffers are not available. Appropriate transitional techniques include variations in building orientation, height step down, and creative and extensive use of landscaping and natural features.

Transition Light Industrial



Transition Light Industrial areas provide opportunities for low-traffic industrial and employment uses. Predominant uses are data centers, contractor establishments, and small-scale assembly or production. Appropriate uses do not generate excessive noise or air pollution or require outdoor storage. Open space that creates effective visual buffers and environmental protection on the site will encompass the business. Trails and passive parks are also appropriate.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Light Production • Data Centers • Flex Space • Contractor 	<ul style="list-style-type: none"> • Retail & Service Commercial (Ancillary retail) • Institutional 	<ul style="list-style-type: none"> • Civic, Cultural, & Community • Public Facilities • Special Activities • Parks & Recreation
Preferred Mix of Uses		
<div style="text-align: center;"> Possible Ranges: <ul style="list-style-type: none"> • Res: 0% • Non-Res: Up to 100% • Public/Civic: 0%+ </div>		

DESIGN CHARACTERISTICS

Context

Industries and businesses within an environment dominated by open space of established forests or thickly vegetated buffers that screen such uses from roads and adjacent development.

Street Pattern:

Rectilinear Grid, Irregular, Contour Forming

Block Length:

Varies

Building Setback:

Varies

Parking:

Surface

Design Amenities:

Sidewalks, street trees, shade trees, lighting, crosswalks, plazas, bike racks

Open Space:

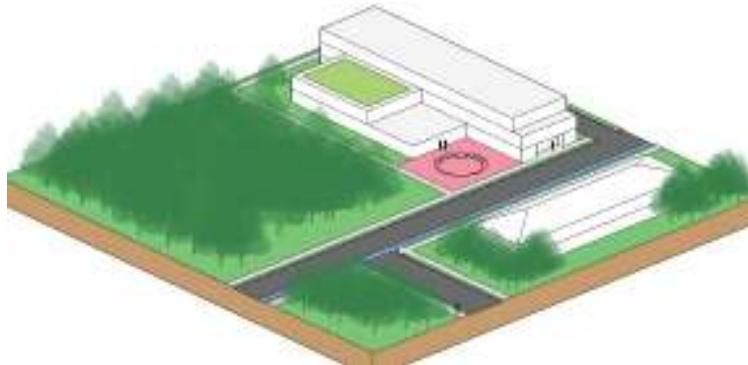
50% of the site-Recreational (trails), Community (outdoor seating, plazas), and/or Natural, Environmental and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total Nonresidential FAR: Up to 0.6

Building Height: 1-3 stories



Transition

Building heights should step down appropriately to less intense residential uses and outdoor activities, noise generators separated from residential uses by buildings, berms and vegetation. Certain employment uses that may not be compatible with adjacent residential uses, such as data centers, should have transitional uses located in between. Transition Light Industrial projects will be visually screened from view of roads and separated from adjacent residential development and sensitive environmental and water supply reservoirs by large wooded buffers, berms, and distance.

Transition Industrial/Mineral Extraction



As a primary industry, mineral extraction should be supported and protected as long as the quarries remain productive. Predominant uses are quarries, large-scale public facilities, and complementary manufacturing operations. Such uses are generally incompatible with residential development and considerable screening and setbacks are necessary to protect their viability.

Core Uses	Complementary Uses	Conditional Uses		
<ul style="list-style-type: none"> General Manufacturing and Assembly Data Centers Research and Development Outdoor Storage Public Facilities Quarry 	<ul style="list-style-type: none"> Office Outdoor Manufacturing Retail & Service Commercial (Ancillary retail) 	<ul style="list-style-type: none"> Special Activities Parks & Recreation 		
Preferred Mix of Uses				
<p>Possible Ranges:</p> <ul style="list-style-type: none"> Res: 0% Non-Res: Up to 100% Public/Civic: 0%+ <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="font-size: 2em;">100%</td> </tr> <tr> <td>Non Residential</td> </tr> </table>			100%	Non Residential
100%				
Non Residential				

DESIGN CHARACTERISTICS

Context

Existing quarries and quarry-related industries and businesses surrounded by substantial open space.

Street Pattern:

Rectilinear Grid, Contour Forming

Block Length:

300-1,000 feet

Building Setback:

Deep

Parking:

Surface

Design Amenities:

Sidewalks, street trees, shade trees

Open Space:

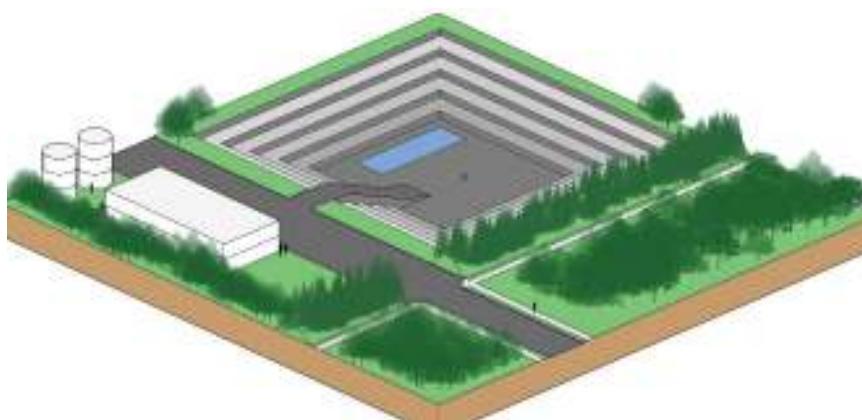
50% of the site-Natural, Environmental and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total Nonresidential FAR: Up to 0.6

Building Height: 1-4 stories



Transition

Transitions between Industrial/Mineral Extractive uses and other developments, in particular adjacent residential neighborhoods, are critically important to the viability of long-term industrial operations. Setbacks, buffering, and natural open space can reduce impacts by blending the edges of Industrial/Mineral Extraction developments with surrounding developments, providing softer transitions than structural buffers. Storage and loading areas are to be oriented away from and screened from streets and adjacent uses. Industry/Mineral Extraction projects should be separated from adjacent development and sensitive environmental and water supply reservoirs by wide, wooded buffers, berms, and distance.

Rural Policy Area

Vision

The Rural Policy Area (RPA) is an enduring rural landscape that is characterized by a unique composite of natural and man-made environments, rural economy uses, working agricultural lands, open space, and a limited residential base.

Introduction

The RPA occupies the western half of the County and is the largest of the County's Policy Areas. It encompasses approximately 230,000 acres, representing about 67 percent of the County's total land area. The RPA comprises a blend of low-density residential, working farms, rural economy uses, pastoral landscapes, forested areas, mountains, and wildlife habitats. The RPA encompasses six of the County's seven incorporated Towns, 12 existing Rural Historic Villages, and numerous smaller crossroad communities. As of April 1, 2017, the population of the RPA is approximately 40,400 people, representing approximately 10 percent of the County's total population.

The RPA is divided into two areas—the Rural North and the Rural South. Each of these distinct geographic areas (see Rural Policy Area Place Types Map) has different base residential densities in response to their dominant rural land use and development patterns. The Rural North (geographically defined as north of Goose Creek and the North Fork of Goose Creek to the County border with Montgomery, Frederick, and Washington Counties, Maryland; Jefferson County, West Virginia; and Clarke County, Virginia) is characterized by a mix of smaller lots that are interspersed with larger parcels in agricultural use. The Rural North, proximate to the Towns within the Route 7 Corridor, has the highest concentration of residential development and a more developed paved roadway network with easy access to commuter routes. Additionally, the Route 15 corridor, both north and south of the Town of Leesburg, has experienced substantial residential growth since the Board adopted the *Revised General Plan* (RGP) in 2001. The Rural South (geographically defined generally as south of Goose Creek and the North Fork of Goose Creek to the County border with Clarke, Fauquier, and Prince William Counties, Virginia) is characterized by an existing large lot pattern and represents the center of Loudoun's prominent equine industry. The Rural South contains a number of large working farms that are accessed by a network of mostly unpaved rural roads. The Rural South contains Loudoun County's largest amount of permanently protected land that is held under voluntary conservation easements. Both the Rural North and Rural South are marked by a scattering of Rural Historic Villages and small crossroad communities, which provide limited retail and commercial services to rural residents and visitors.

Approximately 700 miles of public roads maintained by the Virginia Department of Transportation (VDOT) serve the RPA. These roads range across all classifications, including arterials that feature greater access control to facilitate longer distance travel at higher posted speeds; collector roads that have less access control in order to balance parcel access and mobility; and local secondary roads that primarily provide access to individual parcels. Unpaved gravel secondary roads constitute approximately 255 miles of the County's rural road network. The County, with the support of residents, has made a conscious effort to preserve portions of the historic gravel road

network, which contribute to the character of the rural landscape and provide opportunities for recreational users such as equestrians, bicyclists, and pedestrians.

VDOT, in collaboration with the County, has worked to maintain the delicate balance between service needs and the preservation of the aesthetic character of the road network in the RPA, providing adequate transitions from major rural highways to main streets to rural paved and unpaved road segments. Specific long-range plans and local projects have generally sought to maintain two-lane rural section roadways along most rural corridors, while providing improvements to major commuter routes. These include the Virginia Scenic Byway program; national and state historic district designations; traffic calming projects at appropriate locations; the VDOT Rural Rustic Roads Program; and the incorporation of low-impact modern improvements, such as roundabouts, in lieu of traffic signals and interchanges. As increasing traffic volumes continue to place stress on the rural road network, the County will need to make comprehensive and strategic decisions regarding best practices to provide reasonable mobility, while protecting the rural character and scenic quality of roads in the RPA (see *Loudoun County 2019 Countywide Transportation Plan*).

The Rural North and Rural South are home to a centuries old farming community that shaped the physical landscape and the social and economic fabric of Loudoun. However, over the past 30 years, as portions of the County and the region have become more urbanized, the RPA has faced increased challenges related to demographic changes, land use, economics, and transportation improvements, thus facilitating and enabling the conversion of land for rural residential subdivisions at an increasing rate as some residents seek an alternative to urban life. The adoption of the RGP in 2001 and the accompanying down-zoning of the majority of the land in western Loudoun in 2003 and in 2006, marked a dramatic turn in the County's effort to limit residential development in the RPA and established an approach for land preservation tied to the creation of a viable rural economy and low-density development options, including the clustering of homes to preserve the rural character of the land. The *Loudoun County 2019 General Plan* (General Plan) carries this approach forward.

Rural Residential

A variety of residential development options exist within the Rural Policy Area, including conventional subdivision, subordinate lots, and rural clusters which permit different densities. Among the existing development options, rural clusters remain the preferred residential development pattern in the RPA because these designs better preserve the natural features and open character of the land by tightly grouping homes on smaller lots so that a majority of the land is available for rural economy uses, agriculture, and/or open space. The concentration of homes in a rural cluster also minimize the amount of roads, clearing and grading, and the overall footprint of development, compared to a conventional by-right subdivision which requires placement of homes on a uniform size lot dispersed over an entire property.



Birch Hollow Hamlet, Hillsboro. Clustered residential lots with remainder working farm on 109 acres.

Between 2000 and 2016, 5,653 residential units were built in the RPA. The “build out” analysis for the RPA, which reflects conditions as of July 1, 2016, identifies 91,000 acres of land uncommitted to development projects. This results in the potential for up to 11,643 residential units under current policy and entitlements. The acreage calculation includes parcels that are partially or fully developable and excludes floodplain, conservation easements, mountainside, and steep slope, which do not have development potential. The forecasted development from 2016 to 2040 in the RPA is 7,500 residential units based on current trends and the base density allowed by current zoning, which leaves approximately 4,000 residential units to be developed after 2040. The 2040 forecasts and the ultimate residential buildout for the RPA may be much lower than projected above if property owners continue to retain and preserve large areas of land for agricultural, equine activities, open space, and rural economy uses. Land trusts are anticipated to continue establishing conservation easements on properties in the RPA, reducing the residential development potential allowed by current zoning. Current and future county policies and initiatives, including land use-based property tax assessments and land conservation programs, may also affect future development potential in the RPA.

Rural Economy

The County’s land development approach for the RPA is to limit residential development so that land will remain available for the continued operation, expansion, and establishment of agricultural and rural economy uses that preserve the rural character of the landscape and support the County’s environmental goals. Loudoun’s rural economy has grown to become a collection of business uses that currently include: crop and livestock production, forestry, horticulture and specialty farm products, farm markets and wayside stands, the equine industry, orchards, vineyards, farm wineries, cideries, and breweries, hospitality services such as farm-to-table restaurants, rural

resorts, bed and breakfasts, country inns, banquet/event facilities, private camps and parks, and other similar uses. These rural economy uses largely depend on the agricultural productivity, scenic quality, and rural character of the RPA to derive income to sustain business activities. Additionally, a range of businesses providing indirect support and services to agricultural, forestal, horticultural, and animal husbandry activities also contribute to the rural economy. These agriculture-supportive uses include farm machinery sales and repair services, veterinary services, blacksmiths, agricultural product storage and processing, feed and seed supply, and similar uses. The importance of all these rural businesses to Loudoun County has led to the implementation of a business development plan for the County's rural economy that aims to double the growth of the County's rural economic sectors by 2023. The business development plan strives to create an environment for high value agricultural production that supports the equine and tourism industries, maintains prime farmland, and recognizes that commercial growth in eastern Loudoun is augmented by a thriving rural economy in western Loudoun (see [The Long View, A Business Development Plan for Loudoun County's Rural Economy](#)).

Although many rural economy uses rely on wired or wireless telecommunication networks to support their daily business operations, many areas of the RPA lack adequate high-speed connections. The County, through its strategic initiatives, has identified the provision of high-speed wired and wireless telecommunication networks, including broadband technology, as a priority to support rural businesses and residents in the RPA.

The 2017 Federal Census of Agriculture identified 1,259 farms in Loudoun County (gross income of \$1,000 or more) with a total of approximately 121,932 acres of farmland in production. Almost three quarters of these farms (875) were less than fifty acres in size with the largest percentage of farms being between ten and fifty acres in size. The overall number of farms and acres in farmland production in the County has declined by approximately ten percent since the 2012 Federal Census of Agriculture, when 1,396 farms with a total of 134,792 acres of farmland in production were identified. This data illustrates a number of changes and trends in agriculture: 1) a shift in the type of farming in the County as land and operational costs continue to rise, 2) the subdivision of larger farms into residential lots, and 3) a continuing decline in the amount of farmland and the number of farms and farmers. In light of the census data, County leaders and residents remain committed to keeping rural Loudoun a vital, identifiable place and continue to work to protect and preserve this valuable land resource to sustain the rural economy and support the County's agricultural, equine, and tourism industries.



One of Loudoun County's working farms in the RPA.

In response to market trends, many farmers in the County have shifted to the direct marketing of agricultural products to consumers through either on-farm sales and/or farmers markets to increase

profitability. These specialty farms tend to be smaller in size than traditional farms that produce row crops or raise livestock. These farms include a number of pick-your-own farms which may have fruits, vegetables, flowers, Christmas trees, and other farm-grown products available to the public. A number of farms have also implemented Community Supported Agriculture (CSA) programs where people buy a subscription from a farmer to receive a weekly share of local seasonal produce, meats, and other products (depending on the farmer's offerings).

The equine industry is a major component of the rural economy. Loudoun County leads the state in the number of horses, and the equine industry is the County's largest agricultural employer providing thousands of jobs associated with the care of these animals and the operation of barns and stables. The Virginia Tech Marion DuPont Scott Equine Medical Center is located north of Leesburg, with Morven Park, Glenwood Park, and Oatlands providing regional venues for horse events. Other smaller stables are scattered throughout the County, which provide private lessons, boarding, trail rides, and camps, and host smaller events.

Loudoun County has the highest concentration of wineries and acres in grapes in Virginia, with over 45 wineries and over 1,000 acres in grape production as of 2017. Loudoun County has been marketed as "DC's Wine Country", though it also has the highest number of breweries and leads the state in hops production. The County has a total of 28 breweries, seven of which are farm breweries located within the RPA. In recent years, the region's first hops processing center and Virginia's first dedicated malting operation opened near Luckett's. As of 2017, there are 10 hops yards in the County with 16 acres in production, and there are two growers cultivating 140 acres of malting grain for the production of beer and distilled spirits. Farm wineries, breweries and cideries that grow their own products maintain land in agricultural use which protects the rural character of the RPA and supports rural tourism.

The RPA is home to a number of hospitality and tourism businesses, which provide thousands of jobs and contribute millions of dollars to the local economy through visitor spending on restaurants, retail goods, lodging, and the hosting of weddings and events. County-sponsored events such as the Spring and Fall Farm Tours, Stable Tours, Wine Trail, Ale Trail and Artisan Trail allow visitors to enjoy self-guided driving tours which support local growers, producers and artisans. Numerous community events such as the Bluemont and Waterford fairs draw thousands of residents and visitors to western Loudoun annually. Heritage tourism is also an important contributor to the County's economy, which include the Journey Through Hallowed Ground National Heritage Area and National Scenic Byway, the Waterford National Historic Landmark District, Balls Bluff Battlefield and National Cemetery, Morven Park, Oatlands, Aldie Mill, as well as other historic sites, museums and battlefields. Like many of Loudoun's other rural business uses, these hospitality and tourism businesses rely on the natural, scenic, and rural character of the RPA to attract visitors. Therefore, it is critical to maintain the natural, environmental, and heritage resources that provide the setting and context for our rural tourism economy.

Farmland Preservation and Protection

To support the rural economy and ensure that agriculture continues as a long-term use in the RPA, the County will continue to develop and support voluntary participation in programs that provide assistance and reduced tax burdens to landowners. Such programs and measures as the Land Use

Assessment Program, the Agricultural and Forestal District (AFD) program, and public/private conservation easements will be used to encourage landowners to use their land to expand the rural economy, rather than convert it to residential use. These programs also assist in the protection of the RPA's unique manmade and natural environment, which directly benefit the rural economy.

The County's Land Use Assessment Program and AFD program are tools used to protect agricultural lands and forests. The Land Use Assessment Program provides tax relief to landowners to protect farmland for future agricultural use and to protect historic and scenic resources for the economic and cultural benefits derived from their preservation. The AFD program limits the subdivision of large, farmable acreages and forested lands (typically 20-40 acres), and prohibits cluster subdivisions. While the County's Land Use Assessment Program and the AFD program support keeping land in production and/or open space for a specified number of years, they are voluntary programs that do not preserve land in perpetuity. The primary means of preserving agricultural land and open space permanently is through the establishment of conservation easements on individual properties, which restrict residential and non-agricultural uses. Conservation easements currently preserve over one-third of the acreage within the RPA, the vast majority of which are held by private land trusts (see Conservation Easements in Rural Policy Area: 2019 Map). The County should commit to supporting efforts to increase the total acreage of land held in conservation easements as part of an overall land use strategy to further reduce density in the RPA, and ensure that farmland and open space are available in perpetuity for future generations. The County may consider cost-share initiatives to assist in establishing conservation easements and/or public/private partnerships with existing land trusts to leverage efforts and funding to support the recordation of additional conservation easements.

Future of Rural Strategy

Loudoun County and its citizens continue to recognize the importance of maintaining and preserving the farming and equine heritage, cultural and natural resources, open space, and scenic beauty of the RPA as a fundamental component of the County's identity. The RPA contributes to the overall economic vitality of the County and quality of life of its residents. The General Plan, carries forward the growth management approach for the RPA established in the RGP, which seeks to limit residential growth, retain farmland, and sustain the rural economy. This approach has contributed to the County's economic success through attracting businesses, residents, and visitors while maintaining the character of the RPA. The strength of the agricultural sector, equine industry and the rural economy is a critical component of supporting the economic development and fiscal policy goals of the County. In the future, development pressures and the incremental loss of productive agricultural land to residential development will require continued monitoring by the County to maintain the RPA's unique character.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply only within the RPA.

Land Use & Development

RPA Policy 1: Foster land use and development patterns that incorporate natural, cultural, heritage, and agricultural resources to preserve character-defining features of the rural landscape while providing opportunities for rural living and businesses.

Strategy

- 1.1. Support uses that protect, preserve, and enhance natural areas and open space, retain farmland and the vitality of the rural economy, and foster a high quality of rural life for residents.

Actions

- A. Provide incentives for the consolidation of underutilized or undeveloped small lots into larger parcels for agricultural and rural economy uses.
- B. Consider cost-share initiatives to assist in establishing conservation easements, in order to reduce the land that is available for residential development and to provide landowners with financial options to support working farms, rural economy uses, and/or stewardship of the land.

Rural Residential

RPA Policy 2: Limit residential development to protect the land resource for agricultural operations, rural economy uses, and open space uses; minimize traffic impacts; and reduce the demand for additional public facilities and services.

Strategy

- 2.1. Where residential development does occur in the RPA, it should be designed to preserve the rural character, work with the land form to preserve and protect natural features, and conserve land for agriculture, equine uses, rural economy uses, passive recreation, and open space.

Actions

- A. Evaluate and revise zoning regulations and design standards to improve the design of subdivisions and clustered residential development by incorporating natural features and buffering from roadways and scenic byways.
- B. Encourage the provision of publicly accessible and connected open space.
- C. Educate property owners about alternatives to residential subdivision by providing information on conservation easements, the Land Use Assessment Program, and other land conservation programs to keep rural properties intact and productive.

Rural Economy

RPA Policy 3: Agricultural and rural business uses that are compatible with the predominant land use pattern will be developed in a manner that is consistent with the County's growth management, economic, and environmental goals.

Strategy

- 3.1. Ensure compatibility of rural economy uses through the evaluation of the scale, use, intensity, and design (site and building) of development proposals in comparison with the dominant rural character and adjacent uses.

Actions

- A. Evaluate and revise zoning regulations and development standards for rural economy uses. Such regulations and standards will address traffic capacity, safe and adequate road access, number of employees, site design standards (e.g., land disturbance, buffering, use intensity, siting, and architectural features), and public health, safety, and welfare.
- B. Consider the establishment and/or expansion of existing commercial, industrial, and institutional uses by Special Exception if the use and/or expansion: 1) is compatible in scale, use, and intensity with the surrounding rural environment, 2) uses building forms, massing, and architectural styles that reflect the surrounding rural character 3) preserves ridgetops, natural resources, farmland, and open space, and 4) meets applicable zoning regulations and development standards.
- C. Non-agriculturally related commercial uses may be permitted by Special Exception if the use is compatible in scale and intensity with the agricultural and rural character of the area; poses no threat to public health, safety, and welfare; and helps to preserve farmland, open space, and/or continued agricultural operations.

Strategy

- 3.2. Promote the retention and development of rural business uses that sustain the rural economy and support the County's agricultural, equine, and tourism industries.

Actions

- A. Adopt zoning regulations and design standards that include new types of rural business and agricultural uses, permit flexibility for the sale of farm products, and promote rural tourism, hospitality uses, and similar kinds of rural business uses that are compatible with the character of the RPA.
- B. Evaluate and revise zoning regulations and design standards to permit a variety of accessory residential unit types, such as accessory apartments for seasonal farm laborers and year-round tenant housing, that support the rural economy.
- C. Create zoning regulations and design standards for existing and new types of rural recreational uses to evaluate their appropriateness and ensure their compatibility with the character of the RPA.
- D. Develop County parks with trail networks, cross-country courses, and equestrian riding rings or other equestrian-related features.

- E. Develop a publicly accessible multi-use trail network (i.e., pedestrian, bicycle, and equestrian) to link private and public lands in the RPA in partnership with nonprofit entities, landowners, and developers of rural properties.
- F. Develop a strategy to facilitate the development of high-speed wired and wireless telecommunication networks, including broadband technology, to support rural businesses and residents in the RPA.

Strategy

- 3.3. Promote and expand agricultural enterprises and the rural economy, and attract rural entrepreneurs to locate in Loudoun.

Actions

- A. Promote rural business sectors and community events to support rural tourism, showcase the rural economy, and strengthen the economic vitality of rural businesses, villages, and towns.
- B. Develop a coordinated service approach to assist rural landowners in the review and development of proposals to maintain agricultural operations, preserve the agricultural potential of farmland, institute farm and rural business plans, and assist in filing applications, which support agriculture, agricultural activities, and the rural economy.
- C. Develop additional incentives to retain and encourage agricultural enterprises and support land preservation.
- D. Retain the Rural Economic Development Council (REDC) as an advocacy and advisory committee on initiatives, programs, and policies that affect the economic growth and development of rural Loudoun County.
- E. Support public education and job training in agriculture-based careers to ensure a stable agricultural work force and promote the region's agricultural and tourist based economy.
- F. Facilitate the provision of appropriate on-site housing options for farm interns and apprentices in support of agricultural workforce development.
- G. Develop an update process to ensure the Loudoun County Economic Business Development Strategy is updated on a regular basis.

Strategy

- 3.4. Maintain the Land Use Assessment Program to provide property tax relief to retain and support agriculture, horticulture, forestry, and open space as critical components of the RPA.

Actions

- A. Regularly review, update, and enhance the Land Use Assessment Program and other voluntary agricultural programs, such as the Agricultural and Forestal District (AFD) program, to strengthen the rural economy, preserve rural character, and maintain the viability of farming.

Strategy

- 3.5. Promote and encourage the preservation, rehabilitation, and repurposing of farm buildings and structures to maintain infrastructure for future agricultural enterprises and rural economy uses. Where possible, rural business uses should locate in existing agricultural and historic structures.

Action

- A. Adopt zoning regulations and design standards that facilitate the use of existing agricultural and historic structures.

Strategy

- 3.6. Support and increase farming activities and maintain a resilient food network for local consumption.

Actions

- A. Promote community supported agriculture (CSA); the direct sale of farm products between farmers and local consumers including farmers markets, restaurants and retailers; and the establishment of a permanent year-round indoor farmers market in the eastern portion of the County.
- B. Facilitate effective processing, distribution, and marketing of locally grown products.
- C. Promote best practices in farming, including adapting to new crops, livestock, and technology, to address market demands and diversify agricultural production.

Strategy

- 3.7. Protect farming and farmers from nuisance complaints in accordance with the provisions of the Right to Farm Act, Code of Virginia §3.2-301.

Actions

- A. Maintain zoning regulations and design standards that protect the right to farm.
- B. Support and provide educational programs about farming practices and activities to reduce potential conflicts associated with the proximity of agriculture to nonagricultural uses.

Design Guidelines

The Design Guidelines are to build upon our current development patterns in a manner that allows innovative design and new responses to the market. The Design Guidelines are not meant to be prescriptive and are not intended to be treated as a checklist, but are instead meant to provide a framework for how the desired character of the RPA can be achieved, with the acknowledgement that other methods could achieve the intended results. The Design Guidelines do not supersede or otherwise limit the application of adopted zoning regulations, ordinances, building codes, or any other design standards or regulations administered by Loudoun County.

When using the guidelines make sure to analyze the impact a potential development may have on the landscape, considering not only appearance, but practical considerations such as proximity to roads, utilities, and community amenities to maximize the use of existing infrastructure and limit travel distances. Development should contribute to creating unique places within the Rural Policy

Area by working with existing topography and site features, responding to the local context, preserving farmland and reinforcing the landscape's character, rather than simply attempting to place suburban design onto the rural landscape. Sustainability requires maximum consideration for using the landscape for benefits such as solar heat gain or shelter from wind when siting buildings. It is imperative that buildings and structures are treated as objects in the rural landscape and given due attention to their location and form to ensure they blend with the topography, protect viewsheds, and contribute to the traditional pattern of development in the RPA. The County encourages the use of a design process when planning development in the RPA that conserves natural, environmental, and heritage resources and incorporates any such features into the site design (See Appendix A for Design Guidelines for RPA).

Place Types

As described in the beginning of this chapter, the following Place Types have been designated for specific locations as displayed on the accompanying map. The Place Types will work in concert with the Design Guidelines and Policies, Strategies, and Actions of the RPA and Rural Historic Villages to fulfill the land use patterns and community characteristics intended for the area.

Rural Historic Villages

Vision

Rural Historic Villages continue to be vibrant communities that reflect historic settlement patterns that preserve and enhance Loudoun's social and cultural heritage while contributing to the overall character of the Rural Policy Area.

Introduction

The County recognizes the Rural Historic Villages as important features of the RPA that possess scenic and historic resources, act as gathering places for citizens, provide services to the surrounding community, and support rural tourism. The existing Rural Historic Villages were established during the 18th and 19th centuries, in areas located around historic mills, railroad depots, or major crossroads that later developed as commercial and mercantile business centers that served the surrounding farming communities.

The Rural Historic Villages have gradually developed over a number of years and feature a variety of building setbacks, types, and styles as well as streetscapes that reflect the historic growth and character of the individual villages. The Rural Historic Villages are dominated by residential dwellings with some commercial structures that have upper floor apartments and offices. Small scale, non-residential uses, such as country stores, restaurants, antique shops, and other retail establishments that meet local needs and support tourism, are located within some of the Rural Historic Villages. In addition, numerous civic uses, such as churches, post offices, community centers, fire and rescue stations, and schools, are also located within the Rural Historic Villages.

The County's land development approach for the Rural Historic Villages is to limit residential, business, and commercial activities to uses that are compatible with the historic development patterns, community character, and visual identity of the individual villages. The *Loudoun County 2019 Comprehensive Plan* (Comprehensive Plan) strives to maintain the traditional development pattern and distinguishing features of the individual villages while accommodating opportunities for compact, small-scale growth where appropriate in a manner that enhances existing residential and commercial areas. By encouraging limited compact, residential and non-residential development within the Villages, these policies complement the County's efforts to preserve open space and maintain the character of the rural area. Although limited development is anticipated in the Villages, that development should not adversely affect the quality of life of residents nor pose a threat to public health or safety. Only three of the existing Rural Historic Villages – Aldie, St.

Rural Historic Villages

Aldie

Bluemont

Bowmanton

Lincoln

Loudoun Heights

Lucketts

Neersville

Paeonian Springs

Philomont

St. Louis

Taylorstown

Waterford

Louis and Waterford – are currently served by public community wastewater systems. Aldie is the only village that is served by a private water company. The remainder of the properties located within the Rural Historic Villages are currently served by individual water wells, and septic sewage systems (i.e., conventional drainfields, alternative systems, etc.), which limit the potential scale and intensity of development. Additionally, a number of the Rural Historic Villages are bisected by major roadways that experience high volumes of commuter traffic and impact the quality of life of residents. With careful planning and growth management, the Rural Historic Villages will maintain their scenic and historic character.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply only within the Rural Historic Villages.

RHV Policy I: Development and uses in Rural Historic Villages must be compatible with the historic development pattern, community character, visual identity, intensity, and scale of the individual villages.

Strategy

- 1.1. Encourage the retention and development of a variety of compatible residential, commercial, and community uses that enhance the attractiveness and vitality of the Rural Historic Villages.

Actions

- A. Develop criteria to evaluate existing Rural Historic Villages and other historic crossroads communities, such as Airmont, Bloomfield, Howardsville, Morrisonville, Unison, and Willisville, to determine if their current designation is warranted, define and/or redefine community boundaries as necessary, and amend the Comprehensive Plan and Zoning Ordinance as appropriate.
- B. Work with Rural Historic Villages to develop community plans that will support their community goals and address issues related to land use and zoning; economic development; natural, environmental, and historic resources; community facilities and services; water and wastewater; and transportation to maintain the character of the villages.
- C. Review and revise zoning regulations, design standards, and guidelines to achieve compatible building and street design to ensure that quality development occurs within the Rural Historic Villages.
- D. Coordinate with Rural Historic Village communities to determine appropriate methods to differentiate entrances into the villages from surrounding areas, including through street design, landscaping, and building placement.
- E. Incorporate traffic calming measures that are compatible with the village character where appropriate to reduce vehicle speeds and provide a pedestrian-friendly environment.

F. Evaluate and revise existing Rural Commercial (RC) zoning district regulations to implement Plan policies and design standards for development in the Rural Historic Villages that ensure compatibility with the settlement patterns and neighborhood scale.

Strategy

1.2. Preserve the character of the villages and their historic structures and sites through the rehabilitation and adaptive reuse of existing buildings.

Actions

- A. Promote and support building maintenance and improvements to preserve the existing building stock and the character of the villages.
- B. Evaluate the establishment of additional County Historic Districts in the Rural Historic Villages.

Strategy

1.3. Limited increases in residential densities within the Rural Historic Villages may be considered through legislative approval processes when the design of the project reinforces the character, development pattern, and identity of the village. Conventional, suburban forms of development are not appropriate in or contiguous to Rural Historic Villages.

Action

- A. Adopt zoning regulations and design standards to encourage housing on smaller lots, allow accessory apartments attached to single-family residential units, and allow residential units above commercial/retail uses within the Rural Historic Villages to provide housing options.

Strategy

1.4. Business and commercial uses in the Rural Historic Villages should be 1) small scale, 2) compatible with existing development patterns, 3) generate limited vehicular traffic, and 4) meet local community needs or support rural tourism.

Action

- A. Adopt zoning regulations, design standards and performance criteria that are specific to the types of small-scale, community-related commercial uses that the County encourages within the Rural Historic Villages.

Design Guidelines

The Design Guidelines are to build upon our current high quality development in a manner that allows innovative design and new responses to the market. The Design Guidelines are not meant to be prescriptive and are not intended to be treated as a checklist, but are instead meant to provide a framework for how the desired character of the Rural Historic Villages can be achieved, with the acknowledgement that other methods could achieve the intended results. The Design Guidelines do not supersede or otherwise limit the application of adopted zoning regulations, ordinances, building codes, or any other design standards or regulations administered by Loudoun County.

When using the guidelines make sure to analyze the impact potential development may have on the Rural Village and surrounding landscape, considering not only appearance, but practical considerations such as road and street access, siting of buildings and parking, safe and adequate water and wastewater, community amenities, jobs, and housing to assess compatibility. Development should contribute to the character of the Rural Historic Villages to integrate and blend with existing development patterns and building styles.

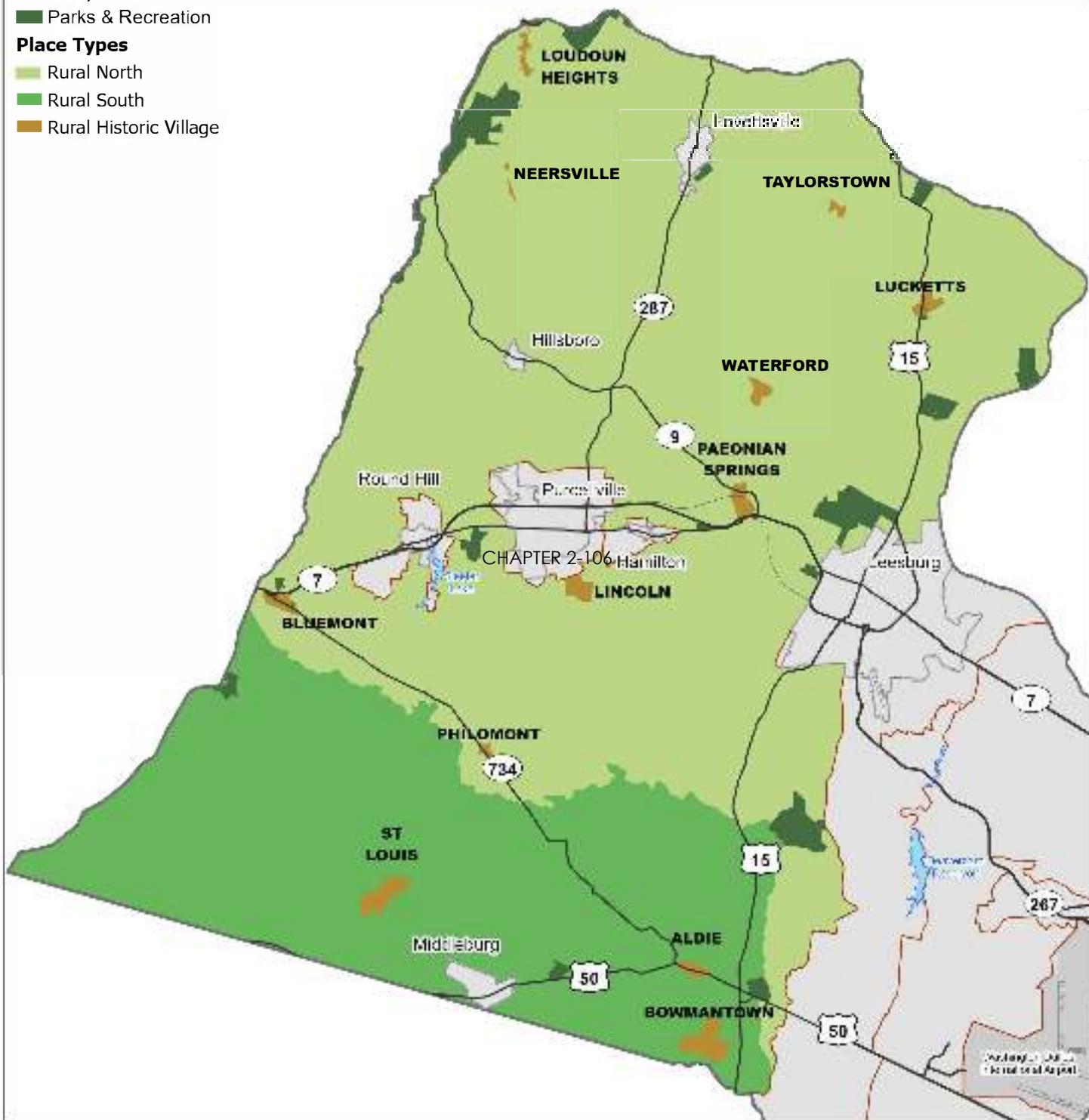
Many properties within the Rural Historic Villages of Aldie, Bluemont, Lincoln, Taylorstown and Waterford are located within County Historic and Cultural Conservation Districts which are zoning overlays that regulate the appearance of properties through architectural design guidelines. Any alterations, additions, demolition or relocation of an existing structure, or any new construction within the conservation districts requires approval from the County's Historic District Review Committee. The goal of the architectural review processes is to ensure the historic, architectural, and landscape characteristics that are unique to the villages are protected, preserved, and enhanced for future generations. While the remainder of the Rural Historic Villages do not have historic district zoning overlays, the County's policies also support compatible development and the retention of the unique character of the individual villages. Public water and wastewater facilities are encouraged to provide services to the villages (See Appendix A for Design Guidelines for Rural Historic Villages).



Policy Areas
Parks & Recreation

Place Types

- Rural North
- Rural South
- Rural Historic Village



Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles

Map Number 2023-065

CHAPTER 2-107

Rural North



The Rural North consists of pastoral and forested landscapes that serve mostly agricultural and agricultural supportive uses with limited residential. The area allows for complementary agricultural, rural business, and tourism uses that constitute Loudoun's rural economy. This category also includes low-density, large-lot residential subdivisions that are compatible with the surrounding pastoral character, and subdivisions that cluster smaller residential lots while retaining large lots for open space, agricultural production and/or rural economy uses. Public utilities are not provided and wells and septic systems are traditional; however, shared community water and wastewater systems may be utilized for cluster developments and rural economy uses. Minimum lot sizes vary according to land use and the development option chosen. All developments should incorporate natural and heritage resources while preserving important viewsheds that contribute to the rural landscape.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Agriculture • Agricultural Supportive Businesses • Equine Facilities • Rural Economy 	<ul style="list-style-type: none"> • Large Lot Residential • Clustered Residential Subdivision • Accessory Residential Units • Agritourism • Rural/Heritage Tourism 	<ul style="list-style-type: none"> • Public Facilities • Civic, Cultural & Community • Institutional • Special Activities • Parks & Recreation

DESIGN CHARACTERISTICS

Context

Large areas of land preserved for open space, agriculture, and rural economy uses to retain the rural character of the area with limited low-density residential and clustered residential development that blends with and is compatible with the surrounding area.

Street Pattern:

Contour Forming, Fragmented Parallel

Block Length:

Irregular

Building Setback:

Varies (incorporate existing natural features to protect viewsheds)

Parking:

Surface lot, driveway, garage, shared

Open Space:

Recreation (Passive), Natural, Environmental and Heritage, and/or Agriculture

70% of site for clustered subdivisions

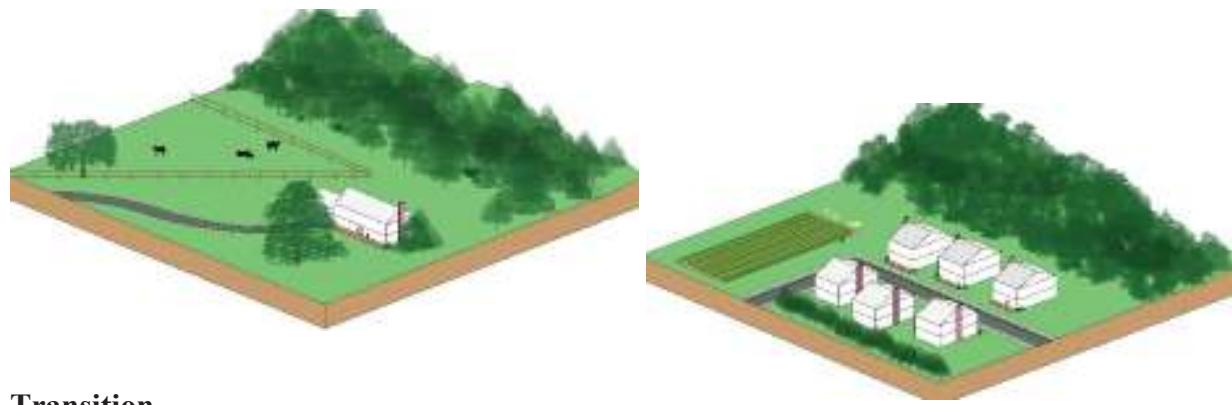
Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: Up to 1 du / 20 acres

Residential Cluster Option: Up to 1 du / 5 acres equivalent

Building Height: Up to 2 stories



Transition

Locate buildings and structures to blend with the existing topography and natural features. Preserve and incorporate existing trees and vegetation on the property and its perimeter to buffer and screen views for adjoining properties. Provide landscaping or supplemental plantings comprised of native species when screening and buffering are required between rural uses.

Rural South



The Rural South contains mostly agricultural and equine uses and allows for complementary rural economy uses. This Place Type includes very low-density residential with homes located on large lots that are compatible with the surrounding pastoral character and clustered subdivisions that group smaller residential lots while retaining large lots for open space, agricultural production, and/or rural economy uses. Public utilities are not provided and wells and septic systems are traditional; however, shared community water and wastewater systems may be utilized for cluster developments and rural economy uses. Minimum lot sizes vary according to land use and the development option chosen. All developments should maintain the distinctive rural character through the incorporation of natural and heritage resources and the preservation of important viewsheds.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Agriculture • Agricultural Supportive Businesses • Equine Facilities • Rural Economy 	<ul style="list-style-type: none"> • Large Lot Residential • Clustered Residential Subdivision • Agritourism • Rural/Heritage Tourism 	<ul style="list-style-type: none"> • Accessory Residential Units • Public Facilities • Civic, Cultural & Community • Institutional • Special Activities • Parks & Recreation

DESIGN CHARACTERISTICS

Context

Large areas of land preserved for open space, agriculture, and rural economy uses to retain the rural character of the area with limited low density residential and clustered residential development that blends with and is compatible with the surrounding area.

Street Pattern:

Contour Forming, Fragmented Parallel

Block Length:

Irregular

Building Setback:

Varies (incorporate existing natural features to protect viewsheds)

Parking:

Surface, driveway, garage, shared

Open Space:

Recreation (Passive), Natural, Environmental and Heritage, and/or Agriculture

70% of site for clustered subdivisions

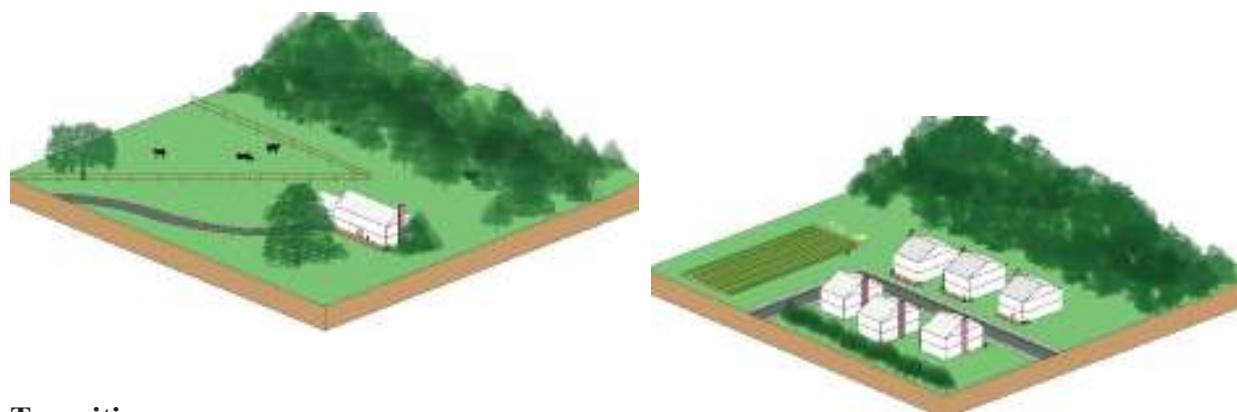
Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: Up to 1 du / 40 acres

Residential Cluster Option: Up to 1 du / 15 acres equivalent

Building Height: Up to 2 stories



Transition

Locate buildings and structures to blend with the existing topography and natural features. Preserve and incorporate existing trees and vegetation on the property and its perimeter to buffer and screen views for adjoining properties. Provide landscaping or supplemental plantings comprised of native species when screening and buffering are required between rural uses.

Rural Historic Villages



Rural Historic Villages consist of small, pedestrian-scale rural communities that are compact in comparison to the surrounding agricultural landscape. The majority of these villages have developed around a small residential and/or commercial core that provide for the daily needs of village residents, surrounding rural residents, and visitors. Rural Historic Villages are characterized by low-density residential development situated on smaller lots interspersed with limited commercial uses. Residential and commercial uses are generally located in detached stand-alone two-story buildings which are located close to the street. In some instances office or residential uses are located above first floor retail. Each Rural Historic Village has its own unique character linked to its historic development pattern, spatial organization, and location within the County.

Spacing of buildings—both commercial and residential—should respect each village's historic precedents for lot size, building setbacks, and orientation to the street. Buildings should be designed to be sensitive to the context of the village through compatible siting, size, scale, massing, materials, design details, and roof forms.

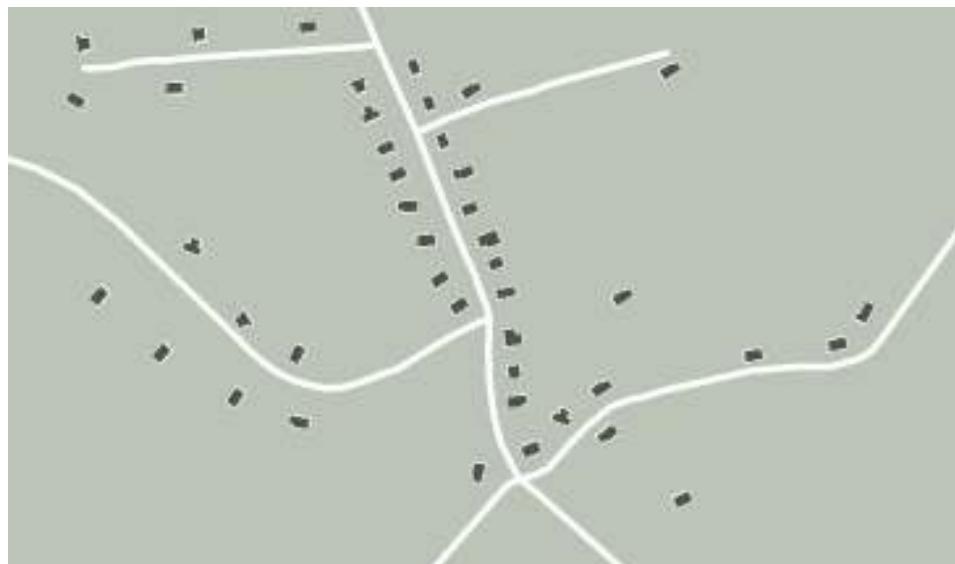
Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Single Family Detached Residential • Retail & Service Commercial 	<ul style="list-style-type: none"> • Office • Live/work units • Civic, Cultural, & Community • Rural/Heritage Tourism • Rural Economy • Agricultural Supportive Businesses 	<ul style="list-style-type: none"> • Accessory Residential Units • Public Facilities • Special Activities • Parks & Recreation

DESIGN CHARACTERISTICS

Context

Small-scale and often historic buildings sited in a compact pattern that contain residential or commercial uses that may also be vertically mixed. Each Rural Historic Village has a unique character and sense of place that should be preserved and enhanced.

Street Pattern:
Contour Forming, Fragmented Parallel, Irregular
Block Length:
Varies by Village
Building Setback:
Shallow
Parking:
On-street, driveway, garage
Open Space:
Recreation (Passive), Community, Natural, Environmental and Heritage, and/or Agriculture



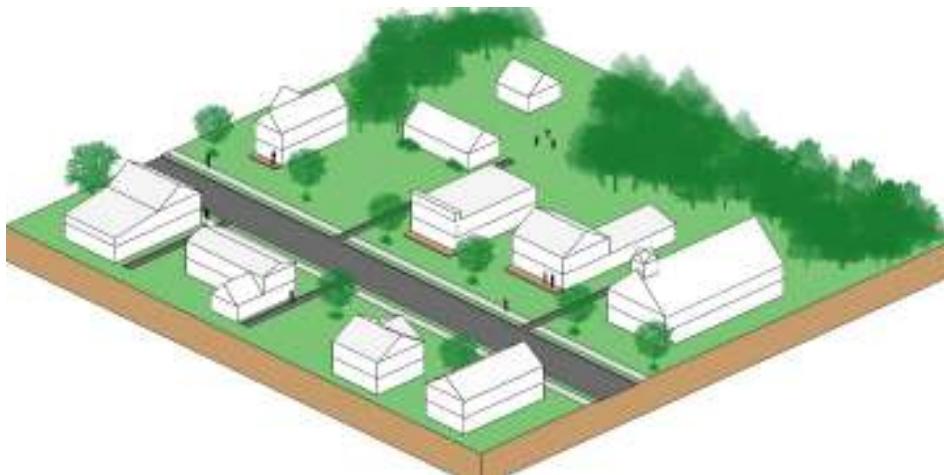
An example plan view of a Rural Historic Village

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: Varies by individual village; no more than 4 du / acre

Building Height: Up to 2 stories



Transition

Maintain areas of open space and natural areas on the perimeter of the villages to maintain a hard edge and visual separation from surrounding uses. Within the village, preserve existing trees and vegetation, which define building lots and contribute to the streetscape. New construction should be designed to complement surrounding properties and maintain the existing development pattern within the Village.

Towns and JLMA

Vision

The Towns will continue to be hubs of economic and cultural activity in western Loudoun.

Introduction

In 2016, approximately 62,000 Loudoun residents lived in Loudoun's incorporated Towns (see Table 1). The seven incorporated Towns offer a window to the County's past and are a key component of Loudoun's unique character today. All have existed as independent incorporated entities for more than a century, first as agricultural business centers providing markets for farm products, and supplying the necessary goods and services for rural residents. They were also distribution points linked by railroad to markets to the east. While still influenced by their agricultural tradition, the Towns play a larger economic and cultural role that includes retail and service-based businesses, educational opportunities, medical centers, and industrial centers. Remnants of the W&OD Railroad line have become an important regional shared-use trail link still tying the Towns to each other and communities to the east.

Table 1. Housing and Population Estimates

Town	Population	Housing Units	Approximate Town Area (acres)	Approximate JLMA Area (acres)
Hamilton	448	193	135	630
Hillsboro	98	44	170	NA
Leesburg	49,401	17,202	8,000	4,300
Lovettsville	2,096	694	570	NA
Middleburg	656	429	680	NA
Purcellville	8,914	2,725	2,200	2,200
Round Hill	570	222	240	1,450
Totals	62,183	21,509	12,000	8,580
Loudoun County	362,435	122,490	333,558	17,160

Source: 2016 American Community Survey

Development Approach

The *Loudoun County 2019 Comprehensive Plan* recognizes the cultural and economic importance of these individual towns maintaining their historic character. The Plan continues the Joint Land Management Area (JLMA) concept, in place since 1991, which intends to accommodate the outward expansion of the Towns, permitting moderate growth at densities and designs suitable to the Towns until the Towns choose to annex property. However, implementation of the JLMA policies has not created development patterns that reflect the historic character of the Towns. The *Loudoun County 2019 Comprehensive Plan* recommends future action to review and modify the JLMA concept. The *Loudoun County 2019 Comprehensive Plan* also recognizes that, where

possible, the remaining defining edge distinguishing the towns and the JLMA from the rural area be maintained and enhanced with an effort to create “gateway” corridors leading to each town. The JLMA zoning regulations offer a range of densities, design guidelines, and utility requirements. Leesburg, Round Hill, Purcellville, and Hamilton have seen extensive development in their respective JLMA, while Lovettsville, Middleburg, and Hillsboro have over time chosen not to have JLMA because of utility constraints, concerns about growth, or a desire to concentrate inside their existing limits. Leesburg’s JLMA has a distinct suburban pattern with predominantly residential development north of Route 7 and business and employment uses south of Route 7.

Policies, Strategies, and Actions

Town Policy I: Collaborate with the Towns on matters of common interest to preserve the identity of each Town and their role as economic and social centers. The County recognizes that the Towns may be impacted by proposed development near their borders and will consider, as appropriate, Town comments on development near their borders.

Strategy

- 1.1 Work with the Towns to develop and implement a shared vision for the Towns and their surrounding areas and gateways.

Actions

- A. Continue to refer to jointly approved area management plans and refer to applicable Town policies on matters within the JLMA.
- B. Establish a regular coordination program with Towns to anticipate, monitor, and address development and planning matters.
- C. Undertake joint planning efforts in the JLMA.
- D. Participate as a partner with the Towns in their negotiations with VDOT and other agencies for road maintenance, safety improvements, and traffic calming, particularly along Routes 15, 50, 7, 9, and 287 in proximity to the Towns, and other changes in roads and/or transportation services that are consistent with both the Town’s and the County’s goals and priorities.
- E. Assess the effectiveness of the JLMA approach and associated zoning in protecting town character, maintaining a defining edge between the town and the rural areas, and/or as a tool for expanding economic development objectives. The defining edge is the boundary between two distinct land use patterns, whether existing or desired. The edge may encompass an area that establishes a visual distinction, either as perceived from the road or from broader views of the landscape.
- F. Add provisions to the rural and JLMA zoning districts specific to gateway corridors leading into each town that would establish deeper building setbacks variable building and lot configuration and orientation, hedgerow landscaping and buffering along the road, and other measures that retain or create a traditional rural or natural appearance

leading into the town.

- G. Work with the Towns, interested groups and nonprofit foundations to identify open-space and agricultural-preservation strategies such as: donation of conservation easements, fee-simple purchase, clustering, and the possible creation of a conservation service district.

Strategy

- 1.2 Encourage new development to locate within the Towns before moving into the JLMA or surrounding area.

Actions

- A. Encourage the maintenance, improvement, or adaptive reuse of existing building stock in a manner that supports social and economic diversity within the community.
- B. Promote the commercial areas within the Towns as the preferred location of retail and service businesses, office development, and public and civic uses, as deemed appropriate by the Towns.
- C. Work with the Towns to enhance their economic base and maintain viable commercial areas through marketing, capital investments, and business attraction.
- D. Support annexations by the Towns when water and sewer extend into a JLMA in accordance with the annexation guidelines in this section and to resolve jurisdictional questions for property owners.
- E. Encourage site layouts in a JLMA that extend the existing and planned development patterns of the Town and surrounding JLMA.

Strategy

- 1.3 Continue to recognize the Towns as the preferred location of public facilities serving the Rural Policy Area, when otherwise consistent with Town policies and when suitable land and services are available.

Actions

- A. Encourage the continued use of existing public facilities located in the Towns and JLMA and seek to maintain existing community-based schools as an important social and economic component of the communities.
- B. Cooperate with the Towns providing local law enforcement to ensure a coordinated enforcement strategy within the Town JLMA.
- C. Support development of sidewalks and recreational, multi-use, and equine trails connecting the Towns to each other, to regional trail networks such as the W&OD and C&O Canal, and to area destinations.

Leesburg

Leesburg, the largest and most populous of the incorporated towns with a population of approximately 49,000 residents¹, has the added distinction of serving as the seat of the County government. By its location, it functions and appears to be a commercial hub at the junction between suburban areas to the east and rural areas to the west. The pressures for growth in Leesburg are the result of the robust regional economy that will continue to draw more businesses, government jobs, and residents. Town character is of paramount importance to Leesburg. The Old and Historic District is the basis of Leesburg's identity. It is a compact, mix of land uses; its blocks and buildings are human scaled; a resurgence in entertainment retail uses and downtown residential development have brought new development interest to the community. Other portions of the Town have a different, more suburban character where more uniform uses and large lots, curved streets, and culs-de-sac dominate the landscape. Between 2001 and 2016, Leesburg added 5.5 million square feet of retail, commercial, office, and institutional development, and approximately 4,300 residential units.

The Town's planning vision for the foreseeable future is to continue the diversity in economic and housing opportunities in a manner that reflects the best and essential qualities of the old and historic downtown. Leesburg will maintain a high quality of life by providing a full range of community facilities and services and diverse economic opportunities, protecting natural, environmental, and heritage resources, and protecting against negative environmental impacts. The Town of Leesburg is approximately 90 percent built out and, like other towns, has limited land area for new government facility development. County strategies recognize the fiscal impact of public facilities on a Town with limited land resources and has added more flexibility to locating such facilities in and around towns.

Leesburg's JLMA is situated almost entirely to the south and east of the corporate limits and contains approximately 7,000 acres. The northeast portion of Leesburg's JLMA has developed in the manner recommended by Town and County plans with a distinct suburban residential pattern, while other areas of the JLMA are planned for non-residential uses.

The Town views the main purpose of JLMA land uses between Route 7 and Route 267 to serve as an expansion of economic development goals by focusing on employment uses. JLMA planned place types reflect Leesburg's Town Plan and no major changes to land use are proposed.

On the south, west, and north sides of Leesburg there is no JLMA; instead, policies support a greenbelt and a defining edge adjacent to the Town. The *Loudoun County 2019 Comprehensive Plan* implements the greenbelt throughrural and transitional place types up to these Town boundaries and proposing specific development guidelines along the major roads leading to the Town to preserve distinctly rural development pattern.

¹ 2012-2016 American Community Survey 5-Year Estimates.

Strategy

1.4 Ensure development within the Joint Land Management Area complies with the *Loudoun County 2019 Comprehensive Plan* and the Leesburg Town Plan, as amended.

Actions

- A. Collaborate with the Town of Leesburg on locating new facilities in the Town or JLMA.
- B. Maintain the planned land use of the JLMA consistent with Town of Leesburg land use policies; maintaining an emphasis on employment uses south of Route 7 and residential to the north of Route 7.
- C. Prohibit power generation plants in the Leesburg JLMA.
- D. Define the Town of Leesburg and JLMA as a distinct community separate from the Suburban and Rural Policy Areas by retaining rural policies and zoning to the north and south of the Town boundary and west of Evergreen Mills Road, and protecting the Goose Creek and Sycolin Creek floodplains to the east and south of the JLMA.
- E. Preserve the rural character of the viewsheds along Route 15 as it approaches the Town of Leesburg from the north and south by encouraging additional conservation easements and instituting design guidelines.
- F. Cooperate with the Town of Leesburg to complete the Potomac Heritage Trail and conserve open space along the Potomac River within the Town boundary and JLMA area.
- G. Coordinate with the Town of Leesburg and VDOT on the feasibility of planning and building Edwards Ferry Road as a two-lane facility with on-road bicycle accommodations. The County will work with the Town and VDOT to designate the road as a scenic by-way.
- H. Protect the viability of the Leesburg Airport by ensuring development in the JLMA does not impede Airport operations by continuing to prohibit residential development inside the 65 Ldn noise contour.

Hamilton

First settled in the 1730s and incorporated in 1875, the Town of Hamilton is located along business Route 7 between Leesburg and Purcellville. Hamilton served as a commercial and tourism hub after the railroad was extended west of Leesburg, though by the mid-1900s had become primarily a residential community. The existing JLMA around Hamilton and the adjacent RPA along the north side of its boundaries have also developed with residential uses. While Hamilton has extended utilities outside of its boundaries and has water facilities in the JLMA, it does not foresee expansion of the JLMA. An existing school and school support facilities on the western edge of the JLMA serve to separate the community from Purcellville.

The Town of Hamilton Comprehensive Plan for the Town of Hamilton and JLMA serves as Loudoun County's planning document for the Hamilton JLMA. The Comprehensive Plan for the

Town and JLMA was jointly adopted by Loudoun County and the Town of Hamilton and planned for a period through 2020. The Policies, Strategies, and Actions specific to Hamilton address the continued coordination between the Town and County regarding future updates to Hamilton's Comprehensive Plan.

The Town of Hamilton supports the Town's ability to annex land within its JLMA. The Town believes such annexations provide "win-win" scenarios that enable the Town to provide better and additional services to property owners, while the County still receives applicable tax revenue from these areas.

The Town of Hamilton also supports collaboration between Loudoun County and the Town regarding development issues near the Town, especially to the west and east along Business Route 7/Colonial Highway.

Hamilton's wells are vital to the continued provision of potable water to County and Town residents. As such, Hamilton supports Policies, Strategies, and Actions regarding the location and depth of private wells to protect municipal wells that provide water to thousands of people throughout Loudoun County.

The Town of Hamilton supports an emphasis on affordable housing and supports increased efforts to provide housing that is affordable to the workforce, seniors, teachers, firefighters, police, and others who allow Loudoun County to function as a community.

Strategy

- 1.5 Development within the Hamilton JLMA will comply with the comprehensive plan for the Town of Hamilton and the adjacent area in the JLMA.

Actions

- A. Maintain the Town of Hamilton authority over subdivision applications within 1 mile of its corporate limits.
- B. Work with the Town of Hamilton to update the Comprehensive Plan for the Town and JLMA after the adoption of the *Loudoun County 2019 Comprehensive Plan*.
- C. Support the Town of Hamilton efforts to develop an identifiable town center to serve as a community focal point for the Town of Hamilton and the JLMA.
- D. Seek to improve street connectivity as the redevelopment and infill development occur in the JLMA and connect to the existing streets in the Town of Hamilton, where feasible, with roads that are compatible with traditional town designs.
- E. Work with the Town of Hamilton to effectively manage transportation systems around the Town and to explore methods of traffic calming on Business Route 7 through town including the possible use of a traffic circle at Route 7 and St. Paul Street.
- F. Maintain a distinct identity for the greater Hamilton community separate from the adjacent rural areas by establishing a greenbelt around the Town of Hamilton and the JLMA using conservation easements, passive and active parks and other means.
- G. Work with the Town of Hamilton to achieve a balanced land use pattern that will retain

Hamilton's historic small-town character in a rural setting and maintain its unique sense of place.

- H. Work with the Town of Hamilton to plan for a shared-use trail connecting to the Town of Purcellville.

Hillsboro

Established in 1752 in the narrow gap of the Short Hill Mountains and known simply as "The Gap" until incorporated as Hillsborough in 1802, today's Town of Hillsboro is among the best-preserved 18th/19th-century rural villages in the Commonwealth. Although a 2016 boundary line adjustment nearly doubled the Town's area, with a population of approximately 100 residents², Hillsboro remains the fourth smallest town in Virginia.

First placed on the National Register of Historic Places in 1977, the Hillsboro Historic District was expanded in 2010 to encompass 152 acres with 52 contributing structures dating primarily from the 18th and mid-19th centuries. The compact linear village is bounded on its south by Catoctin Creek and South Short Hill, and the North Short Hill on the north, and is bisected by Historic Charles Town Pike (Va. Route 9), which has become a major commuter route connecting Northern Virginia to West Virginia and Maryland and carrying more than 17,000 vehicle trips daily.

Hillsboro successfully supported a traffic-calming and congestion mitigation project with the intent to reduce delays during peak hours, control speeds via dual roundabouts and traffic-calming features, and create a safe pedestrian/multi-modal environment with the addition of sidewalks, raised crosswalks, and a series of multi-modal trails. Utilizing context-sensitive materials, streetscaping, and burial of overhead utilities, this project preserves Hillsboro's historic character and enhances its sense of place. With safe parking and pedestrian access allowing appropriate small-scale enterprises, Hillsboro looks to regain its historical role as the hub of a robust agricultural region, which has also become a major tourist destination with an expanding array of vineyards, breweries, and recreational activities – including Virginia's newest state park.

In addition to Hillsboro's traffic-calming project, the complete overhaul of the Town's drinking water system and installation of a low-pressure sanitary sewer force main, in anticipation of a community wastewater treatment facility, will serve the community for years to come.

With its transformative infrastructure projects, Hillsboro's Comprehensive Plan and Zoning Ordinance will be updated to better reflect the potential for appropriate economic development within the existing built environment that is consistent and complementary to historic preservation and provides a broader tax base to ensure long-term viability. The Town will continue the repurposing of its landmarks, Old Stone School and Gap Stage, into a regional venue for the arts in addition to serving as Hillsboro's Town Hall and community/visitor center.

As the traditional "home town" for a nearly 50-square mile rural region in Northwest Loudoun, the Town of Hillsboro has taken a leadership role in unifying and "branding" the area. The Town supported and facilitated the conversion of the Hillsboro Elementary School into Loudoun's second public charter school in 2016, led a successful effort in 2017 to reestablish an official

² 2012-2016 American Community Survey 5-Year Estimates.

Hillsboro postal identity for this area, and fostered the creation of the Greater Hillsboro Business Alliance.

With more than a dozen vineyards, numerous specialty farm operations and Loudoun's greatest concentration of bed and breakfasts within five minutes of the Town's center, Hillsboro is the gateway to one of Virginia's most dynamic rural economies. As such, the Town has an existential stake in the preservation of the farmlands and open spaces, mountainside forests and ridge lines that surround it. Hillsboro's historic integrity as a rural village situated on the 18th-century "Great Road" – Charles Town Pike – is largely defined by the still existent swaths of farmlands on its east and west approaches. As Hillsboro's National Register of Historic Places nomination describes: "The majority of the buildings in Hillsboro are nestled along Charles Town Pike. The nominal setback of these buildings contributes to Hillsboro's sense of time and place, as the uniformity and integrity of the building stock has been maintained.... The buildings share a commonality in their setback, maintaining Hillsboro's integrity of location and feeling. The rural character of Hillsboro is further increased by the size of the outlying properties."

Hillsboro's uniquely unspoiled rural and historic character – despite its location within one of the nation's most economically dynamic, fastest-growing and wealthiest counties – makes the Town and its environs assets that will only become more valuable with the urbanization of eastern Loudoun. Proactive preservation of farmland in the RPA through private permanent conservation easements is essential.

The renaissance that Hillsboro is currently experiencing will serve as a catalyst to ensuring the long-term viability of a strong recreational/agritourism economy in Northwest Loudoun. In partnership with Loudoun County, the Town is committed to forging policies that protect and preserve the vital rural assets that contribute to economic vitality and quality of life for all Loudoun residents.

Strategy

- 1.6 Enhance the role of Hillsboro as a rural gateway and hub for northwest Loudoun's agricultural, recreational, and wine tourism area.

Actions

- A. Encourage the establishment of a greenbelt around the Town using conservation easements, development design techniques and other means to help maintain the distinct edge and rural community identity of the Town of Hillsboro.
- B. Support the development of entry features into the town, to enhance the identity of the Town of Hillsboro as a gateway community.
- C. In recognition of Hillsboro's historic role and future development as the center of a robust agricultural region, support expanded productive farming and rural economic development that will encourage new farmers, preserve and expand area farmland, boost tourism, stimulate county and regional markets for locally produced products and jobs, and expand entrepreneurial opportunities to Hillsboro area residents.

- D. Encourage the preservation of the natural, environmental, and heritage resources that contribute to the identity of Hillsboro.
- E. Oppose any increase in density and development outside of the Town of Hillsboro that does not retain the low density, farm landscape that provides the historic rural context for the Town.
- F. Work with the Town of Hillsboro and with VDOT to establish context-sensitive roadway design standards and to identify short and long-term solutions for improving the safety of Route 9 in western Loudoun and through Hillsboro that do not compromise the rural character of Hillsboro.
- G. Promote safety measures for pedestrians, cyclists, and farm vehicles along and across Route 9, Route 690, Route 719, and Route 812.
- H. Work with the Town of Hillsboro to establish a safe and adequate water supply and modern community wastewater collection and treatment system.

Lovettsville

Lovettsville, originally known as the German Settlement, is a small town with historical roots that go back to 1732. The Town served as a thriving commercial center for the surrounding farming areas for over one-hundred years. This function was eventually eclipsed during the post-World War II period by other, larger communities in Loudoun County, Northern Virginia, and nearby Maryland, which is about three miles from the Town.

Since 2005, Lovettsville has experienced a rapid increase in population and housing associated with growth of single-family detached residences. The population influx consists of people who are attracted to the traditional main street character of Lovettsville set in the larger context of the (mostly) rural northern Loudoun Valley.

Lovettsville continues to focus on development inside its existing boundaries and prefers a distinct edge between its boundaries and the surrounding rural landscape. Lovettsville has made significant investments in streetscape improvements and trails. Commercial development has also occurred at the Town Center and along East Broad Way (Route 673). Lovettsville supports continued County cooperation on transportation and public facilities, with a strong interest in developing multi-use County trails that connect the town to the W&OD and C&O Canal trails.

Significant land use changes have occurred within the Town. Most notably the evolution of the Lovettsville Town Center from its initial concepts to a nearly-completed, neo-traditional community centered on a pedestrian-friendly and centrally-located business district having wide sidewalks, decorative streetlamps, and ample public gathering spaces. This development, residential subdivisions on infill properties, redevelopment of properties in the “Old Town” for modern commercial uses, and implementation of streetscape projects throughout, has contributed to Lovettsville’s growth from a population of 853 in the year 2000 to approximately 2,300 residents

in 2018³. Several large properties within the Town limits are available for future development, although much less land is available for new residential development compared to 18 years ago.

The County has not established a JLMA around Lovettsville, consistent with the Town's desire to focus development inside the existing boundaries. The Town has identified several limited areas outside of its corporate limits that may be candidates for annexation for the purposes of supporting existing and developing future civic, commercial, or employment uses, and achieving the Town's economic development goals. Future annexation of these areas will be considered on a case-by-case basis and is dependent on the capacity of Town water and wastewater services to accommodate the future development of these properties, something that the Town evaluates through its Water and Sewer Master Plan.

The County is actively improving and constructing public facilities in and around the Town including the Lovettsville Community Center, Lovettsville Community Park, Lovettsville Volunteer Fire and Rescue Station, and Lovettsville Elementary School. Coordination is critical to providing utilities and access to these facilities and to planned future development, which may require access through the County to afford multiple points of connection to and from public streets. The Town also seeks continued County funding for streetscape enhancements and for pedestrian safety improvements and traffic calming on Town streets near County facilities.

Strategy

- 1.7 Support the Town of Lovettsville in efforts to consolidate development within its boundaries.

Actions

- A. Retain and recruit businesses that serve the needs of Lovettsville and northern Loudoun County residents and align with Town plans.
- B. Collaborate with the Town of Lovettsville in the planning and regulation of development along Route 287 north and south of Lovettsville to protect the scenic quality and the rural character of the road as it approaches the Town.
- C. Link the County's greenways and trails system with the Town of Lovettsville's internal trail and bikeways network to link Lovettsville with the C&O Canal in Brunswick, Maryland, and the W&OD bike path in Purcellville.
- D. Plan the location and design of County facilities within Lovettsville, in consultation with the Town of Lovettsville.
- E. Collaborate with the Town of Lovettsville and VDOT on transportation planning in and around Lovettsville to improve traffic safety in the Town of Lovettsville and to improve regional road networks and access to employment centers.
- F. Cooperate with the Town of Lovettsville, pursuant to County/Town Annexation Agreement/Corporate Boundary Line Adjustment Guidelines on boundary-line

³ Annual Estimates of the Residential Population, United States Census Bureau.

adjustments to resolve jurisdictional questions, to serve public and civic uses, and to support the Town of Lovettsville's economic goals and priorities.

Middleburg

The Town of Middleburg, established in 1787, is the southernmost town in Loudoun County and retains a traditional village character that is treasured by its citizens and visitors. Middleburg is both the hub of a larger rural area and a major tourist destination. The character of Middleburg is irrevocably tied to the preservation of the farms, vistas, vineyards, open spaces, and forests that surround the Town, with equestrian facilities, estates, wineries, and associated businesses central to Middleburg's way of life and tourism industry.

The commercial core of Middleburg contains both retail and service businesses that serve rural area residents and the tourism industry. Specialty and high-end accommodations and retail, food, and beverage are cornerstones of the Town's economy. The rural nature and character of its surroundings are critical to its continued success. Visitor dollars spent at restaurants, shops, and accommodations within Middleburg generate 75 percent of annual Town revenues.

The Town is home to 656 people and expects its population to increase modestly in the future. A significant portion of the Town has been placed on the National Register for Historic Places and the Town administers a local Historic District to carefully control the look and feel of new development. While undeveloped land is scarce within the Town limits, the Salamander Resort has plans for 109 new residential units, and a limited number of other infill and redevelopment opportunities exist.

To preserve the character of the Town and the rural area that surrounds it, Middleburg promotes a defining edge between in-town development and open and agricultural lands outside of town. The defining edge will be established by the uses and development pattern of the Rural South Place Type and by identifying the lands adjacent to the Town as priority open space areas for conservation easements. For this reason, a JLMA is not proposed and the public utilities will not be extended beyond the Town limits except as supported by the Town and consistent with the Sewer and Water policies of this section. A high priority for the community is to safeguard the protection of its historic character and to ensure the viability of its local and tourism economies. Town citizens and surrounding property owners are extremely concerned about the rate of growth in the County and want to protect the open space around the Town from rural residential and commercial encroachment through land use regulation and conservation programs.

Middleburg is bisected by U.S. Route 50, one of two major east-west routes through the County. The community remains concerned about the volume and speed of traffic on this route, which serves as the Town's main commercial street within the corporate limits. Even with the success of a traffic calming project completed in late 2016, traffic congestion and safety issues remain high priorities and require the County and Town to work together to identify and implement additional traffic demand reduction and traffic calming measures aimed at mitigating local and pass-through traffic in the Town.

Cooperation and regular collaboration should continue between the County and Middleburg to address issues important to both jurisdictions, including issues of economy, rural preservation, and transportation.

Strategy

- 1.8 Maintain a defining edge at the Town of Middleburg's boundary in lieu of a JLMA to clearly distinguish the Town of Middleburg from the surrounding rural, undeveloped countryside.

Actions

- A. Collaborate with the Town of Middleburg on zoning and development activities outside the Town but in its vicinity, with the goal of preserving the rural character of its gateways and surrounding environs.
- B. Be an active partner with the Middleburg community and interested preservation groups to identify open-space and agricultural preservation approaches such as conservation easements, land acquisition, and development standards to promote and implement open-space preservation around the Town of Middleburg that helps establish a greenbelt and protect the rural appearance of roadways leading into the Town.
- C. Protect rural roads and scenic views through measures such as revised state road improvement standards; scenic easements; historic corridor overlay zoning for John Mosby Highway (Route 50), Foxcroft Road (Route 626), and the Plains Road (Route 626); and development setbacks.
- D. Assist, when requested, in the promotion of tourism, as a means of increasing public support for preservation of the scenic and historic Middleburg area.
- E. Work with the Town of Middleburg to implement strategies that will preserve and enhance agriculture as the predominant use in the RPA around Middleburg.

Purcellville

Purcellville was first settled in the mid-1700's, given its official name in 1852, and incorporated in 1908. Purcellville has seen significant growth, with its population of 7,727 in 2010 growing to over 9,700 in 2017.⁴ Residents of Purcellville have expressed their support for maintaining the small town character of the Town as expressed by the traditional architecture of the older neighborhoods, the downtown, the repurposed farm buildings that serve as evidence of the Town's rural past, the rural landscape, farmland, and green space that gives the community a sense of history. To maintain some of these factors requires cooperation between the Town and County to protect the rural nature of the land around the Town and to encourage continued economic development in the Town, which benefits western Loudoun residents.

Demand for housing in and around Purcellville is expected to increase. As Purcellville considers potential future growth demands, the Town's preference is to focus on infill development within

⁴ 2017 Population estimates, United States Census Bureau.

the Town limits and to protect surrounding rural landscapes. Purcellville does not anticipate extending utilities beyond the current Town boundaries. Any growth in or around Purcellville will increase the need for transportation improvements to be coordinated between the Town, County, and State, such as the Route 690 interchange and the Route 7 Bypass/Route 287 intersection.

Purcellville supports the protection of existing and the establishment of new open spaces in the JLMA along with trail connections, particularly between the W&OD Trail and Franklin Park. On the east and west sides of Purcellville the Town directly abuts the Rural Policy Area and there is no JLMA; however, the RPA provides for one dwelling unit per 10 acres. The Town supports a greenbelt extending to incorporate properties that fall within approximately one-quarter mile of the Town limits, with a defining edge” within the RPA. The Town supports preservation and protection programs within these areas.

The Town also supports implementation of gateways protecting rural view sheds at the east, west, north, and south entrances to the Town. To this end, the Town and County dissolved the Purcellville Urban Growth Area Management Plan (PUGAMP) in 2013 and adopted a rural development policy for the JLMA. The County encourages a low density, rural mix of residential and business uses around the Town that are distinguishable from the intensity and character of development in Purcellville.

Strategy

- 1.9 Support Town of Purcellville’s efforts to accommodate growth within the existing Town limits that will not compromise its small town charm or character and to maintain its role as a hub of economic development in western Loudoun.

Actions

- A. Establish a “defining edge” by implementing the uses and development pattern of the Rural North Place Type and by identifying the lands adjacent to the Town of Purcellville as priority open space areas for conservation easements.
- B. Work with the Town of Purcellville to plan for a trail extension that connects the W&OD Trail with Franklin Park.
- C. Include setbacks, height limitations, and landscaping standards along Route 7, Route 287, and the Route 7 Bypass to establish and maintain a greenbelt or defining edge around the Town of Purcellville characterized by open space and tree-lined roadways.
- D. Encourage the use of frontage roads, coordinated development plans, and other means of minimizing the number of driveways along Route 7 and Route 287 leading into Purcellville.
- E. Encourage new commercial uses to locate in the Town of Purcellville before locating in the JLMA.
- F. Encourage owners of historic projects in the JLMA to place properties into a Purcellville or County Historic District.
- G. Protect historic structures in the context of their natural settings.

- H. Work with the Town of Purcellville to expand broadband connectivity for citizens and businesses.

Round Hill

Round Hill first became a recognized community in the mid-1800's, after the construction of the Leesburg and Snicker's Gap Turnpike, now Route 7. Incorporated in 1900, Round Hill served as a destination for those looking for a holiday from Washington, D.C., benefiting from the Washington and Old Dominion Railroad and proximity to the Shenandoah River.

The population within the Town's limits is approximately 668 residents.⁵ Growth potential within Round Hill's boundaries is very limited with a projected buildout of only 20 additional residences. In contrast, the JLMA around Round Hill has experienced the addition of 1,200 new homes and approximately 3,000 residents over a 16-year period. Approximately 400 additional homes can be built in the JLMA. As development in the JLMA increases, Round Hill's ability to balance revenue and costs will be a significant consideration in annexing these residences into Round Hill's boundaries. The Town continues to seek commercial gateways at the east and west entrances to Town and is constrained downtown by the lack of space. Maintenance of the local roads is also a growth consideration. Maintenance is currently the responsibility of the Virginia Department of Transportation (VDOT) but would become a Town responsibility if the Town reaches a certain population through annexation.

There is a desire to expand public-use facilities and provide the community with additional amenities, such as a daycare, senior center, and community center. Round Hill also has an opportunity to become an Appalachian Trail community by taking advantage of its proximity to Bear's Den and Blackburn trail stops.

Strategy

- 1.10 Support planning efforts to retain the small-town character of Round Hill and assist the Town of Round Hill in efforts to preserve the historic character and resources in and around the town.

Actions

- A. Development within the Round Hill JLMA will comply with the Round Hill Area Management Plan and Round Hill Comprehensive Plan and adopted policies applicable to the JLMA.
- B. To that end new development should:
 - i. Be of a density, lot pattern, street pattern, and scale which replicates existing development within the Town of Round Hill.
 - ii. Become an extension of the existing town, forming logical and natural additions to the historic fabric and enhancing the existing town as the central focal point of the entire community.
 - iii. Demonstrate that adequate water and sewer service will be available to serve the proposed development.

⁵ 2017 Population Estimates, United States Census Bureau.

- iv. Support the clustering of residences as a method to obtain additional open space.
- v. Oppose development that proposes an average density greater than it would have been without clustering unless a rezoning is also involved.
- vi. Advocate for walkable neighborhoods in the JLMA using connected streets in a grid pattern and discourage the use of culs-de-sac.
- C. Encourage housing for the elderly that will allow residents to remain in the Town of Round Hill.
- D. Encourage rural economy business development in the greater Round Hill Area to provide local goods, services and jobs to Town of Round Hill residents and visitors.
- E. Oppose any increase in density and development outside of the JLMA that is not consistent with the traditional rural character of western Loudoun County.
- F. Avoid high density development between the current boundaries of Purcellville and Round Hill and expand open space around Franklin Park to help maintain a greenbelt between communities.
- G. Enhance the gateways to the Town of Round Hill by developing features or retaining a clear distinction between the surrounding rural area and the edge of the town. Techniques may include measures to protect existing trees, hedgerows, viewsheds, and vistas; design guidelines for lot configuration to retain the rural lot pattern; new landscaping and entrance features and other techniques.
- H. Support development of sidewalks, trails, and linear parks that connect civic and public facilities with residential and commercial neighborhoods in the Town of Round Hill and JLMA and extend to Franklin Park and the W&OD Trail.
- I. Coordinate transportation planning with the Town of Round Hill to ensure that traffic generated from development within the County does not adversely affect Round Hill. The County will work with the Town of Round Hill on traffic calming measures.

Towns and Joint Land Management Areas – Municipal Water and Sewer

Town Policy 2: Town municipal systems will be given the opportunity to provide utilities to surrounding Joint Land Management Areas. An alternative municipal provider shall only be used when the Town, the County, and the Health Department agree.

Strategy

- 2.1 Due to the proximity of central system water and wastewater systems to the Leesburg JLMA, and in order to avoid out-of-town utility rates for County residents and businesses, the central system shall be the presumed utility service provider in the Leesburg JLMA for new service put in place after adoption of the *Loudoun County 2019 Comprehensive Plan*. If the property owner is not able to come to an agreement with the

central system provider or the central system provider declines or is unable to provide utility service to the Leesburg JLMA or any portion thereof, utility service may be provided by the municipal system.

- 2.2. Except as provided in Strategy 2.1, serve all development in JLMA by a municipal system when agreed to by the adjacent Town.

Actions

- A. Prior to approval of development in the JLMA beyond current zoning, require written assurance from the central system provider or the adjacent town, for a municipal system, that water and sewer will be provided.
- B. Consider potential impacts of surrounding development on Town wells during the development review process.
- C. Any future expansion of municipal (Town) sewer and water into the County JLMA will support development that is consistent with the goals and policies of the County and Town adopted plans.
- D. Retain the option to use shared or alternative sewer and water facilities to serve Town and County owned and operated public facilities upon agreement between the Town and the County.
- E. Permit the extension of municipal sewer and water into the Rural Policy Area only to serve public facilities or to address a potential public health risk. (See also, Chapter 6, Fiscal Management and Public Infrastructure, Rural Sewer and Water)

Design Guidelines

The Design Guidelines are to build upon our current development patterns in a manner that allows innovative design and new responses to the market. The Design Guidelines are not meant to be prescriptive and are not intended to be treated as a checklist, but are instead meant to provide a framework for how the desired character of the JLMA can be achieved, with the acknowledgement that other methods could achieve the intended results. The Design Guidelines do not supersede or otherwise limit the application of adopted zoning regulations, ordinances, building codes, proffers or any other design standards or regulations administered by Loudoun County.

When using these Design Guidelines, make sure to analyze the impact a potential development may have on the landscape, considering not only appearance, but practical considerations such as proximity to utilities, community amenities, jobs, and housing to maximize the use of existing infrastructure and limit travel distances.

The County encourages the use of a design process when planning development in the JLMA that conserves natural, environmental, and heritage resources and incorporates any such features into the site design. (See Appendix for Design Guidelines for the JLMA)

County/Town Annexation Agreement/Corporate Boundary Line Adjustment Guidelines

The County and the incorporated Towns will explore entering into annexation agreements to facilitate the annexations of properties that are receiving Town sewer and water services and are compatible with Town comprehensive plans. Agreements might include language based on the following recommendations:

1. Notwithstanding anything else in this Plan to the contrary, there shall be a presumption that land in the Leesburg Joint Land Management Area, which can be served by the central system, shall remain in the County and not be brought into the corporate boundaries of the Town.
2. With the exception of the Leesburg JLMA, the Town and the County should only honor requests for the extension of municipal sewer and/or water services outside the Town's corporate limits, within the designated JLMA when the beneficiaries of such service provide written acknowledgement of the right of the Town Council to annex the subject properties. If the Town should desire, this written acknowledgement may include the beneficiaries' written agreement to join with the Town in a joint annexation petition.
3. Parcels located within the designated JLMA and contiguous to the corporate boundaries of the Town, which have agreed to annexation in exchange for municipal sewer and/or water service, should be immediately annexed by the Town upon County approval of the rezoning and/or development proposal that requires municipal water and/or sewer service.
4. Parcels located within the designated JLMA, which have agreed to annexation in exchange for municipal sewer and/or water but which are not contiguous to the corporate boundaries of the Town, should enter into an agreement with the Town as follows: that annexation of these parcels should take place at such time as the subject parcels become contiguous with the corporate limits of the Town or five years from the date of County approval of the rezoning and/or land development proposal, which requires municipal water and/or sewer service, whichever comes first. In the latter case, where parcels receiving Town sewer and water remain noncontiguous to the corporate limits of the Town, any parcels lying between the corporate limits of the Town and the noncontiguous parcel which is receiving municipal sewer and water should be annexed at the end of the five-year period. However, these intervening parcels should not be required to hook into the Town sewer and/or water service unless desired by the property owner or necessary to maintain public health standards.
5. With the exception of the Leesburg JLMA, when the County approves the rezoning and/or development proposal of a property in the JLMA, which would require municipal sewer and/or water service, such approval should constitute the County's approval of annexation. At the time of such approval, the County should also provide the Town with written consent of annexation.
6. The County and Towns may proceed with annexations or with corporate boundary line adjustments, pursuant to State Code requirements, irrespective of whether the Town has a JLMA.

Place Types

As described in the beginning of this chapter, the following Place Types have been designated for specific locations as displayed on the accompanying map. The Place Types will work in concert with the Design Guidelines and Policies, Strategies, and Actions of the JLMA to fulfill the land use patterns and community characteristics intended for these areas.

Reference Maps

Policy Areas (Map #2023-063)

Priority Commercial Redevelopment Areas (Map #2018-156)

Legacy Village Cores (Map #2019-148)

Urban Policy Areas Place Types (Map #2018-150)

Suburban Policy Area Place Types (Map #2023-067)

Route 28 Highway Transportation Improvement District Area (Map #2018-312)

Transition Policy Area Place Types (Map #2023-061)

Rural Policy Area Place Types (Map #2023-065)

Conservation Easements in Rural Policy Area: 2023 (Map #2023-060)

JLMA Place Types (Map #2023-066)

JLMA Place Types

2019 General Plan

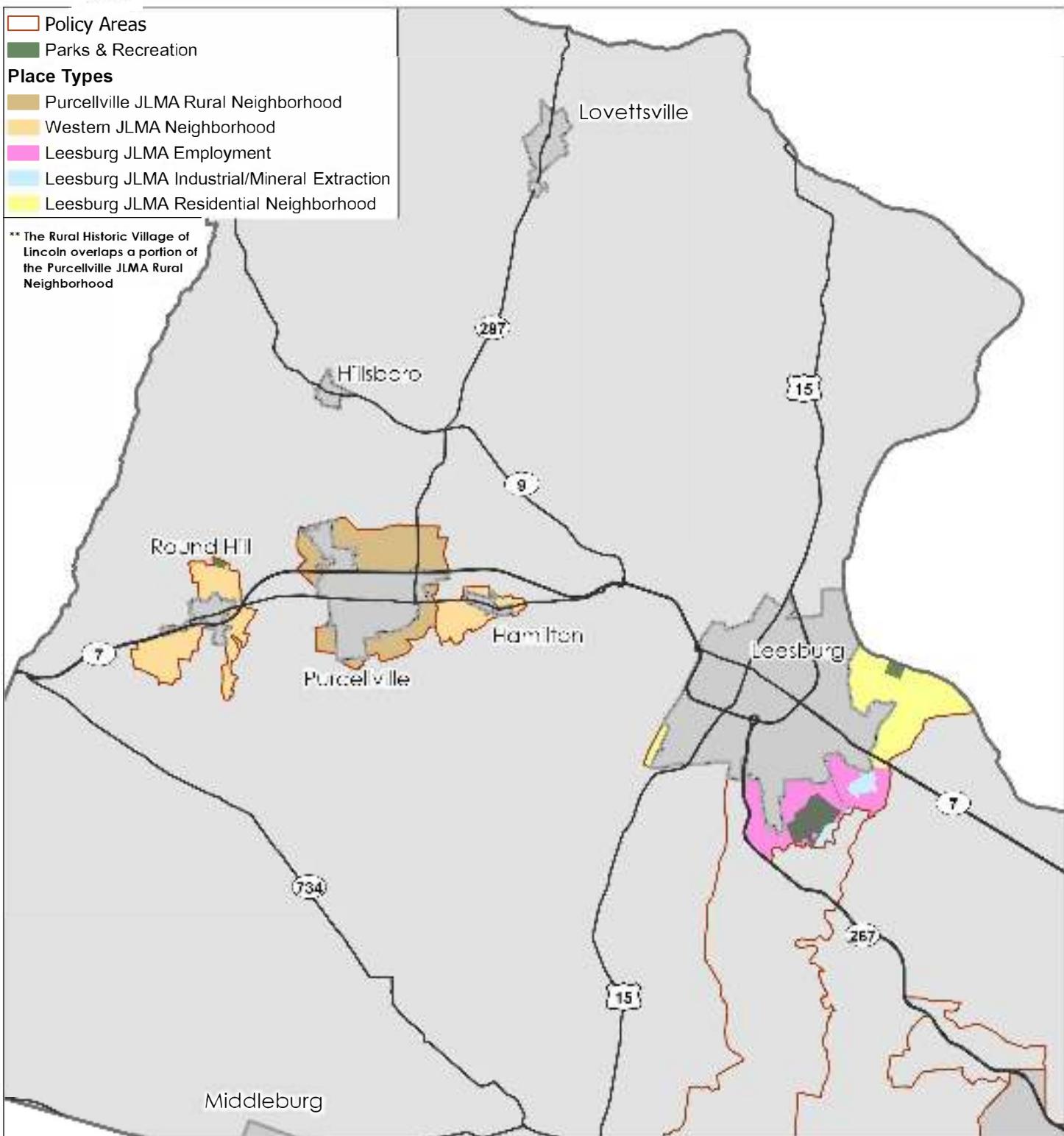


- Policy Areas
- Parks & Recreation

Place Types

- Purcellville JLMA Rural Neighborhood
- Western JLMA Neighborhood
- Leesburg JLMA Employment
- Leesburg JLMA Industrial/Mineral Extraction
- Leesburg JLMA Residential Neighborhood

** The Rural Historic Village of Lincoln overlaps a portion of the Purcellville JLMA Rural Neighborhood



Loudoun County IS NOT LIABLE for any use of or reliance upon this map or any information contained herein. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for use of any purpose.

0 0.5 1 2 3 4 5 Miles
Map Number 2023-066

CHAPTER 2-134

Purcellville JLMA Rural Neighborhood



The Purcellville JLMA Rural is a combination of low-density rural residential uses and limited agriculture and related businesses in a rural visual setting that is easily distinguished from the Town development pattern. Uses are predominantly residential but limited agriculture-supportive businesses that can be accommodated by onsite well and septic systems are appropriate. Municipal water and sewer service is not anticipated except to address potential health threats, but shared water and wastewater systems are permitted for public facilities.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Large Lot Residential • Agriculture • Agricultural Supportive Businesses • Equine Facilities • Rural Economy 	<ul style="list-style-type: none"> • Clustered Residential Subdivision • Accessory Residential Units • Agritourism • Rural/Heritage Tourism 	<ul style="list-style-type: none"> • Public Facilities • Civic, Cultural & Community • Institutional • Special Activities • Parks & Recreation

DESIGN CHARACTERISTICS

Context

Large areas of land preserved for open space, agriculture, and rural economy uses to retain the rural character of the area leading to the Town with limited low-density residential and clustered residential development screened from the roads to maintain the distinct identity of the Town.

Street Pattern:

Contour Forming, Fragmented Parallel

Block Length:

Irregular (0.5-5 mile)

Building Setback:

Varies (incorporate existing natural features to protect viewsheds)

Parking:

Surface lot, driveway, and garage

Open Space:

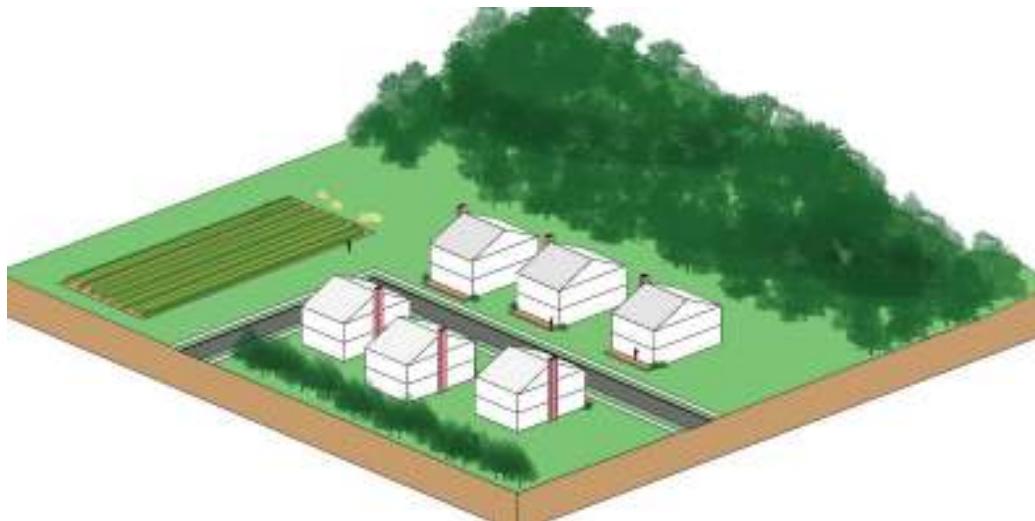
30-50% of site-Recreation (Passive), Natural, Environmental and Heritage, and/or Agriculture

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: 0.3 – 2.0 du / acre

Building Height: 1-3 stories



Transition

Locate buildings and structures to blend with the existing topography and natural features. Preserve and incorporate existing trees and vegetation on the property and its perimeter to buffer and screen views for adjoining properties. Provide landscaping or supplemental plantings comprised of native species when screening and buffering are required between uses.

Western JLMA Neighborhood



The Western JLMA Neighborhood applies to areas around the towns of Round Hill and Hamilton. This Place Type includes a variety of residential subdivisions ranging in densities from 0.3 to 3.0 units per acre. The higher density development is adjacent to Round Hill and resulted from the Round Hill Associates rezoning that was approved in 1991. Remaining areas include densities from 0.3 to 1.0 units per acre. Most neighborhoods are connected to Town water and sewer.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Large Lot Residential • Cluster Residential Subdivision 	<ul style="list-style-type: none"> • Accessory Residential Units • Agriculture • Equine Facilities • Rural Economy 	<ul style="list-style-type: none"> • Public Facilities • Civic, Cultural, & Community • Institutional • Special Activities • Parks & Recreation

DESIGN CHARACTERISTICS

Context

Low-density residential neighborhoods maintaining the development pattern around Hamilton and Round Hill. Much of these JLMA areas has been developed and remaining sites should develop with a consistent and compatible pattern and intensity.

Street Pattern:

Contour Forming, Fragmented Parallel

Block Length:

Irregular (0.5-5 mile)

Building Setback:

Varies (incorporate existing natural features to protect viewsheds)

Parking:

Surface lot, driveway, garage, shared

Open Space:

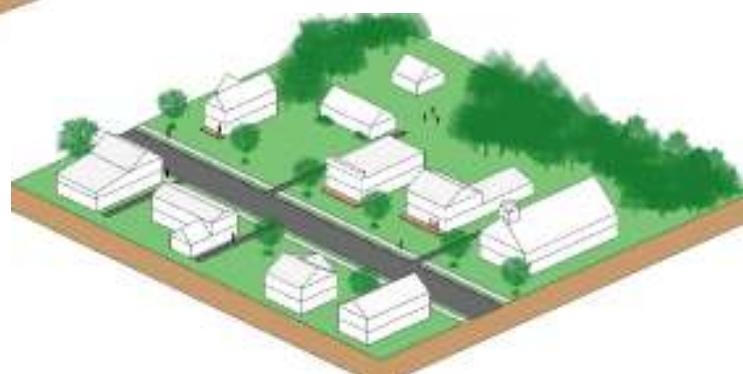
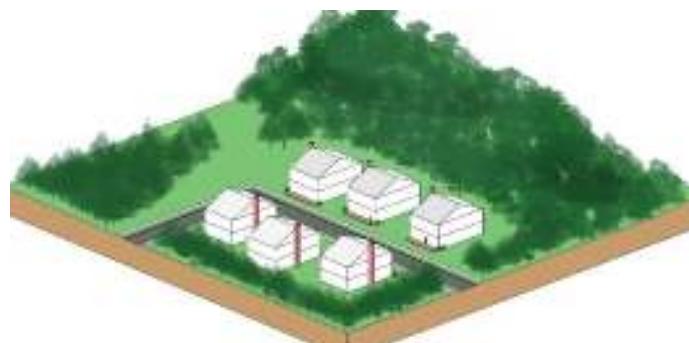
30-50% of site- Recreation, Community, Natural, Environmental and Heritage, and/or Agriculture

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: 0.3 – 2.0 du/acre

Building Height: 1-3 stories



Transition

Buildings and structures should be surrounded by natural buffers that visually screen the development from view of surrounding roads and from other developments.

Leesburg JLMA Residential Neighborhood



The Leesburg JLMA Residential Neighborhood reflects a suburban residential pattern with densities between 0.3 and 4.0 units per acre. This Place Type applies primarily to areas north of Route 7 near the eastern boundary of the Town and adjacent to the Woodlea Hills community on the southwest side of the Town. Single family detached and attached homes are the predominant land use. Retail and service uses that serve the routine shopping needs of the immediate neighborhood (e.g., grocery, gas stations, drive-throughs, dry cleaners, etc.) should be integrated into the area at significant intersections and along major roads. Neighborhoods include a range of amenities and community open space.

Core Uses	Complementary Uses	Conditional Uses			
<ul style="list-style-type: none"> • Single Family Detached Residential • Single Family Attached Residential 	<ul style="list-style-type: none"> • Accessory Residential Units • Public Facilities • Multi-Family Residential • Retail & Service Commercial 	<ul style="list-style-type: none"> • Civic, Cultural, & Community • Public Facilities • Special Activities • Parks & Recreation 			
Preferred Mix of Uses					
<table> <tr> <td style="vertical-align: top;"> Possible Ranges: • Res: 85-100% • Non-Res: 0-15% • P/C: 0+ </td><td style="vertical-align: middle; text-align: center;"> Non Residential 5% </td><td style="vertical-align: top;"></td></tr> </table>			Possible Ranges: • Res: 85-100% • Non-Res: 0-15% • P/C: 0+	 Non Residential 5%	
Possible Ranges: • Res: 85-100% • Non-Res: 0-15% • P/C: 0+	 Non Residential 5%				

DESIGN CHARACTERISTICS

Context

Low-density residential neighborhoods maintaining the development pattern along the eastern and western boundary of Leesburg. Much of these JLMA areas has been developed and remaining sites should develop with a consistent and compatible pattern and intensity.

Street Pattern:

Fragmented Parallel, limited Loop and Cul-de-sac

Block Length:

600-1,500 feet

Building Setback:

Shallow to medium

Parking:

Driveway, garage, or on-street

Design Amenities:

Sidewalks, street trees, lighting, crosswalks, common open spaces

Retail and Service:

Neighborhood - individual uses under 5,000 or small center up to 30,000 square feet

Community- individual uses under 30,000 or center between 30,000-150,000

Open Space:

Minimum 30% of site- Recreation, Community, and/or Natural, Environmental and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Residential Density: Up to 4.0 du/acre

Total Nonresidential FAR: Up to 0.4

Building Height: 1-3 stories



Transition

Development is intended to be consistent with surrounding neighborhoods. Transitions should be gradual, and appropriate transitional techniques include variations in building orientation, height step down, and creative and extensive use of landscaping and natural features. Fencing or other barriers should not be used as the sole means of screening and buffering. Where possible, new developments within Leesburg JLMA Residential Neighborhood areas should locate uses along their perimeter that are similar in use and density with adjacent neighborhoods.



Leesburg JLMA Employment



Leesburg JLMA Employment areas provide opportunities for a range of light and general industry uses similar to the existing pattern south of Route 7 and around the Leesburg Executive Airport. This Place Type accommodates flex space, manufacturing, warehousing, contractor services and other productive uses.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> • Light Production • Research & Development • Warehousing • Contractor without Outdoor Storage • Fleet & Equipment Sales & Service • Flex Space 	<ul style="list-style-type: none"> • Office • Retail & Service Commercial • Data Centers 	<ul style="list-style-type: none"> • Institutional • Civic, Cultural, & Community • Public Facilities • Special Activities • Parks & Recreation
Preferred Mix of Uses		
Possible Ranges: <ul style="list-style-type: none"> • Res: 0% • Non-Res: Up to 100% • Public/Civic: 0%+ 		

DESIGN CHARACTERISTICS

Context

Primarily separate one-to-two-story buildings used for industrial and employment uses.

Street Pattern:

Rectilinear Grid or Fragmented Parallel

Block Length:

300-1,000 feet

Building Setback:

Short to medium; greater if flex use

Parking:

Structured, on-street, accessory, or short-term

Design Amenities:

Sidewalks, street trees, shade trees, bike racks

Retail and Service:

Employment Supportive-Limited to support the predominate use. Generally 10% of the gross FAR of the employment uses.

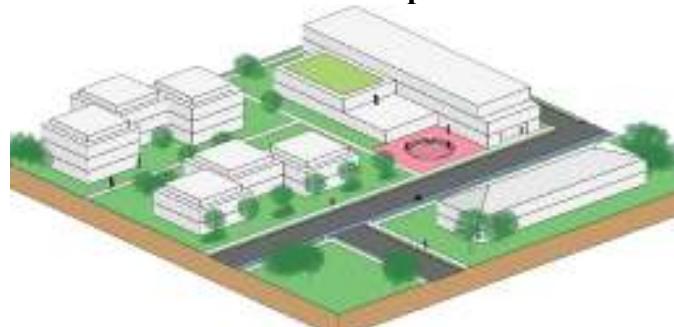
Open Space:

20% of the site- Recreational (sidewalks or trails), Community (outdoor seating area), and/or Natural, Environmental and Heritage

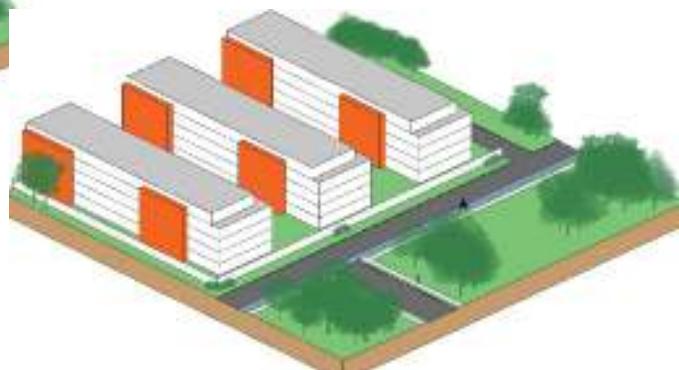
Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total Nonresidential FAR: Up to 1.0



Building Height: 1-4 stories



Transition

Extensive buffering including berthing and, where appropriate, walls can separate and screen parking, loading and other industrial activities from public roads and adjacent residential uses. Larger projects should situate lower intensity uses next to residential or other sensitive uses. Landscaping, lawns and retained natural areas will frame buildings and streets.

Leesburg JLMA Industrial/Mineral Extraction



Leesburg JLMA Industrial/Mineral Extraction areas consist of large manufacturing, warehousing, and other productive uses. Streets in this district are typically designed to accommodate freight ingress and egress. This Place Type also includes mineral extraction areas such as quarries and mines as well as associated uses such as asphalt plants and cement plants. Industrial and mineral extraction uses are incompatible with residential uses due to the prevalence of outdoor storage and the emissions of noise, odor, and vibrations. Buffers between these uses and residential uses are necessary to ensure compatibility and maintain commercial viability.

Core Uses	Complementary Uses	Conditional Uses
<ul style="list-style-type: none"> General and Heavy Manufacturing and Assembly Warehousing Contractor with Outdoor Storage Data Centers Fleet & Equipment Sales & Service Outdoor Storage Public Utilities Quarry 	<ul style="list-style-type: none"> Retail & Service Commercial Flex Space Light Production Research & Development 	<ul style="list-style-type: none"> Office Public Facilities Special Activities Parks & Recreation
Preferred Mix of Uses		
<div style="text-align: center;"> Possible Ranges: <ul style="list-style-type: none"> Res: 0% Non-Res: Up to 100% Public/Civic: 0%+ </div>		

DESIGN CHARACTERISTICS

Context

Primarily one-to-two-story buildings used for warehousing, data centers, contractor services, or manufacturing.

Street Pattern:

Rectilinear Grid, Contour Forming

Block Length:

300-1,000 feet

Building Setback:

Deep, varying with use

Parking:

Surface Lot

Design Amenities:

Sidewalks, street trees, shade trees

Retail and Service:

Employment Supportive-Limited to support the predominate use. Generally 5% of the gross FAR of the employment uses.

Open Space:

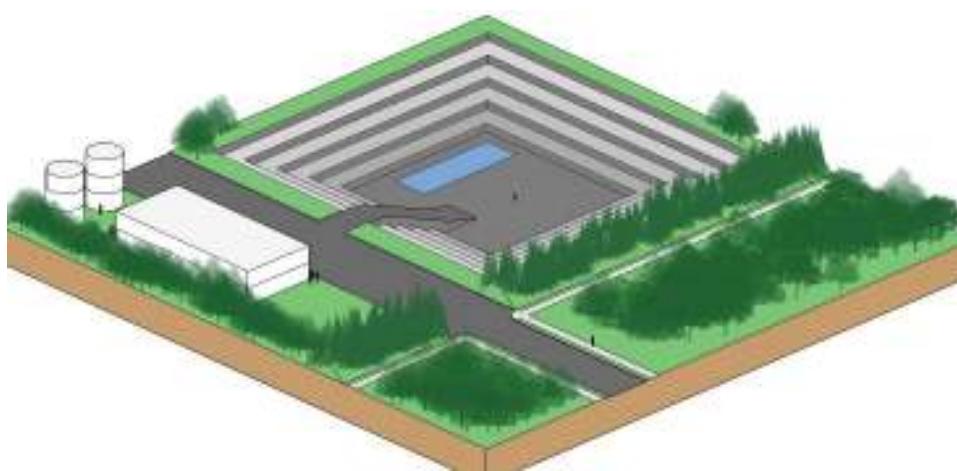
20% of the site- Recreational (sidewalks or trails), Community (outdoor seating area), and/or Natural, Environmental and Heritage

Place Type Rendering

An oblique projection of development within a Place Type to showcase the qualitative characteristics of how buildings within the Place Type should interact to create activity.

Total Nonresidential FAR: Up to 1.0

Building Height: 1-4 stories

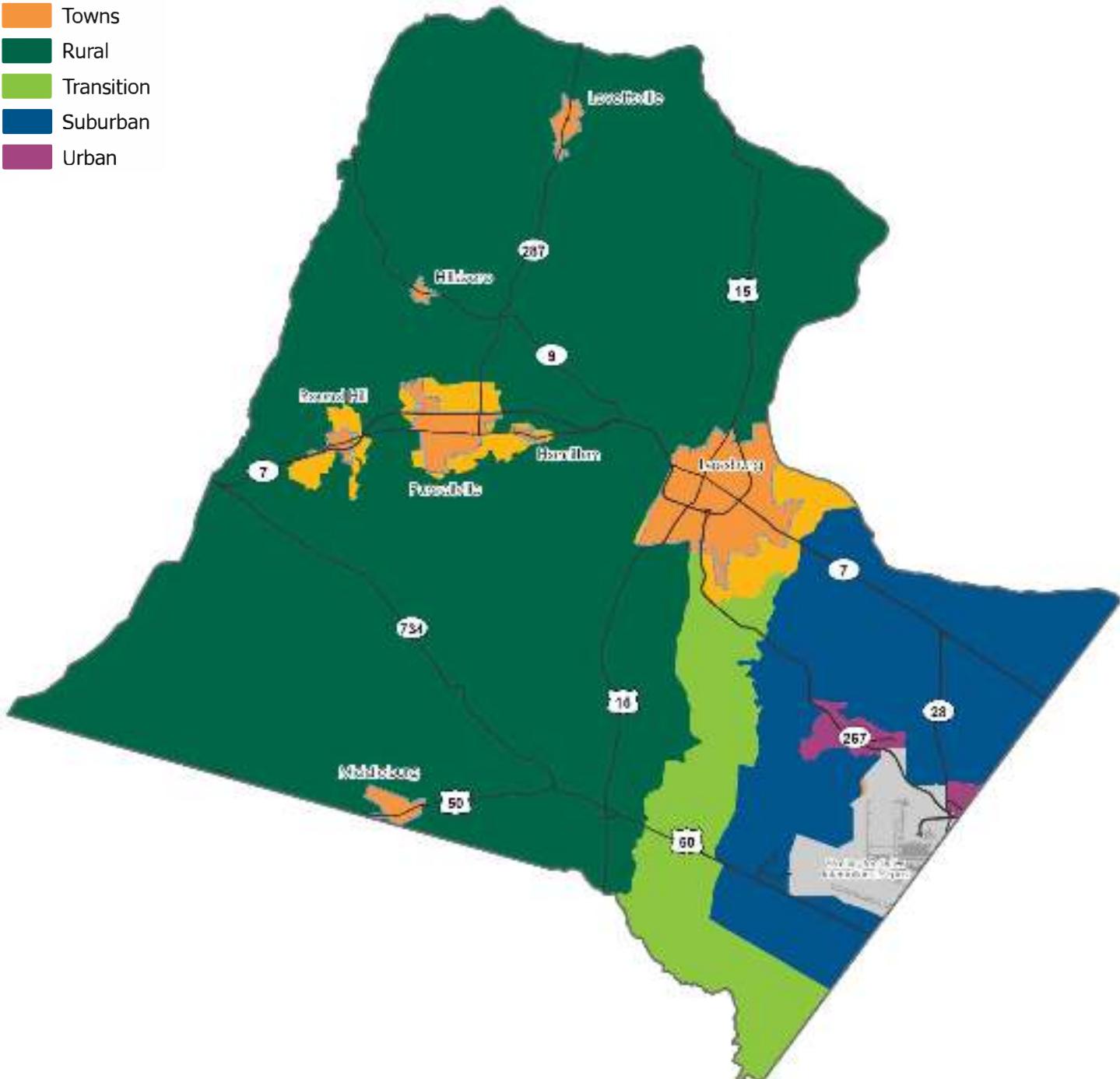


Transition

Transitions between Leesburg JLMA Industrial/Mineral Extractive uses and other developments, in particular adjacent residential neighborhoods, are critically important to the viability of long-term industrial operations. Extensive buffering, berming, and distance should separate and screen adjacent uses. Larger projects should situate lower intensity uses next to residential or other sensitive uses. Storage and loading areas are to be oriented away from and screened from streets and adjacent uses.



- Town JLMA
- Towns
- Rural
- Transition
- Suburban
- Urban

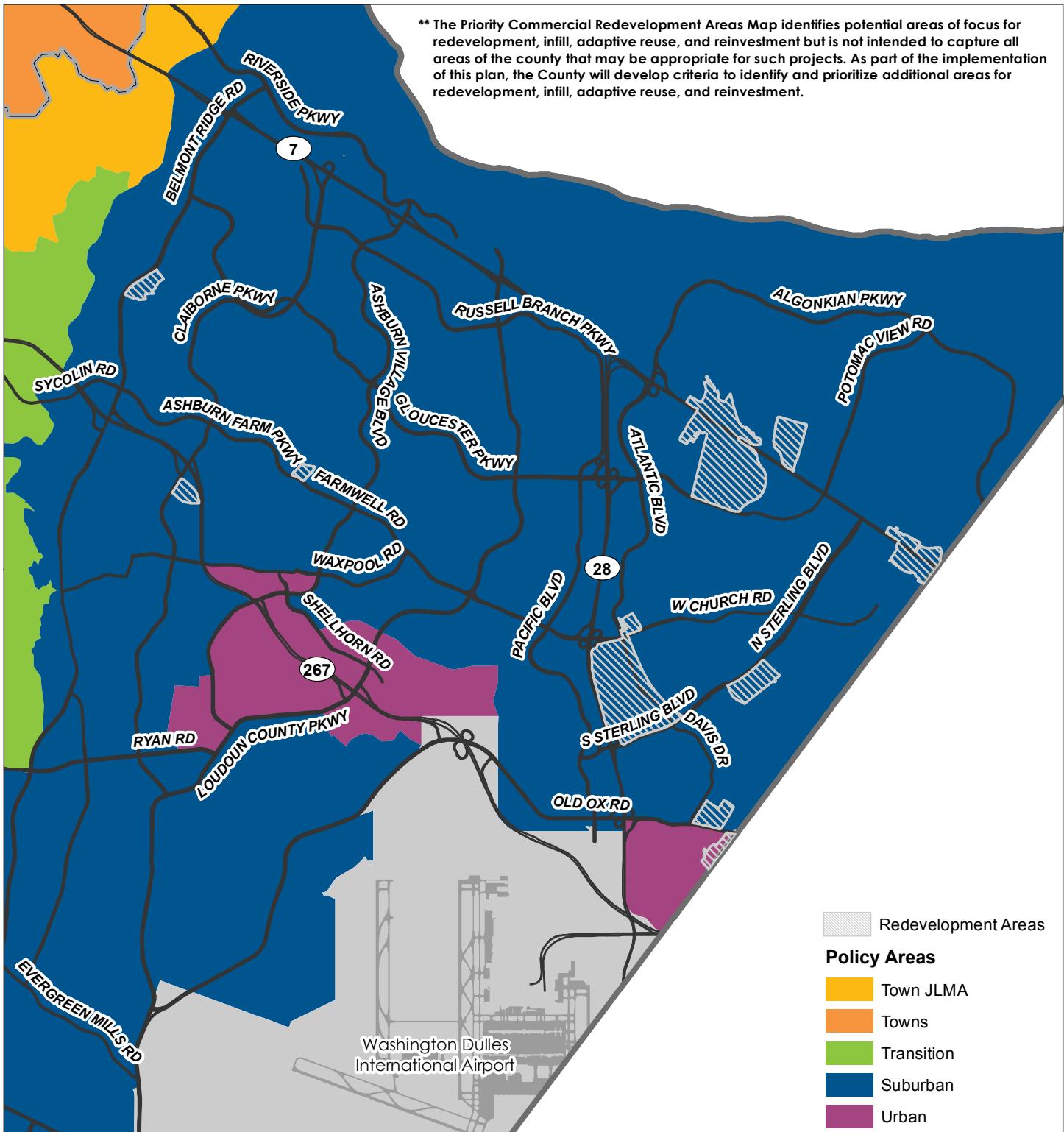


Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles
Map Number 2023-063

CHAPTER 2-147

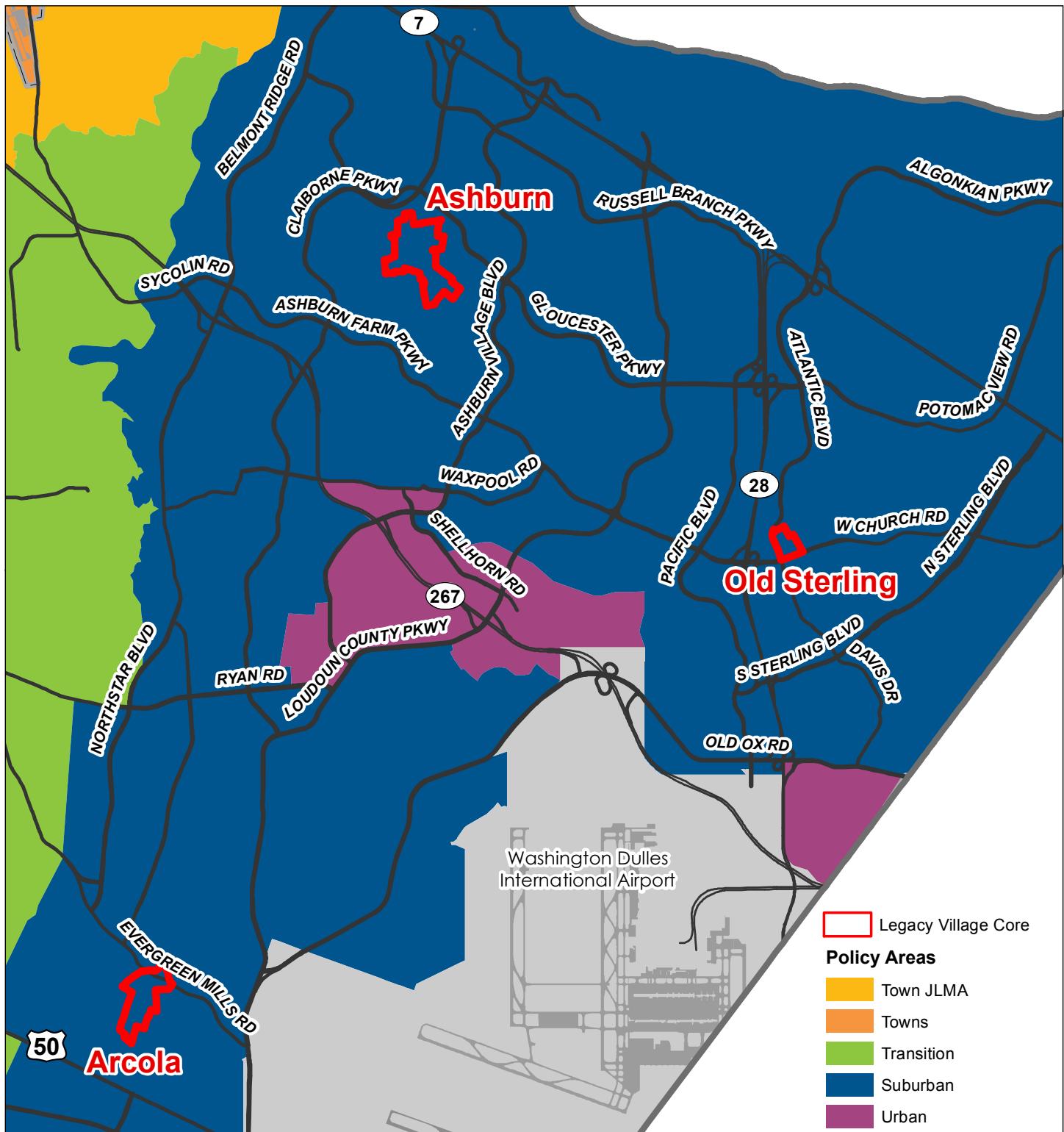
Loudoun County
**Priority Commercial
Redevelopment Areas**
2019 General Plan



Loudoun County IS NOT LIABLE for any use or reliance upon this map or any information contained herein. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for use of any purpose.

0 0.5 1 2 3 Miles
Map Number 2018-156

CHAPTER 2-148

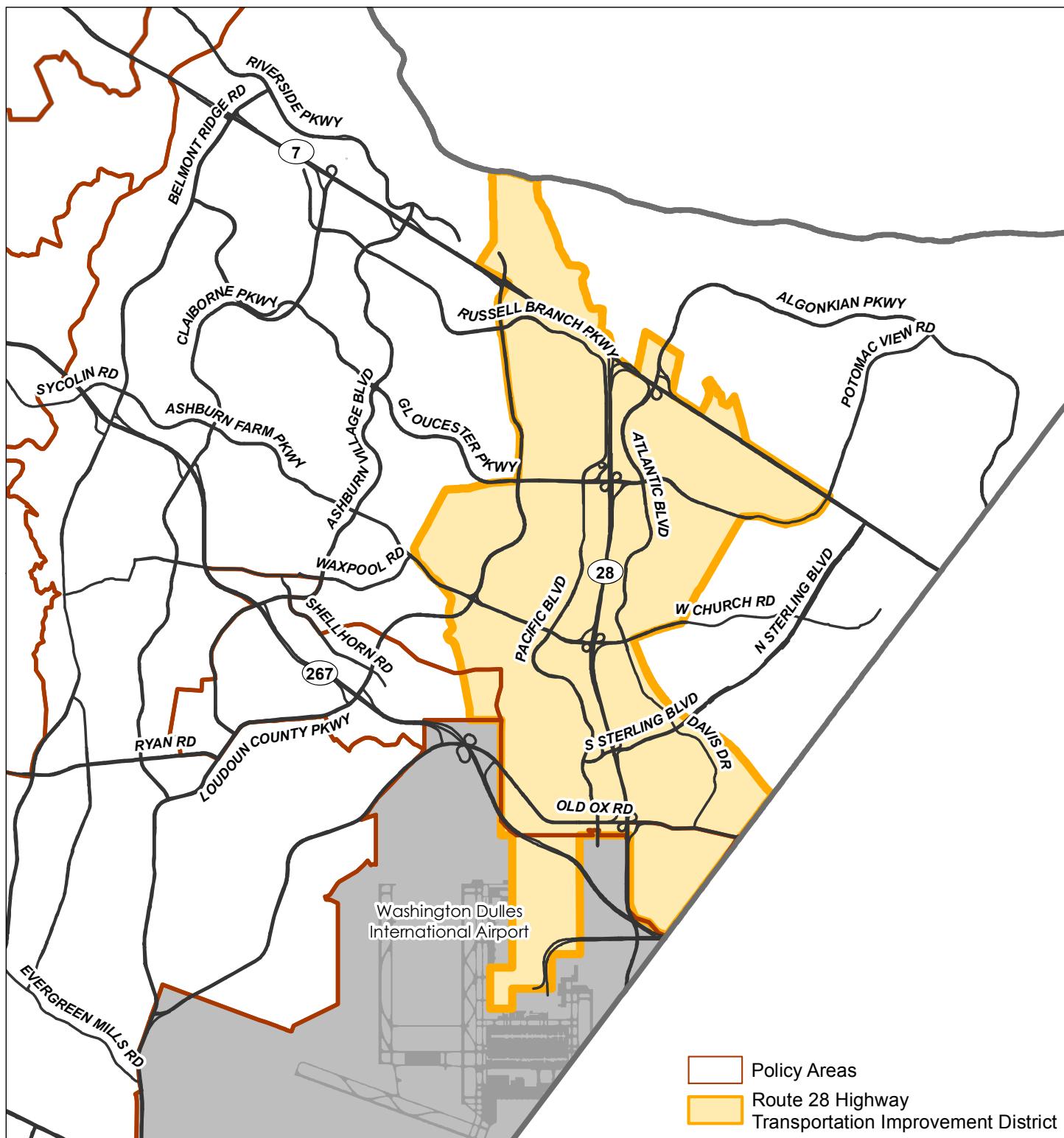


Loudoun County IS NOT LIABLE for any use of or reliance upon this map or any information contained herein. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for use of any purpose.

Loudoun County

**Route 28 Highway Transportation
Improvement District Area**

2019 General Plan



Loudoun County IS NOT LIABLE for any use or reliance upon this map or any information contained herein. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for use of any purpose.

0 0.5 1 2 3 Miles
Map Number 2018-312

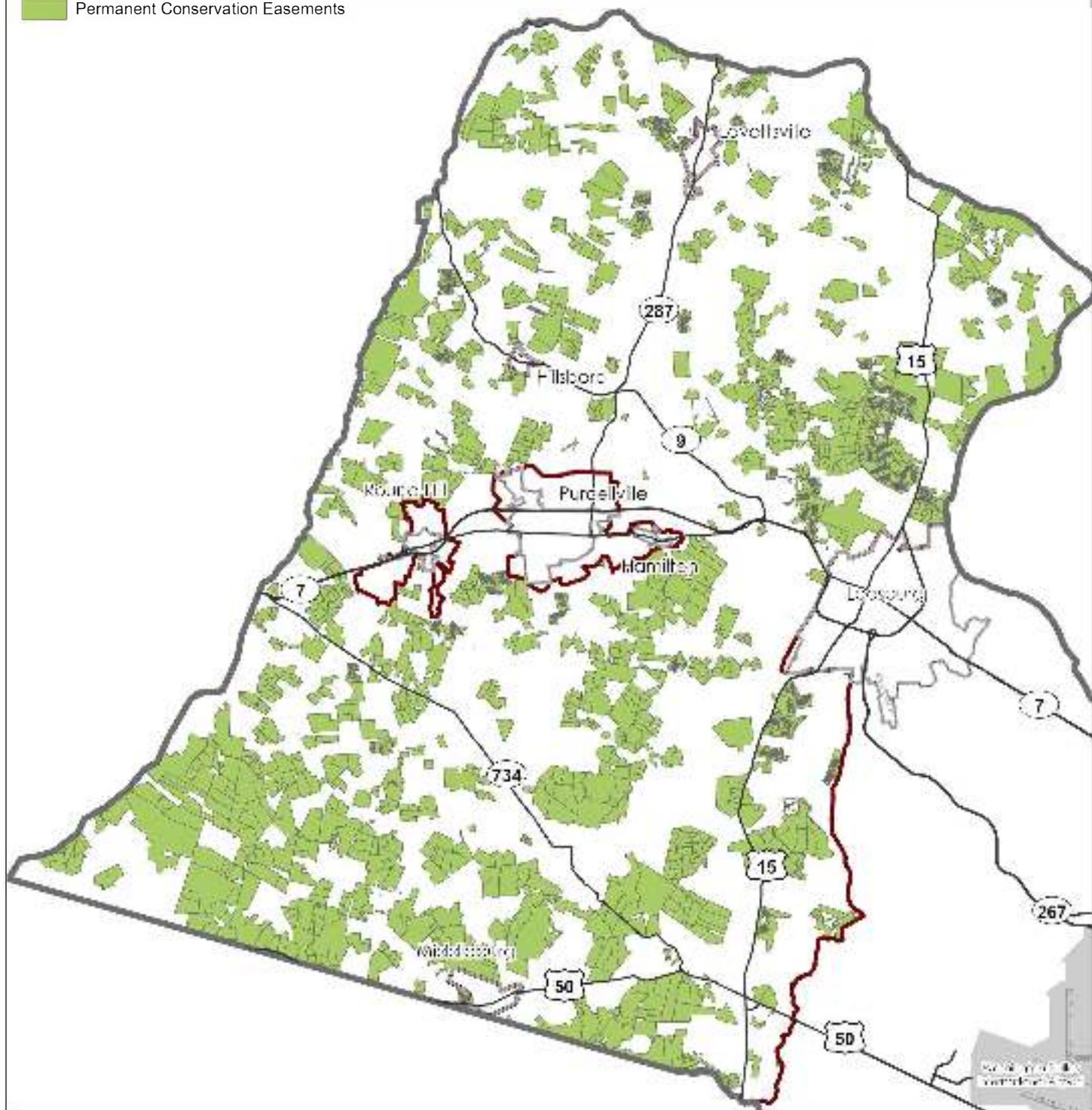
CHAPTER 2-150

Loudoun County
**Conservation Easements
in Rural Policy Area: 2023**

2019 General Plan



- Rural Policy Area
- Permanent Conservation Easements



Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles
Map Number 2023-060

CHAPTER 2-151

Chapter 3 – Natural, Environmental, and Heritage Resources

Table of Contents

Vision.....	2
Introduction.....	2
Topics.....	3
Water Resources	3
Geologic and Soil Resources	5
Forest, Trees, and Vegetation	7
Historic and Archaeological Resources	8
Cultural Landscapes.....	10
Plant and Wildlife Habitats.....	10
Complementary Elements.....	11
Sustainability.....	12
Policies, Strategies, and Actions	14
Reference Maps	33

This page left blank for printing purposes.

Chapter 3 – Natural, Environmental, and Heritage Resources

Vision

Protect and enhance the County's natural, environmental, and heritage resources, which are fundamental to the health, safety, welfare, sustainability, and enjoyment of current and future generations.

Introduction

Abundant natural, environmental, and heritage resources define Loudoun County's unique sense of place. Loudoun County has a tradition of being in the forefront of natural, environmental, and heritage resource protection in Virginia, which is evident in past planning efforts. The *Loudoun County Choices and Changes Plan*, adopted in 1991, grouped natural, environmental, and heritage resources into categories that shared common elements, strengthening the relationships among them. The 2001 *Revised General Plan* retained the grouping of elements while also developing a Green Infrastructure strategy for the conservation, preservation, and restoration of these elements. The *Revised General Plan* also identified a conservation design process to allow for conservation of the natural, environmental, and heritage resource elements while also providing for full development of a site. The *Loudoun County 2019 Comprehensive Plan* (Comprehensive Plan) continues to encourage the use of a design process to better protect and enhance the County's natural, environmental, and heritage resources and incorporate such features into site design.

Protect and enhance natural, environmental, and heritage resources through the following:

Conservation

Careful management of natural and environmental features within the built environment.

Preservation

Retaining and protecting natural, environmental, and heritage resources.

Restoration/Recapture

Enhancing natural, environmental, and heritage resources wherever possible.

Education

Communicating the importance of natural and heritage resources.

Natural, environmental, and heritage resources include the Potomac River edge, major rivers, stream corridors, floodplains, wetlands, steep slopes, ridges and mountainsides, forested and vegetative landscapes, limestone geology areas, farmlands, soil resources, important plant and wildlife habitats, historic and archaeological sites, scenic areas and corridors, designated heritage areas, battlefields, historic cemeteries, and cultural landscapes. Complementary elements, such as air quality, aural environment, and the night sky are also important to the health, safety, and welfare of Loudoun residents. Natural, environmental, and heritage resources are tangible assets that make

the County an appealing place to live, work, learn, and play while contributing directly and indirectly to Loudoun's economy. Preserving, protecting, and enhancing these resources is critical to the County's long term economic, environmental, and social sustainability.

This chapter provides guidance for the protection of natural, environmental, and heritage resources in conjunction with the development and redevelopment of the County. These resources are important County assets and should be a primary consideration in the development of a site. Although many of the County's best preserved natural, environmental, and heritage resources are located within the Rural Policy Area, important resources have been identified in all parts of the County and are, in many cases, critical to the character of individual communities both east and west (See Natural and Environmental Resources Map). The County has a history of protecting and preserving these important resources through policies, regulatory measures, land acquisition, and educational programs. The protection of these resources will not only provide environmental and heritage benefits but will enable residents to experience the natural environment within the context of the built environment. The protection of these resources is interrelated, creating a network of natural, environmental, and heritage resources. For instance, the protection and preservation of existing forest cover adjacent to a stream helps to filter pollutants from entering the stream and provide for streambank stabilization, while also improving air quality, conserving energy, creating wildlife corridors, and protecting archaeological resources.

Updating and adopting zoning regulations and development standards to implement the objectives of this chapter will be important for protecting the health, safety, and welfare of Loudoun residents as well as preserving natural, environmental, and heritage resources for the enjoyment of future generations.

Topics

Water Resources

River and Stream Corridor Resources (RSCR) consist of rivers and streams that drain 100 acres or more, associated 100-year floodplains, adjacent steep slopes, and a 50-foot management buffer surrounding the floodplains and adjacent steep slopes (See River and Stream Corridor Resources Map). RSCRs constitute the County's largest natural ecosystem, supporting air quality, water quality, and biological diversity. If the floodplain and adjacent steep slopes are less than 100 feet beyond either stream bank, a 100-foot minimum stream buffer will protect the river and stream corridor. The buffers help to maintain stream bank stabilization, temperature moderation, flood control, and aquatic habitat as well as filter nutrients and sediments from upland disturbances and adjacent development. Because rivers and streams and their associated floodplains are dynamic, the buffers help to ensure that development adjacent to the floodplain today will not be in the floodplain in the future. The 50-foot management buffer can be reduced if it can be shown that a reduction does not adversely impact the floodplain, adjacent steep slopes, wetlands, and riparian forests of the river and stream corridor.

The identification of buildable areas on a site will protect and preserve river and stream segments draining less than 100 acres and wetlands that are not part of the RSCR.

The County has two State-designated Scenic Rivers: Goose Creek and the segment of Catoctin Creek that runs from Waterford to the Potomac River. These scenic rivers are an important part of the County's river and stream corridor system. The County also seeks to preserve the Potomac River shoreline.

Major water resource issues for the County include ensuring an adequate supply of drinking water, protecting groundwater and surface water from contamination and pollution, stormwater management, and preventing the degradation of water quality in the watersheds (See Watersheds Map).

Impaired Streams

Many stream segments across the County have been designated as "impaired" by the Virginia Department of Environmental Quality (DEQ). In 2009, the County conducted an assessment of streams within all the County's watersheds. The County assessment indicated impairments in over 75 percent of County streams (see Impaired Streams Map). One tool used by the State to help restore these degraded waters is the Total Maximum Daily Load (TMDL) program, which is defined by Section 303(d) of the Clean Water Act (CWA). The TMDL represents the amount of a pollutant that a waterway can assimilate and still maintain its health. The TMDL identifies the responsible pollutant and the suspected cause and source of the pollutant. Based on the results of the TMDL, DEQ may require the County to develop and implement a TMDL Action Plan to reduce pollutants. If required, actions may include stormwater pollutant reduction and mitigation projects, such as stormwater infrastructure retrofits, reforestation, stream restoration, and/or riparian plantings. Additionally, Loudoun County is located within the Chesapeake Bay Watershed and is currently subject to the Chesapeake Bay TMDL and the Chesapeake Bay Watershed Implementation Plan (WIP), which requires state jurisdictions within the watershed, including Virginia, to meet sediment, phosphorus, and nitrogen reduction goals by 2025.

Due to the length of the TMDL process and the number of impairments in the County, it may take decades before certain water quality restoration efforts achieve positive results. Additionally, given the anticipated rate of development within the County, many areas will likely have entitlements prior to the development of the local TMDL Action Plans. Therefore, a proactive approach towards water quality efforts will help to avoid costly and time-consuming processes to restore water quality to the required standards after development is completed. Actions and cooperation by all

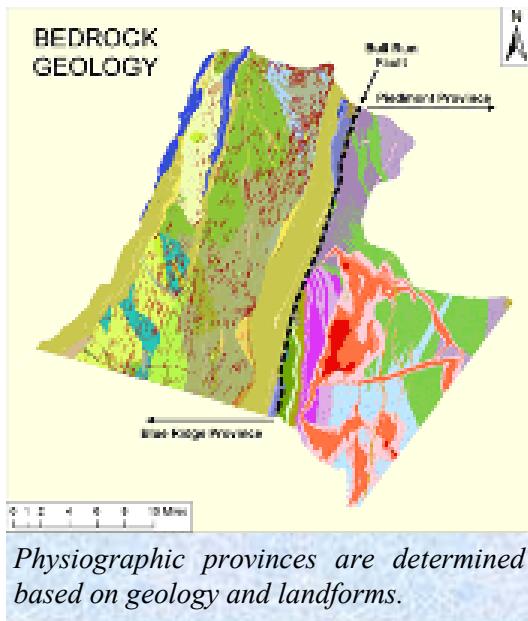
The County has completed several efforts regarding water resources since 2001:

- Water quality monitoring;
- 2009 County Stream Assessment;
- Strategic Watershed Management Solutions;
- Chesapeake Bay Watershed Implementation Plan;
- Comprehensive Watershed Management Plan;
- Upper Broad Run Watershed Management Pilot Project; and
- Countywide Floodplain Remapping of February 17, 2017.

sectors including County Government, land developers, and property owners are needed to effectively control and meet required pollution standards to protect water resources.

Surface and Groundwater Resources

Groundwater supply is the primary drinking water source for residents of Loudoun's western towns and rural areas. Loudoun Water and the Town of Leesburg source drinking water from the Potomac River, and Loudoun Water also uses two reservoirs located along Beaverdam Creek and Goose Creek. The western towns provide drinking water from wells, and the Town of Purcellville augments this with surface water from the J. T. Hirst Reservoir. As of 2018, there are over 15,000 private groundwater wells in the County, mostly in western Loudoun. Increasing impervious land cover contributes to diminishing groundwater capacity and stream degradation, as rainwater that was once filtered through the soil to replenish groundwater and remove pollutants is now kept above ground. Stormwater is then carried via culverts and stormwater pipes directly to local streams bypassing the natural filtration process.



Geologic and Soil Resources

The eastern half of Loudoun County is located in the Piedmont physiographic province, and the western half is in the Blue Ridge physiographic province. The Bull Run fault, coextensive with the eastern edge of the Catoctin Mountain, forms the boundary line between the two provinces. Soils and geologic information are important considerations in land development, predicting potential impacts on erosion, water quality and quantity, and failing slopes, as well as informing mitigation of adverse impacts post-development.

Limestone

An area of approximately 18,000 acres (approximately 5.5 percent of the County) that lies predominately north of Leesburg and east of Catoctin Mountain is characterized as karst terrain (See Limestone Overlay District Map). Karst terrain refers to areas where mildly acidic water has gradually dissolved the underlying limestone and other carbonate rocks, creating a landscape characterized by underground cavities, sinkholes, and springs. These areas are susceptible to increased cavity collapse, ground slippage, groundwater pollution, and threats to the stability of foundations and structures. In 2010, the Board of Supervisors (Board) adopted amendments to the Zoning Ordinance that established the Limestone Overlay District (LOD), which regulates development in karst areas.

District Map). Karst terrain refers to areas where mildly acidic water has gradually dissolved the underlying limestone and other carbonate rocks, creating a landscape characterized by underground cavities, sinkholes, and springs. These areas are susceptible to increased cavity collapse, ground slippage, groundwater pollution, and threats to the stability of foundations and structures. In 2010, the Board of Supervisors (Board) adopted amendments to the Zoning Ordinance that established the Limestone Overlay District (LOD), which regulates development in karst areas.

Prime Agricultural Soils

Prime agricultural soils are soils that are best suited for conventional agricultural use. Nineteen

percent of the County consists of prime farmland as defined by the U.S. Department of Agriculture. These soils are usually found in areas that are nearly level to gently sloping, well drained, and with access to water sources. Loudoun's remaining best agricultural soils are generally located in the Rural Policy Area. Prime agricultural soils in Loudoun are often seen as desirable for residential development. Once this land-based resource is lost, however, it cannot be reclaimed. Because the County has emphasized the rural economy as an important part of its overall economic health, prime farmland and agricultural soils are especially valuable. Since the establishment of the Loudoun County Agricultural and Forestal District (AFD) Program in 1979, over 43,000 acres are enrolled within 23 Agricultural and Forestal Districts (AFDs)¹ throughout the County.

Mountainside and Steep Slopes

Loudoun's mountains are a valued environmental resource and distinctive feature of the County's scenic beauty. Mountainsides contain headwaters to many of the County's streams and are identified as a critical groundwater recharge area for western Loudoun County. Residents, visitors, and rural businesses value the scenic vistas that the hills and mountains provide. They are also highly sensitive to land disturbance and development. In addition to the destruction of prime



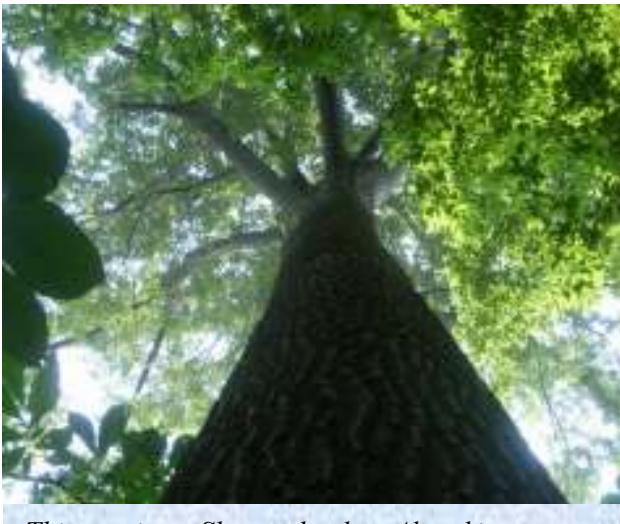
Loudoun's mountains are a significant attraction for residents and visitors and contribute to the County's distinctive beauty.

viewsheds, uncontrolled land disturbance within these areas can cause major soil slippage, debris flows, or landslides. Disturbances that can initiate these land surface failures include removal of trees and vegetation; cutting, filling, or blasting of the soil and bedrock; and altering the soil moisture content by excessive groundwater withdrawal or changing surface water runoff. The Zoning Ordinance regulates these areas through the Mountainside Development Overlay District (MDOD). The MDOD contains land use restrictions and performance standards to minimize the destruction of individual resources and the disturbance of the ecological balance of these resources. The boundaries of the MDOD are based on a range of both technical and aesthetic factors. Mountainside areas are divided into three areas depending on the elevation and the types of resources present as determined by weighted analytical criteria (Somewhat Sensitive, Sensitive, and Highly Sensitive). Policies in this Plan also encourage mountainside areas to be placed under permanent open space easement. Updates to the MDOD are included as an Action to bring the Zoning Ordinance and the Plan guidance into alignment.

Recognizing the importance of protecting steep slopes beyond the mountainous areas of the County, in 1993 the Board adopted an amendment to the Zoning Ordinance establishing standards

¹ As of September 25, 2017

for development on steep slopes. Since the adoption of the Steep Slope standards, several revisions have occurred, resulting in greater flexibility in the standards. Steep slopes and moderately steep slopes occupy an area of approximately 53,000 acres (approximately 16 percent of the County). Moderately steep slopes are areas with a 15 percent to 25 percent grade (identified by Slope Class D on Loudoun County soil maps). Steep slopes refer to more environmentally critical slopes with a grade greater than 25 percent (identified by Slope Class E on Loudoun County soil maps). Improper use and disturbance can trigger increased erosion, building failure, road failure, downstream flooding, and other hazards.



This specimen Shumard oak at Algonkian Regional Park is one of the largest trees in Loudoun County, measuring 112 feet tall and 176 inches around.

Forest, Trees, and Vegetation

The County's forests and trees improve air and water quality, offer important habitat for birds, small mammals, and other wildlife, and provide buffers between communities. Forests and trees conserve energy by providing shade and evaporative cooling through transpiration. They also reduce wind speed and redirect airflow, reduce stormwater runoff and soil erosion, and can increase real property values. Riparian forests along streams provide the greatest single protection of water quality by filtering pollutants from stormwater runoff, decreasing stream bank erosion, and maintaining the physical, chemical, and biological condition of the stream environment. The County also has some of the state's best hardwood stands for

lumber and veneer production. Working forests in rural areas contain valuable stands of hardwood timber, while trees and forest resources in the more urban portions of the County help to make them attractive places to live, work, learn, and play.

The County supports the incorporation of existing tree cover into required buffers as well as the control and removal of invasive species. The use of existing vegetation to meet screening and landscape buffer requirements is preferred over the removal and planting of new vegetation. Action steps call for the submittal of a Tree Cover Inventory as part of development applications to evaluate existing tree cover and identify areas worthy of preservation. Forest resources are also protected through AFDs, easements, and other voluntary means, as well as through the implementation of the MDOD, LOD, and Steep Slope standards in the Zoning Ordinance.

Historic and Archaeological Resources

The cultural heritage of the County is reflected in its remaining rural landscapes, scenic road networks, historic structures, and archaeological sites. Identification, preservation, conservation, and sensitive reuse of these resources is critical for the retention of the County's distinctive character. Where these resources have not yet been identified or studied, public and private resource surveys are increasingly important to inventorying and preserving them. Most of these elements will remain in private ownership and can be preserved through private stewardship, protective buffers, donation of open space easements, County historic district zoning standards, and context-sensitive site design. A number of incentive-based programs can also be used, including state and federal tax credit programs.



Archaeological Investigations at Lansdowne.

Since 1972, Loudoun County has helped protect its unique historic assets through the designation and regulation of local historic districts under the County's Zoning Ordinance. There are six County-administered Historic and Cultural Conservation Districts (Aldie, Bluemont, Goose Creek, Oatlands, Taylorstown, and Waterford) and two County-administered Historic Site Districts (Welbourne and the Broad Run Toll House properties). The County has also designated a Historic Roadways District, the Beaverdam Historic Roadways District, which comprises a network of 32 rural roads (See Historic Districts Map). In addition, the incorporated towns of Leesburg, Middleburg, and Purcellville administer local historic districts through their zoning ordinances.



Oatlands Plantation, a historic estate dating from the late 18th century, is one of 88 County sites listed on the National Register of Historic Places.

There are also five National Historic Landmarks in the County, including Balls Bluff Battlefield, Dodona Manor, Oatlands Plantation, Oak Hill, and Waterford. Resource surveys have identified nearly 7,000 individual historic structures and archaeological sites in the County to date. The County has 88 sites listed in the National Register of Historic Places. The County last conducted a comprehensive architectural resource survey in 2004; however, an analysis of the number of heritage resources that may have been impacted or lost in the interim has not

been conducted. The County's inventory of heritage resources is constantly expanding as property owners, developers, and preservation organizations document and record new resources.

Most of the County-initiated comprehensive survey work was completed in the early 2000s, such as the Post-Civil War Structure Survey (2003) and an [African-American Historic Architectural Resources Survey](#) (2004). The County also conducted surveys in 2016 for the [Ball's Bluff Battlefield Expansion Project](#) and a Rural Schools Survey. The County and state database of surveyed resources is largely augmented through the Phase 1 archaeological and historic resources surveys that are required with legislative and preliminary subdivision applications, as well as private property owners requesting listing in the National Register of Historic Places.

There is a difference: local, state, and national historic designation

- National Historic Landmark (NHL) (five in Loudoun County) – **Honorary** – deemed significant to all Americans because of their exceptional values or qualities, which help illustrate or interpret the heritage of the U.S. If a property is named a NHL, it is also listed on the National Register of Historic Places (NRHP) and the Virginia Landmarks Register (VLR).
- National Register of Historic Places (76 County historic districts and individual properties within Loudoun County) – **Honorary** – includes buildings, structures, sites, objects, and districts significant in American history, architecture, archaeology, engineering, and culture.
- Virginia Landmarks Register (two in Loudoun County) – **Honorary** – eligible for but not automatically listed in the National Register if a majority of property owners submit notarized objections to the VDHR.
- Local Historic Designation (six local historic districts, 2 individual historic properties, and 1 historic roadway district) – **Regulatory** – the only designation regulated by the County or incorporated Towns through zoning overlays. Does not regulate routine repairs and maintenance.

The Board adopted the [Heritage Preservation Plan](#) (HPP) in 2003 and a subsequent amendment to the HPP in 2009. The Board created the Heritage Commission (HC) in 2011 to implement many of the recommendations in the HPP. The HC brings a range of public and private sector experience and expertise to heritage issues. Since the adoption of the HPP in 2003, the County has recognized the need to focus attention on heritage resources associated with historically marginalized communities in the County. Because African American communities and Native American communities are not well represented in the historic written record, the County recognizes the importance of archaeological resources, oral histories, historic settlements, cemeteries, burial grounds, and places of worship to understand, preserve, and interpret the lives and contributions of these Loudoun residents (See African American Historic Communities Map). Development applications will be evaluated using both the HPP and this Plan.

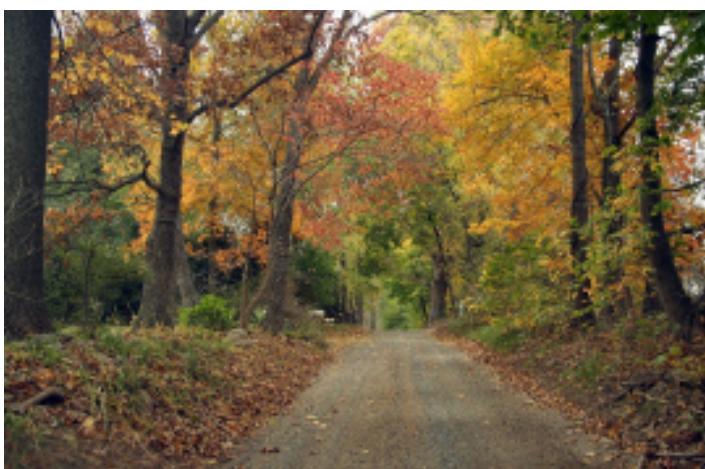
Cultural Landscapes

Cultural landscapes include heritage areas and corridors, scenic byways and waterways, battlefields, and historic cemeteries. There are several roadways within the County that are designated as Virginia Byways. Goose Creek and a portion of Catoctin Creek are designated as State Scenic Rivers. In 2002 the County established the Beaverdam Creek Historic Roadways District to protect a cultural landscape that has changed little since Loudoun County's formation in 1757.



Catoctin Creek

Photo Credit: James Hanna



Loudoun County's scenic network of more than 200 miles of unpaved roads is the most extensive in the state.

A nationally recognized heritage area, The Journey Through Hallowed Ground, as well as a state-designated heritage area, the Mosby Heritage Area, fall within the boundaries of Loudoun County. The Journey Through Hallowed Ground follows Route 15/29 from Gettysburg in Pennsylvania (a designated National Byway), through Loudoun County, to Monticello near Charlottesville, Virginia. In 2008, the Board passed a resolution in support of the Mosby Heritage Area, and the County is a partner with The Journey Through Hallowed Ground project. The

Mosby Heritage Area, formed in 1995, represents the cultural landscape and landmarks of three centuries of our nation's history. The Mosby Heritage Area encompasses parts of five counties, including all of Loudoun County.

Plant and Wildlife Habitats

Plants and animals play an important role in nature's lifecycle and its ecosystems. For wildlife habitats, large contiguous parcels of natural open space are preferable to more numerous but disconnected and smaller areas. The creation of a larger network helps ensure the viability of the habitat.

While many high-quality plant and animal habitats have already been lost or altered due to land development, the County still has several unique and natural habitat areas. The largest contiguous areas of forest and naturally vegetated land are on mountainsides, steep slopes, and along stream channels. These areas play a key role in preserving the abundance and diversity of the County's remaining plant and wildlife resources. The integrated approach to preserving natural, environmental, and heritage resources is intended to help prevent habitat fragmentation, while enhancing ecological connections with larger areas.

The County strives to protect, preserve, and create large-scale plant and wildlife habitats that overlap with other important resources and resource systems. The County will also protect rare, threatened, and endangered plant and animal species habitats in accordance with the federal Endangered Species Act. Action steps call for development applications that have the likelihood of one or more natural heritage resources to conduct a species assessment and develop a plan for impact avoidance in cases where the presence of the species is identified.



Heron rookery adjacent to the Broad Run near Ashburn.

Natural Heritage Resources include: rare, threatened, and endangered plant and animal species; exemplary natural communities, habitats, and ecosystems; and other natural features of the County.

Complementary Elements

Complementary elements consist of elements that are not directly a part of the land-based environmental and heritage resources but complement them. They include air quality, aural environment, and lighting and the night sky.

Air Quality

In order to meet the federal goals of the Clean Air Act, the County offers an integrated land use approach that protects air quality by planning development in locations that are close to major transportation facilities and transit nodes, limiting gross densities in the Rural and Transition Policy Areas, and promoting and implementing alternative modes of transportation. Loudoun is included in the United States Environmental Protection Agency's (EPA) Washington, D.C. nonattainment area for meeting national standards for air contaminants. The County has an active role on the Metropolitan Washington Air Quality Committee (MWAQC) and the National Capital Region Transportation Planning Board (TPB).

Aural Environment

Efforts to protect existing and future residents from increased levels of environmental noise have focused primarily on airport noise surrounding Washington Dulles International Airport (IAD) and Leesburg Executive Airport (see Airport Noise Impact Area Map). The Airport Impact Overlay District (AIOD) of the Zoning Ordinance imposes development restrictions within specified areas to protect existing and future residents as well as maintains the economic viability of these important transportation and economic development resources. Future Airport Noise Corridor studies could lead to updates to the noise contours surrounding IAD.

The County also has policies to protect noise-sensitive uses adjacent to major roadways, calling for appropriate noise mitigation measures to be incorporated into the overall project design when Noise Abatement Criteria (NAC) Hourly A-Weighted Sound Levels are approached or exceeded.

Lighting and the Night Sky

The County's night sky is an asset that should be protected from excessive and improper lighting. The County recognizes the need for artificial lighting for the purposes of public safety and visibility, but such lighting should be designed and programmed to minimize light pollution. Action steps call for updating lighting standards that promote quality and energy-efficient lighting, preserve the natural beauty of the night sky, and minimize impacts on people, plants, and wildlife.

Sustainability

Sustainability seeks to achieve economic development, social equity, and environmental protection in a balanced manner. Sustainability is commonly defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Over the last several decades, Loudoun County has integrated sustainability into the community fabric to foster a high quality of life. The County will continue its leadership and infuse a sense of responsibility among all sectors of the community to take a more active role in sustainability.

Sustainable development calls for practices that are cost-effective, enhance human health and well-being, and protect and restore the environment. The County has developed and implemented the following programs and plans that demonstrate a commitment to a more sustainable community:

- [Clean Waters Initiative](#), which hosts educational and partner projects, from floating wetlands, to native tree planting, to rain gardens, to pasture and crop management, to stream protection.
- [The Loudoun County Energy Efficiency and Conservation Program](#), which provides leadership, guidance, education, and technical expertise to reduce energy consumption, improve energy efficiency, reduce energy costs, and facilitate energy conservation in County facilities.
- [Energy Strategy 2009](#), a 30-year road map of energy strategies for the Loudoun County government and community.

- [Environmental Policy](#), which provides outreach and guidance regarding pollution reductions set by the Total Maximum Daily Load (TMDL), which was established by the EPA for the Chesapeake Bay. Monitors environmental legislation and regulatory activity that may have an impact on Loudoun County operations and residents, including federal regulations such as the EPA's Chesapeake Bay TMDL.
- [Stormwater Management Program](#), which addresses the design, development, improvement, operation, inspection, maintenance, and oversight of the stormwater management system.
- [Water and Wastewater Program, established through Water and Wastewater Needs Assessment Implementation Plan](#), is a program that recognizes the need for a detailed, systematic approach to solve existing and potential future water and wastewater problems in the county, including assistance and support for communities experiencing issues with deficient or absent water and/or wastewater systems.

Energy use is the major human cause of greenhouse gases. The electricity sector is currently the largest emitter of greenhouse gases, followed by the transportation sector; industry, commercial, and residential fuel use; and agriculture. In 2007, the *County Energy Strategy* (CES) concluded that if Loudoun County remained on a business-as-usual track with its countywide growth – while accounting for some expected improvements in the efficiency of both existing structures and new construction – then by 2040 the County would require 46 percent more energy to manage the expected growth. Over the same period, total greenhouse gas emissions would increase by 50 percent.

The County monitors inefficient energy sources at government facilities and eventually plans to shift to an alternative source of energy. As an example, Loudoun County converted Purcellville Library's oil Heating, Ventilation, and Air Conditioning system to electric and propane.

The County enforces the 2012 International Energy Conservation Code (IECC), the most current model code establishing the minimum design and construction requirements for energy efficiency. County policies have a goal of constructing County facilities to Leadership in Energy and Environmental Design (LEED) Silver, or equivalent standards, where it makes sense to do so. Green building rating systems provide a consistent metric for measuring site development and building performance. Also, rating systems raise awareness of the environmental impacts of site development and buildings and help determine measures to minimize those impacts.

Loudoun County is a member of the Metropolitan Washington Council of Governments (MWCOG). MWCOG focuses on the following environmental planning areas: water resources, air quality, climate and energy, recycling and solid waste, and agriculture and forestry. Loudoun County assists in advancing the goals laid out in MWCOG's [Region Forward](#) for clean water, air, and land, and a more sustainable region.

The County is committed to policies, strategies, and actions that protect natural, environmental, and heritage resources and integrate the concepts of sustainability into greater community planning and development goals. As the County continues to grow, so will the opportunities and challenges related to preservation and conservation of natural, environmental, and heritage resources. A

proactive approach to water quality could help to avoid costly and time-consuming processes to restore water quality as part of TMDL Action Plans. Through watershed management plans, the County has the opportunity to identify areas where management practices will most effectively enhance water quality. The County also has the opportunity to document efforts to promote sustainability, environmental stewardship, and protect the environment. The County should continue to support and build upon work that has already begun and consider the development of a sustainability plan or an annual report highlighting work that is being done. The Board can use this report to identify future goals. Essential to the preservation of heritage resources and cultural landscapes is proactive survey and evaluation of these resources as provided in the HPP. The following Policies, Strategies, and Actions reflect these concepts and more, balancing the environmental, social, and economic factors that will shape the County for future generations.

Policies, Strategies, and Actions

Unless otherwise specified, the following Policies, Strategies, and Actions apply Countywide.

Natural, Environmental, and Heritage Resources

(See also Chapter 6, Fiscal Management and Public Infrastructure)

NEHR Policy I: Provide protection for natural, environmental, and heritage resources.

Strategy

- 1.1. Support mechanisms to further the goals of conservation, preservation, restoration, recapture, and education to protect the health, safety, and welfare of Loudoun residents.

Actions

- A. Maintain a map of natural, environmental, and heritage resources as part of an integrated system and contiguous network of natural and passive open spaces and active recreational sites.
- B. Identify those properties that are not conducive to development due to sensitive environmental, cultural, and historical characteristics, and promote their preservation through various public and private programs (such as the Open Space Preservation Program, conservation easements, etc.).
- C. Adopt zoning regulations and development standards that implement a process identifying natural, environmental, and heritage resources worthy of preservation and developing around those resources as part of all land development.

D. Update the *Facilities Standards Manual*, the *Land Subdivision and Development Ordinance*, and other development standards to implement the natural, environmental, and heritage policies in this Plan.

E. Should the Board of Supervisors consider adopting a Transfer of Development Rights (TDR) program in the future, a thorough evaluation of the countywide impact on sending and receiving areas for density transfers will be conducted and, if acceptable to the Board of Supervisors, such additional policies will be added to the Comprehensive Plan and considered for implementation with a future TDR ordinance.

F. Use a design process that conserves natural, environmental, and heritage resources and incorporates any such features into the site design; Use Value Assessment Program; AFDs; public-private partnerships; and other regulatory and incentive-based efforts (e.g., a potential TDR program) for the preservation, conservation, restoration, and management of the County's natural, environmental, and heritage resources. Explore and implement additional incentive-based approaches.

G. Retain conservation easements as a tool to protect open space areas in subdivisions and to ensure long-term maintenance and protection of the area. Such easements will be recorded as part of the subdivision process and include public access where appropriate.

H. Direct public investment and resources toward completing a natural, environmental, and heritage resource network and recapturing natural, environmental, and heritage resources in developed areas.

I. Require development proposals that impact one or more natural, environmental, and heritage resources to offset impacts by enhancing and/or recapturing natural, environmental, and heritage resources elsewhere onsite.

J. Require development proposals to create links to adjacent natural, environmental, and heritage resources to create an integrated network and prevent habitat fragmentation.

Land Development applications should use the following design process to identify buildable areas:

1. *Identifying the environmental, natural, and heritage features of a site to be preserved;*
2. *Locating buildings on the unconstrained land; and*
3. *Locating street, utility, and trail on the development plan.*
4. *Locating lot lines.*

Transfer of Development Rights (TDR) and Conservation Easements are tools available to the County and public and private entities to protect and preserve open space, farms, and natural, environmental, and heritage resources in perpetuity, allowing landowners to retain ownership of their property, while maximizing the economic value of the land.

Strategy

1.2. Promote private, state, and federal conservation programs and their allocated resources to advance conservation programs within the County through public and private means such as grants, voluntary easements, and dedications.

Action

A. Study and, if feasible, aid in the establishment of a public-private conservation partnership to facilitate communication, grants, easements, education, and partnership opportunities to conserve and protect natural, environmental, and heritage resources.

Strategy

1.3. Act as a leader and educator in environmental design to achieve and sustain a high-quality built environment.

Action

A. Provide incentives for innovative design and support collaborative public-private-community partnerships for program implementation including provisions for awards of certificates of excellence in environmental design for the public and private sectors.

Strategy

1.4 Link natural, environmental, and heritage resources to create opportunities for open space corridors for the enjoyment of current and future generations.

Action

A. Prioritize protection of the following priority open space areas through conservation easements acquired by the County or others, participation in the Open Space Preservation Program, development design, and other means:

- i. Key natural, environmental, and heritage resource features not already protected from development by conservation easements or regulation,
- ii. Rural areas immediately adjacent to the Towns, JLMAs, and Rural Historic Villages that help form greenbelts and gateway buffers,
- iii. Areas adjacent to the Potomac, Catoctin, Bull Run, Goose Creek, and Broad Run floodplains to protect water quality,
- iv. Properties on the State or National Registers of Historic Places and within local historic districts,
- v. Corridors and sites that the County has identified for trails and parks and additions to existing parks provided they permit the construction of such facilities, and
- vi. Other areas of local natural, historic, or cultural significance including designated scenic rivers and roads.

River and Stream Corridor Resources

RSCR Policy 2: The County will protect natural ecosystems, restore water quality, serve Loudoun's population, and support the built environment through healthy surface and groundwater resources.

Strategy

- 2.1. Establish and maintain a healthy river and stream corridor ecosystem that meets desired water quality standards, protecting from the damages of soil erosion and flooding while promoting biological diversity.

Actions

- A. Amend zoning regulations and development standards, including but not limited to the Floodplain Overlay District (FOD) and Scenic Creek Valley Buffer sections, to address the objectives of the RSCR policies. Zoning regulations and development standards will establish performance standards and best management practice (BMP) requirements to ensure the health and biological integrity of the river and stream corridors and minimize adverse impacts.
- B. Develop and implement a watershed management plan for each watershed, establishing development guidelines and performance standards to protect water quality.
- C. Establish appropriate regulations for Catoctin Mountain, Short Hill Mountain, and the Blue Ridge Mountains to limit diversions of water from the Catoctin and Goose Creek headwaters and prevent stream pollution.
- D. Maintain a working relationship with the Federal Insurance and Mitigation Administration of the Federal Emergency Management Agency (FEMA) for continued participation in the National Flood Insurance Program (NFIP). The County will also maintain its current status as a Cooperating Technical Partner in FEMA's Flood Map Modernization program.
- E. Work with the incorporated towns, Loudoun Water, and other organizations and agencies to establish overall water quality goals and specific standards for individual streams and river and stream corridors, consistent with County RSCR objectives and policies.
- F. Coordinate with the Metropolitan Washington Airport Authority regarding water quality protection within the Broad Run watershed.
- G. Promote and encourage community programs, such as the "Adopt-A-Stream" program, in order to keep river and stream corridors free of litter and debris and as a means of promoting public awareness of the County's river and stream corridors.

- H. Support the interstate 2014 Chesapeake Bay Watershed Agreement—a watershed partnership among Virginia, Maryland, West Virginia, Delaware, New York, Pennsylvania, the District of Columbia and the United States EPA—and continue supporting Virginia’s action towards meeting the Chesapeake Bay TMDL and WIP.
- I. Support the mitigation of stream and wetland impacts and the creation of stream and wetland mitigation banks within Loudoun County to improve water quality in Loudoun.
- J. Maintain the County’s Predictive Wetland Model and require submittal of digital wetland delineations in conjunction with land development applications in order to develop a reliable wetlands inventory and map of wetland areas.

Strategy

- 2.2. Establish River and Stream Corridor Resource (RSCR) buffers to promote river and stream health (streambank/streambed stability, temperature moderation, nutrient removal, sediment removal, flood control, and aquatic food and habitat).

Actions

- A. Amend zoning regulations and development standards to establish a minimum 100-foot stream buffer to protect rivers and streams when floodplains and adjacent steep slopes do not extend beyond either bank by 100 feet.
- B. Amend zoning regulations and development standards to establish a 50-foot management buffer as part of the RSCR surrounding floodplains and adjacent steep slopes. Specific criteria for allowable reductions in the 50-foot management buffer should be included to ensure that reductions do not adversely impact the other elements of the RSCR. The RSCR 50-foot management buffer will not be added to the 100-foot minimum stream buffer.

Examples of measures to help mitigate a reduction in the 50-foot management buffer:

- i. Reforestation of open areas adjacent to the stream and floodplain;
- ii. Increasing Tree Conservation Areas adjacent to the floodplain (especially when the floodplain is narrow);
- iii. Buffering streams and wetlands outside of the RSCR; and
- iv. Enhanced stormwater and erosion and sediment control measures.

- C. Develop and use incentives to encourage property-owners to establish and maintain a 100-foot minimum riparian stream buffer.

Permitted Uses in the RSCR

Permitted uses within the RSCR are intended to support or enhance the biological integrity and health of the river and stream corridor. These uses are intended to have minimal adverse effects on natural, environmental, and heritage resources. Development of such uses requires mitigating impacts while complementing the hydrologic processes of the river and stream corridors including flood protection and water quality. New uses should be limited to:

- a. Road crossings, rail crossings, bridges, and drive-way crossings
- b. Public water and sewer
- c. Local and regional stormwater management facilities within the minor floodplain river and stream corridor resource only (subject to BMP requirements)
- d. Public lakes and ponds (subject to BMP requirements)
- e. Public water supply reservoirs
- f. Historic and archaeological sites
- g. Paths and trails – including footpaths, biking or hiking paths, and horse trails (of a permeable material only)
- h. Passive recreation – limited to hiking, biking, horseback riding, picnicking, camping, climbing, hunting, fishing, and wildlife viewing
- i. Active recreation within the minor floodplain river and stream corridor resource only
- j. Agricultural activities, but not structures – including crop planting and harvesting and grazing (subject to appropriate BMP requirements)
- k. Silviculture – as required to care for forests and not commercial forestry (limited to forest preservation and tree planting, limited tree clearing and clearing of invasive species, tree trimming and pruning, and removal of individual trees (subject to appropriate BMP practice requirements)
- l. Planting native vegetation (subject to appropriate BMP requirements)
- m. Conservation – including stream restoration projects, wetland mitigation banks, facilities and activities; Adopt-A-Stream programs; scientific, nature, and archaeological studies; and educational programs
- n. Raised boardwalks

Strategy

- 2.3 Protect and improve stream quality and watershed health by decreasing the amount of stormwater runoff and pollutants from reaching local waters.

Actions

- A. Develop appropriate standards and regulations to protect natural streams from the harmful effects of increased stormwater volume, velocity, and pollutant loads resulting from development.
- B. Encourage stormwater BMPs on-site or as close to the area being treated as possible to prevent increased nutrient and sediment runoff.

- C. Establish incentives and/or a funding program for reforestation, SWM/BMP projects, and SWM/BMP retrofits.
- D. Support the retrofitting of older stormwater systems and the rehabilitation of degraded areas to enhance pollution removal capabilities and create open space amenities.
- E. Retain a site's natural hydrology and drainage patterns wherever possible when designing stormwater management systems; otherwise, promote the use of low-impact development to replicate natural hydrologic patterns and alleviate the strain on centralized systems.
- F. Support and incentivize reforestation for degraded forested areas in upper stream reaches that do not include Major Floodplain and promote natural regeneration within the limits of the Major Floodplain to mitigate the loss of native canopy coverage as a result of construction.
- G. Develop and maintain standards for activities that propose pollution sources such as the storing and dispensing of fossil fuels, chemical storage, and sale or transfer of potential contaminants.

Strategy

- 2.4. Protect and enhance impaired streams and their tributaries to improve water quality and provide ecological benefits while also providing opportunities for passive recreation.

Actions

- A. Encourage the implementation of enhanced pollutant control measures and watershed management strategies such as: downspout disconnection; tree planting/reforestation, especially within riparian areas; storm drain marking; stream restoration; wetland creation; adding BMPs; enhanced stormwater management ponds; enhanced pollution/erosion control measures; coordination and outreach with the Virginia Department of Transportation (VDOT) and owners associations on use of sand and anti-ice materials in snow removal/road clearing operations; and stormwater pond water quality enhancements.
- B. Actively participate in regional water quality initiatives to protect and improve water quality.
- C. Comply with the Virginia General Permit for stormwater discharges from small Municipal Separate Storm Sewer Systems (MS4 General Permit).
- D. Prepare and implement TMDL Action Plans, as necessary to meet TMDL requirements. The Action Plans, designed to improve the County's surface water quality may include working with other entities, such as the Loudoun Soil and Water Conservation District (LSWCD) and Virginia Cooperative Extension-Loudoun (VCE-Loudoun).

- E. Collaborate with the Department of Environmental Quality, the Goose Creek Scenic River Advisory Committee, and other stakeholder groups on any pollution impairment issues within streams and support volunteer water quality monitoring efforts and coordination of these efforts with federal, state, and local water quality data collection.

Surface Water Resources

Strategy

- 2.5. Protect rivers and public drinking water reservoirs to ensure a clean, safe, and adequate supply of drinking water.

Actions

- A. Protect public water supply reservoirs, Scenic Rivers, the Potomac River, and the Bull Run by establishing a 300-foot no-build buffer or the other elements of the RSCR buffer, whichever is greater. Areas outside of the no-build buffer are priority open space areas for the creation of a greenbelt. The greenbelt could be created through various mechanisms such as land donations, conservation easements, and other land conservation mechanisms. Specifically those areas outside of the no-build buffer identified as the 200-foot transitional buffer along the Bull Run and the 1,000-foot voluntary open space area along the Goose Creek, Goose Creek Reservoir, and Beaverdam Reservoir will be designated as priority open space areas.
- B. Protect lands that are critical to the quality of key water supplies through easement, fee simple acquisition, regulatory measures, or other sufficient measures. Restore filtration and erosion control functions through the re-naturalization and native revegetation of these areas.
- C. Develop and implement a watershed overlay district for all public water supply reservoir watersheds, establishing more stringent development guidelines and performance standards to protect water quality.
- D. Develop and implement a Potomac River shoreline management plan and seek to coordinate this effort with adjacent jurisdictions (local, state, and regional organizations, advisory boards, and citizen groups). This plan should include:
 - i. The boundaries of the study area,
 - ii. A comprehensive natural resources inventory,
 - iii. Existing and proposed private/public water access entry points,
 - iv. Policy recommendations for river corridor management and protection,
 - v. A process for integrating the participating groups, and
 - vi. A plan for acquiring and managing open space corridors along the Potomac River.
- E. Establish appropriate standards and land uses in consultation with Loudoun Water and/or incorporated towns to protect drinking water supplies.

- F. Develop a community-based Source Water Protection Plan in cooperation with Loudoun Water and other agencies and organizations.

Groundwater Resources

Strategy

- 2.6. Preserve and protect groundwater quantity and quality.

Actions

- A. Develop and implement a comprehensive groundwater protection strategy to ensure adequate and sustainable water supply.
- B. Develop and implement a comprehensive pollution management program to monitor and protect groundwater resources.
- C. Local wellhead protection plans will be taken into consideration during review of development applications to maintain drinking water quality and protect groundwater from contamination.
- D. Limit the installation of additional wells and limit the number of additional households and irrigation systems that are dependent on wells through water conservation efforts and through the use of communal and/or central water systems where feasible and as approved by Loudoun Water.
- E. Ensure the location, depth, and rate of extraction of individual wells do not impact the quality and quantity of municipal wells.
- F. Assess the recharge and consumption rates for groundwater in each watershed by analyzing data from groundwater level monitoring and stream flow measurements. If negative impacts are detected, the information will be presented to the Board of Supervisors for appropriate action.
- G. Develop standards for uses that consume and/or require the usage of large quantities of water in those areas that could affect neighboring wells and aquifers.
- H. Provide education to school children and homeowners on the use and consumption of groundwater for areas of the County that are not connected to the central water supply.
- I. Study best practices/guidelines to reduce impervious surfaces and minimize increases in post-development runoff peak rate, frequency, volume.

Additional Notes:

- The RSCR performance standards, BMP requirements, and list of permitted uses will apply to the no-build buffer, except adjacent to existing or planned drinking water reservoirs where stormwater management facilities are not permitted.
- The limits of the 300-foot no-build buffer for reservoirs is measured from their projected high water mark where expansion is proposed.

Soils and Geologic Resources

SGR Policy 3: Preserve and protect the County's soils, unique geologic characteristics, farmland, steep slopes, mountainsides, and ridgelines recognizing their sensitivity to land disturbance and development as well as their contribution to healthy ecosystems and the quality of life valued by residents and visitors.

Limestone Geology Areas

Strategy

- 3.1. Protect limestone geology areas susceptible to sinkholes, cavity collapse, ground slippage, pollution, and other hazards.

Actions

- A. Maintain performance standards for lands within areas underlain by limestone — including minimum setback distances from karst features (e.g., sinkholes and rock outcrops) —to ensure structural stability and prevent adverse impacts to environmental and public health.
- B. Limit density and intensity of development within areas underlain by limestone, especially on sites proximate to karst features.
- C. Require communal water and wastewater systems built to Loudoun Water standards for new development in areas underlain by limestone.
- D. In areas of the limestone overlay district and/or other areas where subsurface karst geology exists, require potable water supply systems that can be demonstrated to treat groundwater to a surface water level of treatment standard, following Loudoun Water's Engineering Standards Manual, as a condition of approval.
- E. Identify pollution sources and establish appropriate standards for reducing pollution in areas underlain by limestone.

Prime Agricultural Soils

Strategy

- 3.2. Preserve and protect prime farmland and agricultural soils, recognizing their importance to the overall economic health of the rural economy.

Action

- A. Develop a public education program that will focus on communicating advantages associated with private protection of Prime Agricultural Soils.
- B. Encourage the retention and conservation of prime agricultural soils within open space areas.
- C. The County will update, maintain, and make available the Countywide Prime

Agricultural Soils Map.

Steep Slopes, Moderately Steep Slopes and Mountainside Areas

Strategy

- 3.3. Protect steep slopes, ridgelines, and mountainside areas against destabilization, erosion, building and/or road failure, downstream flooding, and other hazards and to maintain the scenic and rural nature of these areas.

Actions

- A. Manage and regulate development in mountainside areas using performance standards and regulations to minimize negative environmental impacts; minimize land disturbance; protect the ridgelines; maintain woodlands, plant, and wildlife habitats; and preserve other natural features.
- B. Prohibit land disturbance on naturally occurring very steep slopes (greater than 25 percent grade and/or soil slope class of E), with limited exceptions such as access easements to existing lots where no other access is possible. Agricultural or silvicultural activities, excluding structures, may be allowed provided that a County approved Farm Management Plan or Forest Management Plan, whichever is applicable, is implemented. Apply performance standards to protect soils, vegetation, and other environmental features when roads are permitted or allowed by special exception.
- C. Apply performance standards to protect moderately steep slopes (15 to 25 percent grade and or soil slope class of D) to include BMPs and locational clearances for clearing and grading. Develop incentives to locate development outside of moderately steep areas. Limit clearing to only essential clearing that is necessary for home construction, road construction, and utility installation on moderately steep slopes.
- D. Preserve forests and native vegetation on very steep slopes.
- E. Protect ridgelines through updates to the Mountainside Development Overlay District, the development of a Ridgeline Protection Overlay District, and the prioritization of protecting such areas through open space easement acquisition.
- F. Require special exception approval for the subdivision of properties into three or more lots in Sensitive and Highly Sensitive Mountainside Areas.
- G. Seek the expansion of passive outdoor recreational opportunities in mountainside areas, including the development of public park sites and improving access to existing recreational facilities such as the Appalachian Trail.
- H. Review and amend zoning regulations and development standards to ensure consistency with the mountainside area policies.
- I. Establish performance standards for unavoidable development on questionable soils

as defined by the International Building Code.

Forests, Trees, and Vegetation

FTV Policy 4: Preserve, protect, and manage Loudoun County's forests and trees for current and future use and enjoyment, recognizing these resources provide many benefits, such as improving air and water quality; offering important habitat for birds, small mammals and other wildlife; providing buffers between communities; conserving energy; reducing wind speed and redirecting airflow; and reducing stormwater runoff and soil erosion.

Strategy

- 4.1. Preserve, protect, and manage forest resources for their economic and environmental benefits.

Actions

- A. Require applicants to submit a Tree Cover Inventory as part of all development applications and, where applicable, require applicants to submit a Tree Conservation Plan for designated Tree Conservation Areas; such Tree Conservation Plan should demonstrate a management strategy that ensures the long-term sustainability of these designated areas and address the removal and monitoring of invasive woody vegetation and insects.
- B. Incentivize and encourage the preservation of existing trees within required landscape buffer areas and for screening of uses.
- C. Require the removal of invasive plant species during the development process.
- D. Develop and adopt a Tree Preservation Ordinance.
- E. Inventory and map trees and native vegetative resources to be preserved or managed in accordance with County standards and create and maintain a database of these resources to include, but not be limited to, old growth forests, significant tree stands, specimen trees, heritage trees, and State or National Champion trees.
- F. Participate in community tree projects such as the Arbor Day Foundation's Tree City USA Program.

Strategy

- 4.2. Promote tree planting and preservation to reduce the heat island effect, manage stormwater run-off, and improve water quality, air quality, and wildlife habitat.

Actions

- A. Prioritize the planting of native vegetation, specifically along those corridors that provide connections to other natural, environmental, and heritage resources.

- B. Develop Countywide goals and objectives for the creation, maintenance, and preservation of the County's tree canopy.

Historic, Archaeologic, and Scenic Resources

HASR Policy 5: Loudoun County's distinctive cultural landscapes encompass scenic and heritage resources, including Scenic Rivers and Byways, historic buildings, archaeological sites, battlefields, and historic cemeteries. These resources are foundational elements of the County's changing landscape that together tell the story of the formation and settlement of the County. The County will protect and enhance these resources, recognizing them as relevant, character-defining elements of both the natural and built environments.

Strategy

- 5.1. Preserve cultural and scenic character through conservation and preservation of designated heritage areas, battlefields, cemeteries, scenic corridors, Scenic Rivers, the Potomac River, significant geological features, archaeological sites, historic structures and their settings. Convey the benefit of these resources to the public through public education in collaboration with private landowners and preservation organizations.

Actions

- A. Evaluate land development applications within the context of this Plan as well as those more specific policies contained in the *Heritage Preservation Plan*.
- B. Evaluate the *Heritage Preservation Plan* every five years and update if necessary.
- C. Require an archaeological and historic resources survey for all development applications. This survey must include a plan for recordation of identified resources and measures for preservation, mitigation, and adaptive reuse. The County will maintain a repository for artifacts recovered from required surveys; such artifacts will be used for research and public education purposes.
- D. The County will update its cultural resource inventory through the land development process and County-sponsored historic surveys.
- E. Evaluate the historic or archaeological value of inventoried resources based on criteria set forth in the Secretary of the Interior's Standards for Archaeology and Historic Preservation, which include historic context and site integrity. The County will evaluate resources for consideration for state and National Registers. Identify, through survey and community outreach, locally important historic and archaeological resources that meet criteria for listing on the County Heritage Register as outlined in the Heritage Preservation Plan.
- F. Identify, delineate, and map historic cemeteries, burial grounds, and graves to ensure

they are protected from destruction or neglect. Ensure that adequate buffers are provided around these sites to protect them during the development process.

- G. Identify African American and Native American cultural resources, document them in the County's database of heritage resources, and create policies and programs that protect, preserve, and interpret these resources for the benefit of County residents.
- H. Maintain the County's database by using the inventory of cultural resources as a dynamic body of data to be reevaluated as needed.
- I. Conduct a staff assessment to determine historic significance prior to issuing a demolition permit for a structure that is 50 years old or older.
- J. Work with local communities to protect and enhance the character of cultural landscapes and historically significant sites through the designation of County Historic and Cultural Conservation Districts.
- K. Preserve and protect significant cultural and scenic resources from development impacts by promoting private or public acquisition and/or conservation easements.
- L. Where consistent with the applicable provisions of the Virginia Code, applicants may proffer cash contributions to the County for the enhancement and/or improvement of historic features within Loudoun to fulfill the open space guidelines described in Chapter 6 if the historic feature is in the same planning subarea identified in the latest Capital Needs Assessment and the County agrees to accept such contribution.
- M. Prioritize the adaptive reuse of historic structures that are of local, regional, or national significance as the primary method of preserving the County's diverse collection of historic architecture within the framework of sustainable development.
- N. Amend zoning regulations and development standards to ensure the viability of adaptive reuse, particularly in the County's villages where the ability to reuse historic structures is vital to the historic character and vitality of these communities.
- O. Prepare and implement corridor management plans, including identifying and defining viewsheds for the County's Scenic Rivers to protect their natural and scenic quality.
- P. Prohibit the diversion of Scenic Rivers under any circumstances.

A viewshed analysis for a Scenic River typically involves looking at both the view from the resource itself as well as the view towards the resource.

Natural Heritage Resources

NHR Policy 6: Preserve, protect, and create a network of privately and publicly protected open space, favoring large contiguous areas rather than smaller disconnected areas; maintaining natural, environmental, and heritage resource assets; preventing habitat fragmentation; and reinforcing the unique character of the diverse communities in the County.

Strategy

- 6.1. Conserve and protect natural heritage resources including rare, threatened, and endangered plant and animal species; species of greatest concern; exemplary natural communities, habitats, and ecosystems; and other natural features of the County.

Actions

- A. Use open space requirements, passive recreation, nature preserves, incentives, and regulations to protect areas of natural biodiversity and rare, threatened, and endangered plant and animal species, and plant communities in keeping with the federal Endangered Species Act and to foster the implementation of the Virginia Wildlife Action Plan.
- B. Require development applications to identify Loudoun County's natural heritage resources through coordination with the Virginia Department of Conservation and Recreation (VDCR) – Division of Natural Heritage and the Virginia Department of Game and Inland Fisheries (VDGIF). For those development applications that have a likely presence of one or more natural heritage resource, the County will require the applicant to conduct relevant assessments. In cases where the presence of the species is identified, the County will require the applicant to develop and submit a plan for impact avoidance.
- C. Ensure that the study of natural heritage resources is conducted by qualified research organizations such as the VDCR and VDGIF, and develop implementation strategies for the preservation of identified natural heritage resources.

Wildlife Habitats

Strategy

- 6.2. Conserve and protect wildlife habitats, wildlife travel corridors, and access to streams and water sources through the preservation of natural resources such as native vegetation, forest cover, woodlands, floodplains, streams and stream corridors, wetlands, and undeveloped areas associated with steep slopes.

Actions

- A. Require development proposals to create links to adjacent open space and natural resources to help prevent habitat fragmentation and foster biodiversity.

- B. Identify essential wildlife corridors and encourage protection of these areas through conservation easements acquired by the County or others, participation in the Open Space Preservation Program, development design, and other means.
- C. Ensure that new development, redevelopment, and infill development incorporates existing native vegetation and plantings of native vegetation into the landscape design.
- D. Encourage the preservation and plantings of native vegetation to protect pollinators, migrant birds, and other wildlife.
- E. Promote and support the establishment of public and private nature preserves throughout the County as part of the protection and enjoyment of natural, environmental, and heritage resources.

Complementary Elements

CE Policy 7: The County promotes healthy air and low levels of noise and light pollution as essential elements for current and future residents.

Strategy

- 7.1. Preserve and protect air quality.

Actions

- A. Comply with the requirements of the Federal Clean Air Act Amendments of 1990 through support of the State Implementation Plan (SIP).
- B. Evaluate and implement methods to reduce emissions of airborne pollutants including particulates, greenhouse gases, ozone precursors, and other gases known to adversely affect human and environmental health.

Strategy

- 7.2. Protect noise-sensitive uses.

Actions

- A. Continue to support the Washington Dulles International and Leesburg Executive Airports by continued and complete prohibition of new residential and other noise-sensitive land uses from the areas located within the Ldn 65 or higher aircraft noise impact area for both airports and by allowing only non-noise-sensitive land uses within these contours.

The Airport Noise Impact Area (ANIA) consists of three (3) components or aircraft noise impact areas:

- (i) Ldn 65 or higher;
- (ii) Ldn 60-65; and
- (iii) Within one (1) mile of Ldn 60

- B. Continue to work with the Metropolitan Washington Airports Authority to understand and minimize the effects of airport operations and routes on existing noise-sensitive areas within the Ldn 60-65 aircraft noise impact area for Washington Dulles International Airport and minimize residential and noise-sensitive development in noise sensitive areas.
- C. Prohibit residential encroachment into the areas designated as within the Ldn 65 or higher aircraft noise impact area to ensure that residential development will not create pressure for reductions in the intensity of service or prohibit the expansion of service at the airport.
- D. Continue to enforce and update with the most current information, as appropriate, the Airport Impact Overlay District included as part of the Loudoun County Zoning Ordinance.
- E. Consider the 2019 Washington Dulles International Noise Contour Map Update when reviewing land development applications surrounding the airport.
- F. Consider replacing the existing noise contours for Washington Dulles International Airport to reflect the noise contours in the 2019 Washington Dulles International Noise Contour Map Update. **[Implemented with CPAM-2021-0001, ZMAP-2021-0011, and ZOAM-2021-0002, Airport Impact Overlay District Update. However, the Ldn 65 or higher aircraft noise impact area is revised to exclude areas already approved for residential development through proffered rezoning.]**
- G. Require roadway noise studies for residential, institutional, or other noise sensitive uses adjacent to existing or proposed arterial and major collector roads to ensure that forecasted noise levels fall within acceptable levels, or can be abated to meet County standards (See also *Loudoun County 2019 Countywide Transportation Plan*, Chapter 7, Environmental and Heritage Resources).
- H. Allow approved residential rezonings that were located outside of the Ldn 65 or higher aircraft noise impact area at the time of approval, but projected to be within the Ldn 65 or higher noise impact area by the 2019 Washington Dulles International Noise Contour Map Update, to develop in accordance with their approval. Such rezonings will be designated within the Ldn 60-65 aircraft noise impact area.
- I. Require disclosure by property owners to prospective buyers of dwellings within the Airport Noise Impact Area (ANIA) that the property may be impacted by airport noise.

Strategy

- 7.3. Prevent light pollution.

Actions

- A. Update lighting standards to achieve the following:
 - i. Promote the use of lighting for convenience and safety while minimizing light pollution;
 - ii. Promote a glare-free environment through proper lighting performance standards to improve visibility and enhance public safety;
 - iii. Promote appropriate lighting standards to conserve energy;
 - iv. Develop appropriate lighting standards to prohibit unnecessary and intrusive light trespass that detracts from the beauty and view of the night sky; and
 - v. Promote the International Dark-Sky Association's Dark Sky standards to prevent light pollution.

Sustainability

SUS Policy 8: Promote sustainability efforts throughout the County.

Strategy

- 8.1. Support sustainability practices within the Loudoun County Government.

Actions

- A. Update and implement the County Energy Strategy (CES) to account for rapid growth in population and high energy demand uses, technological changes allowing improved energy storage, changing renewable energy markets, and the impacts of climate change.
- B. Continue to evaluate the energy demands of government buildings as well as transportation needs and develop plans for energy efficiency.
- C. Encourage benchmarking the energy use of existing and planned County buildings to establish a baseline for energy demand estimates.
- D. Use the data from benchmarking the energy use to set policy and regulations in the County.
- E. Whenever feasible, build County-constructed facilities to LEED Silver, or equivalent, standards.
- F. Continue to evaluate all sustainability efforts and improve efforts as new options and technologies become available.
- G. Continue to monitor the efforts of MWCOG.
- H. Support Loudoun Water in the expansion of the reclaimed water network.

- I. Incorporate natural, environmental, and heritage resources and BMPs into County Energy Strategy.
- J. Prioritize government purchase and use of goods and services that have reduced impacts to human and environmental health.
- K. Prioritize the use of Loudoun farm products in government purchase of food.
- L. Develop a Sustainability Plan for the County that provides the framework to balance economic development, social well-being, and environmental health.
- M. Consider providing electric car charging stations at newly constructed County-constructed facilities.

Strategy

- 8.2. Support energy efficient practices for all in Loudoun County.

Actions

- A. Evaluate the energy demands of residential and non-residential buildings, including data centers as well as transportation needs and develop plans for energy efficiency.
- B. Research and support opportunities for micro-grid energy and district energy systems.
- C. Encourage the use of Commercial Property Assessed Clean Energy (C-PACE) and research and support residential PACE program.
- D. Prioritize public investment in energy efficient, clean products and infrastructure.

Strategy

- 8.3. Support sustainable economic practices within Loudoun County to strengthen economic growth and innovation.

Actions

- A. Create partnerships with universities and private sector companies to foster growth of a sustainable economy that supports workers and students in the advanced technology and science industries.
- B. Promote the production and access to sustainable, healthy local food.
- C. Support and expand community gardens throughout the County.

SUS Policy 9: Encourage sustainable development practices, including long-term water conservation, green building principles, sustainable site design, renewable energy, preservation and adaptive re-use of historic structures, and integrated

energy management planning.

Strategy

- 9.1. Promote water conservation through innovative, cost-effective reuse systems, domestic water saving devices, and low impact development techniques, which integrate hydrologically functional designs with methods for preventing pollution and educational programs.

Actions

- A. Educate and encourage the harvesting of rainwater for non-potable use, such as landscape irrigation.
- B. Establish incentives for sustainable development.

Strategy

- 9.2. Promote the use of salvaged, recycled, or locally produced materials whenever possible.

Strategy

- 9.3. Evaluate the establishment of Eco-districts within the County.

Strategy

- 9.4. Promote green building standards and green building.

Strategy

- 9.5. Support renewable energy.

Actions

- A. Adopt solar zoning and permitting best practices for accessory use solar development.
- B. Become certified as a “solar-ready” community under the Department of Energy’s SolSmart program.
- C. Support solar farms with locational criteria to be identified.

Reference Maps

Natural and Environmental Resources (Map #2018-141)

River and Stream Corridor Resources (Map #2018-142)

Watersheds (Map #2018-143)

Historic Districts (Map #2018-144)

Airport Noise Impact Area (Map #2023-023)

African American Historic Communities (Map #2018-201)

Impaired Streams (Map #2018-203)

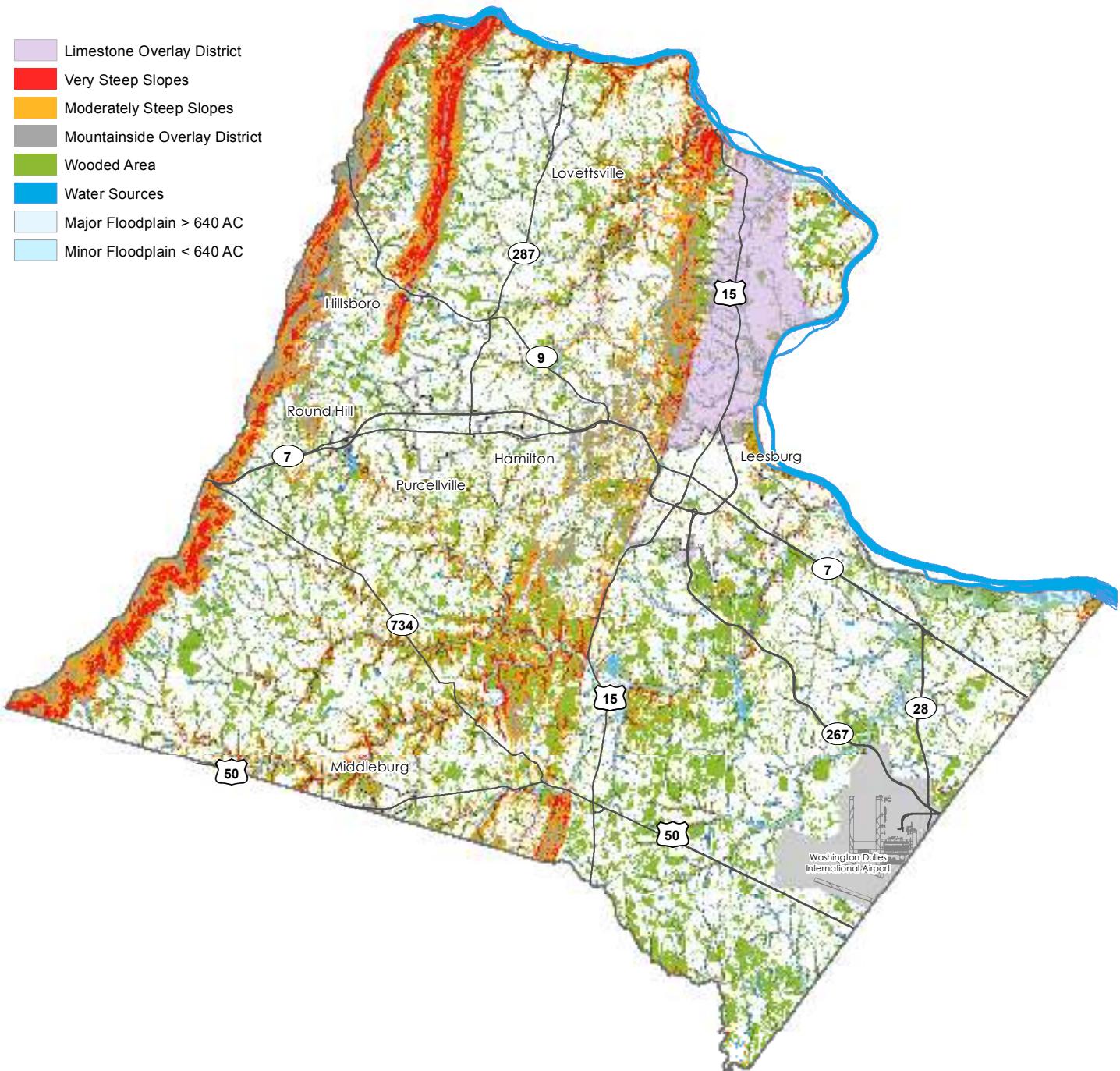
Limestone Overlay District (Map #2018-204)

Countywide Prime Agricultural Soils Map (Map #2019-262)

Loudoun County
Natural & Environmental Resources
2019 General Plan



- [Purple square] Limestone Overlay District
- [Red square] Very Steep Slopes
- [Yellow square] Moderately Steep Slopes
- [Grey square] Mountainside Overlay District
- [Green square] Wooded Area
- [Blue square] Water Sources
- [Light blue square] Major Floodplain > 640 AC
- [Very light blue square] Minor Floodplain < 640 AC



Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

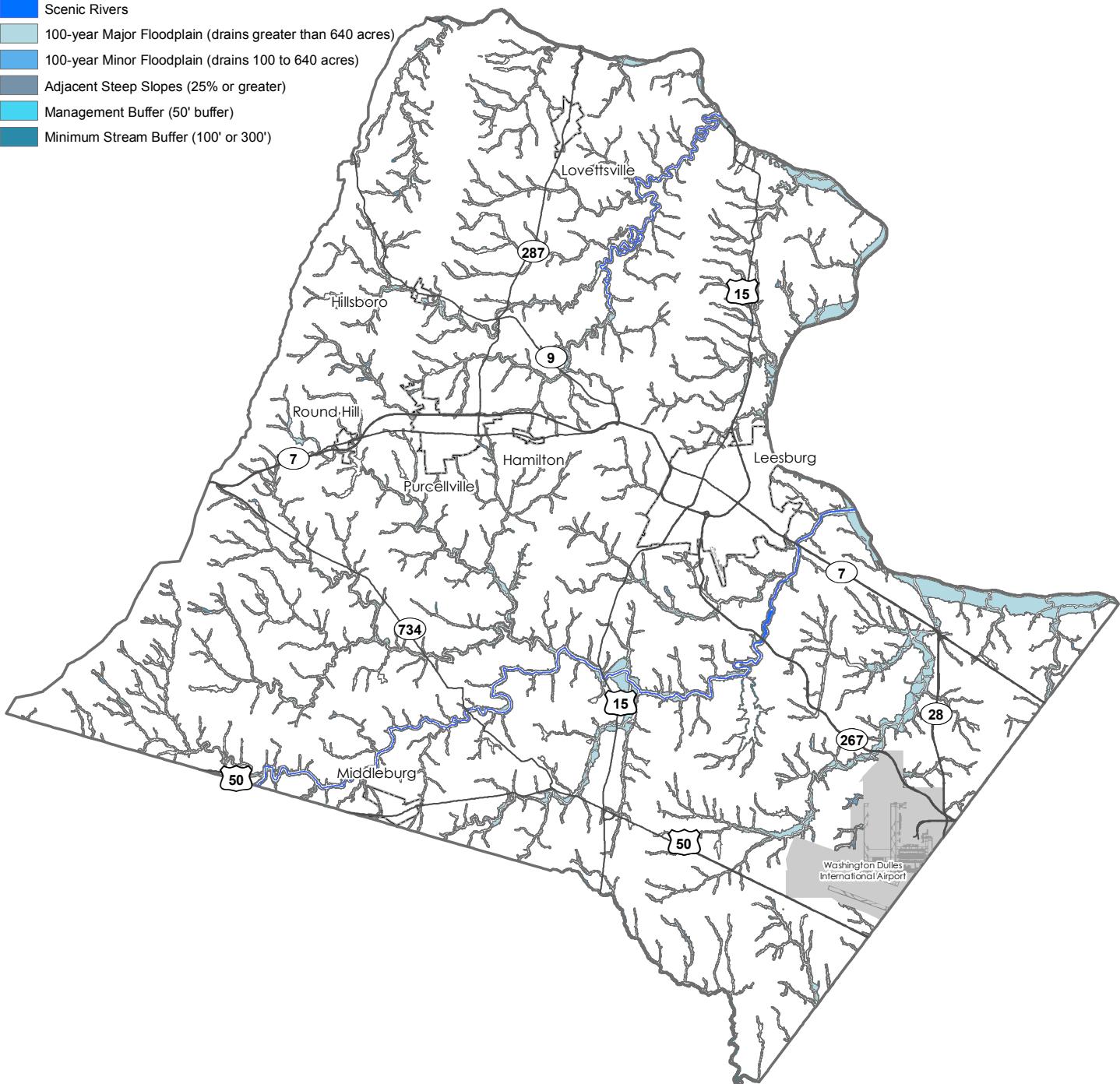
0 1 2 4 6 8 Miles
Map Number 2018-141

Loudoun County
**River and Stream
Corridor Resources**

2019 General Plan

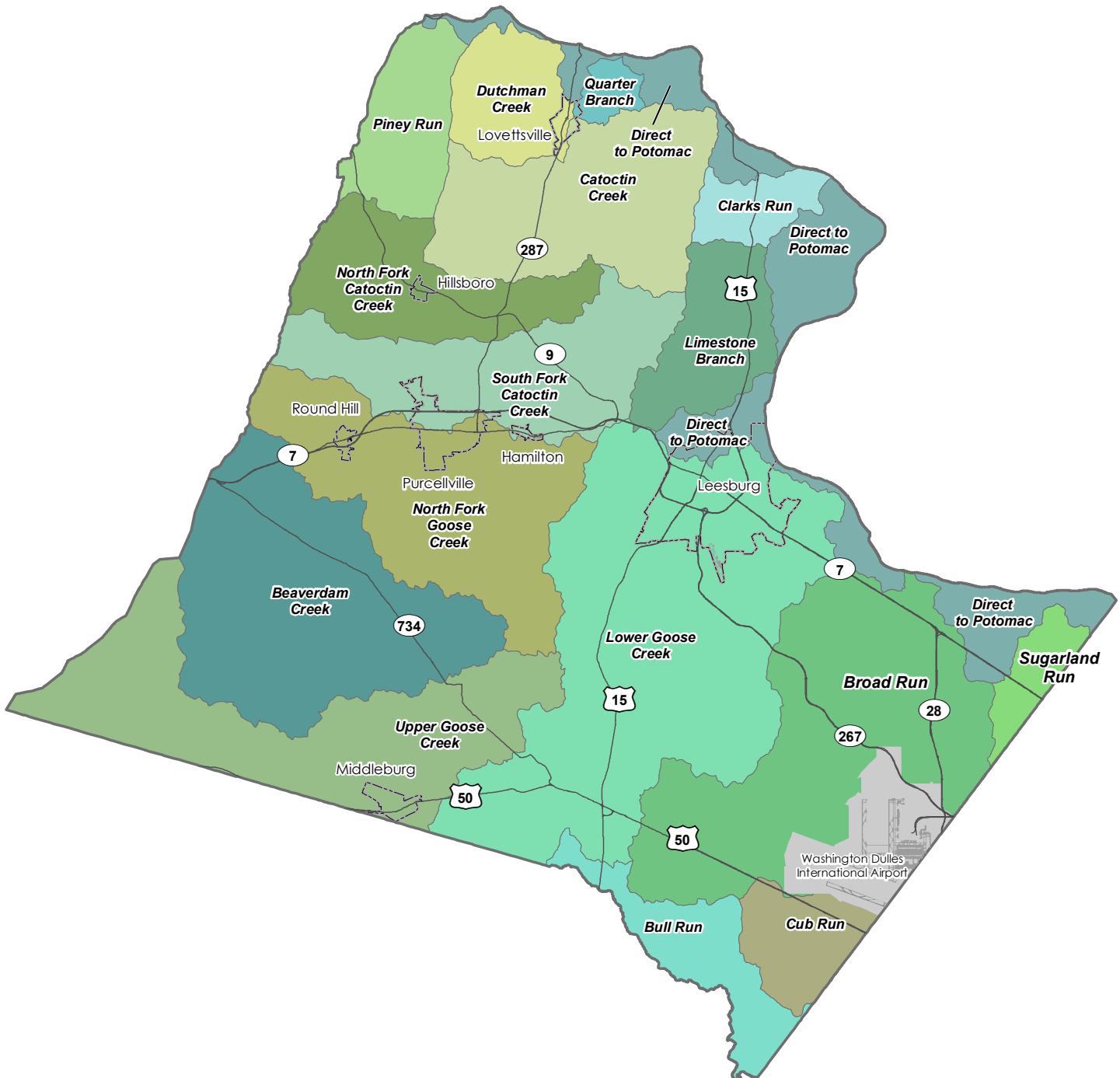


- █ Scenic Rivers
- 100-year Major Floodplain (drains greater than 640 acres)
- 100-year Minor Floodplain (drains 100 to 640 acres)
- Adjacent Steep Slopes (25% or greater)
- Management Buffer (50' buffer)
- Minimum Stream Buffer (100' or 300')



Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles
Map Number 2018-142

Watersheds

Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles
Map Number 2018-143

Loudoun County
Historic Districts

2019 General Plan



National Register Historic Districts

National Historic Landmarks

Town Historic Districts

Virginia Historic Landmark District

Loudoun County Historic Districts

Aldie Historic District

Beaverdam Creek Historic District

Bluemont Historic District

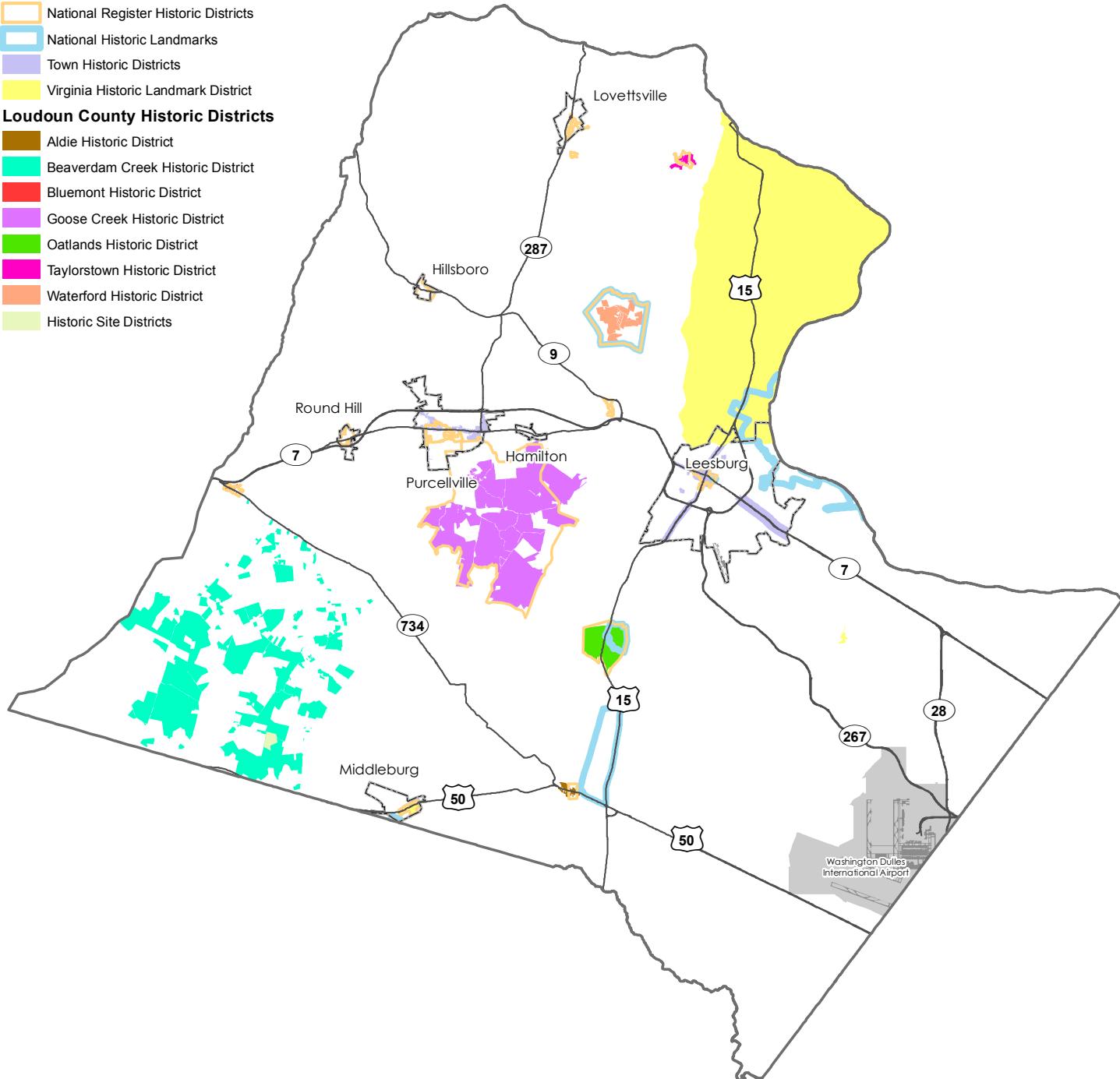
Goose Creek Historic District

Oatlands Historic District

Taylorstown Historic District

Waterford Historic District

Historic Site Districts

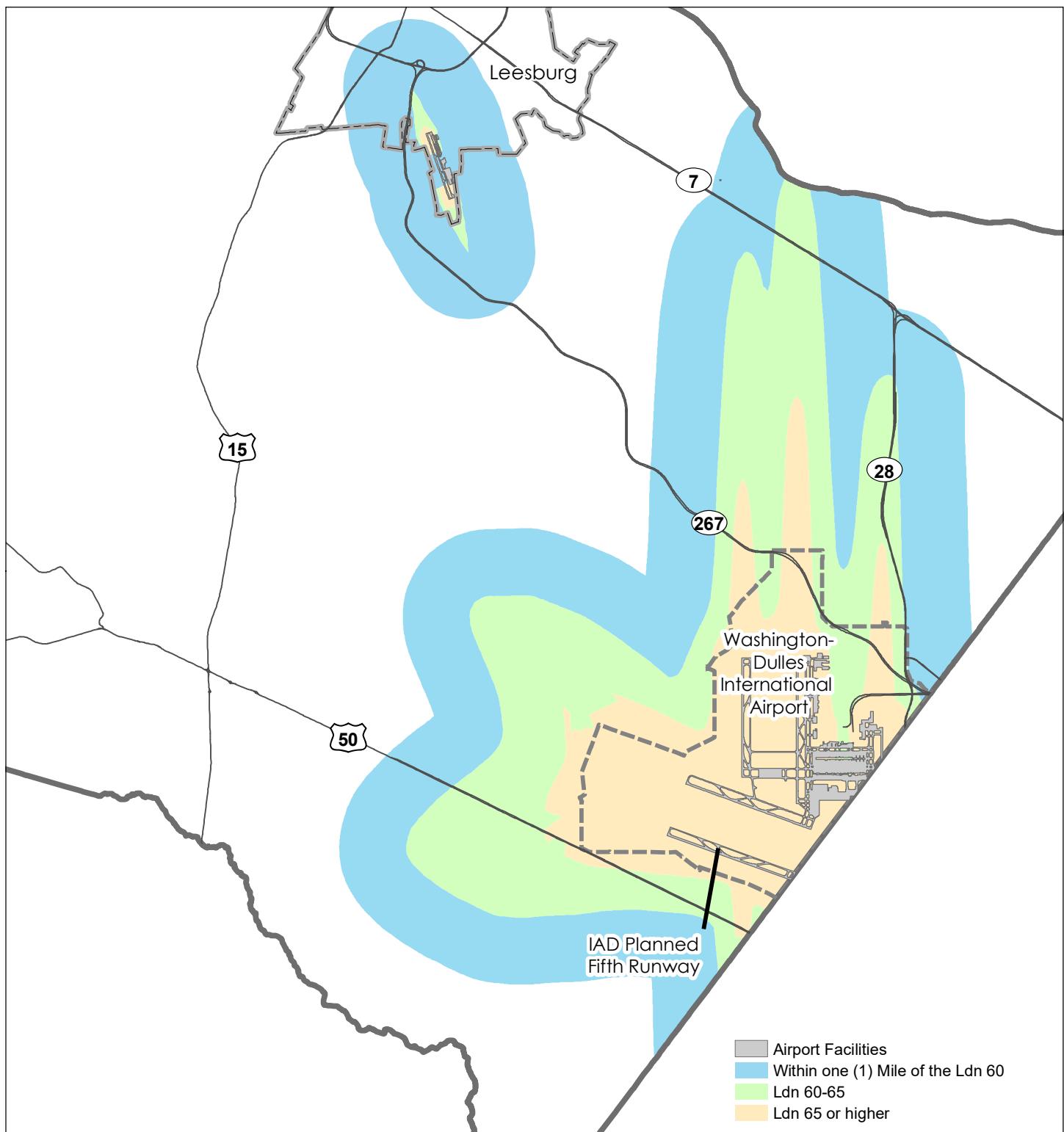


Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles

Map Number 2018-144

Loudoun County
**Airport Noise
Impact Area**
2019 General Plan



Loudoun County IS NOT LIABLE for any use
of reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 0.5 1 2 3 4 Miles
Map Number 2023-023

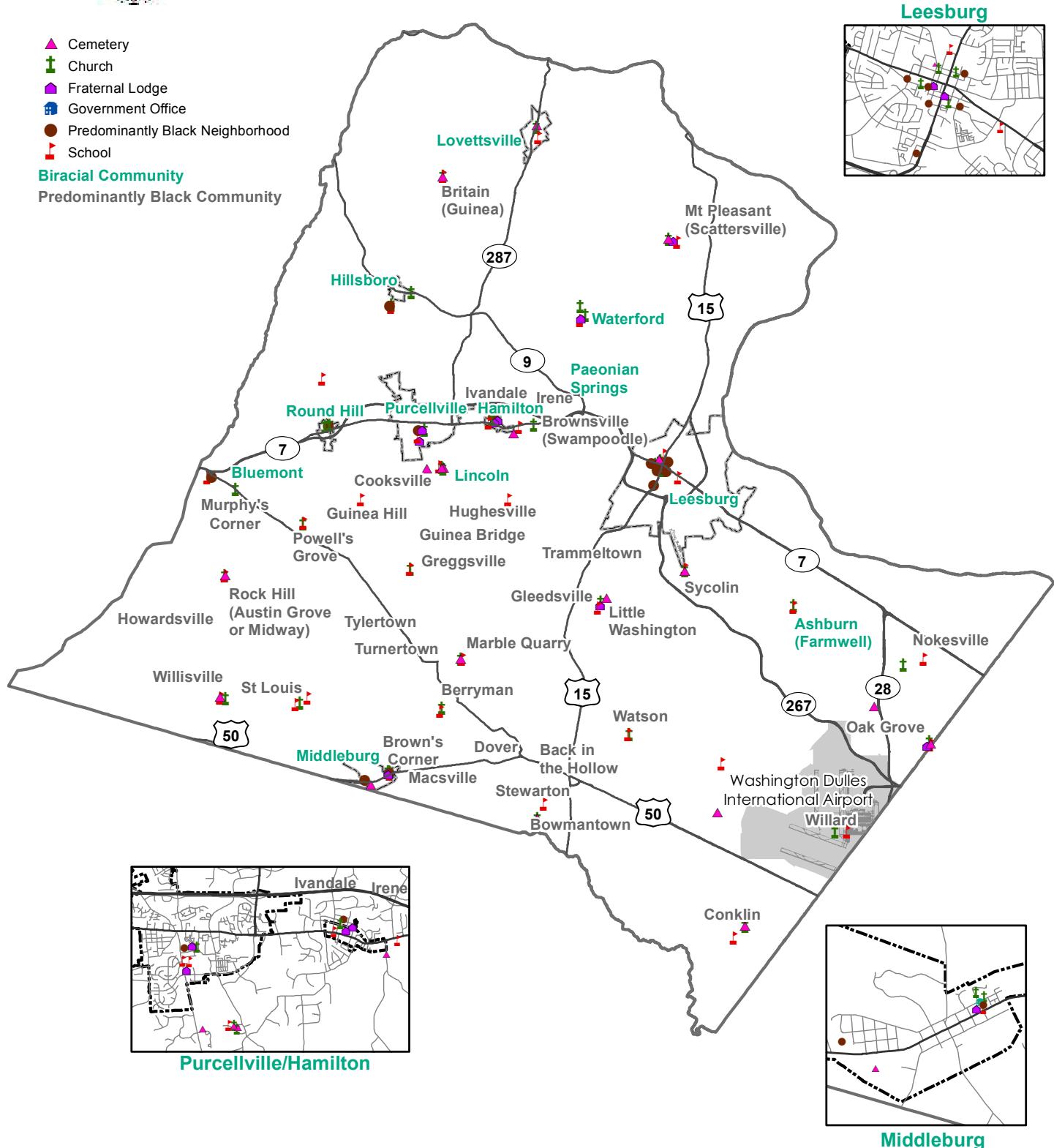
Loudoun County
**African American
 Historic Communities**
 2019 General Plan



- ▲ Cemetery
- ✚ Church
- ▲ Fraternal Lodge
- Government Office
- Predominantly Black Neighborhood
- 🚩 School

Biracial Community

Predominantly Black Community



Loudoun County IS NOT LIABLE for any use
 of or reliance upon this map or any information
 contained herein. While reasonable efforts have
 been made to obtain accurate data, the County
 makes no warranty, expressed or implied, as to its
 accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles
 Map Number 2018-201

Loudoun County

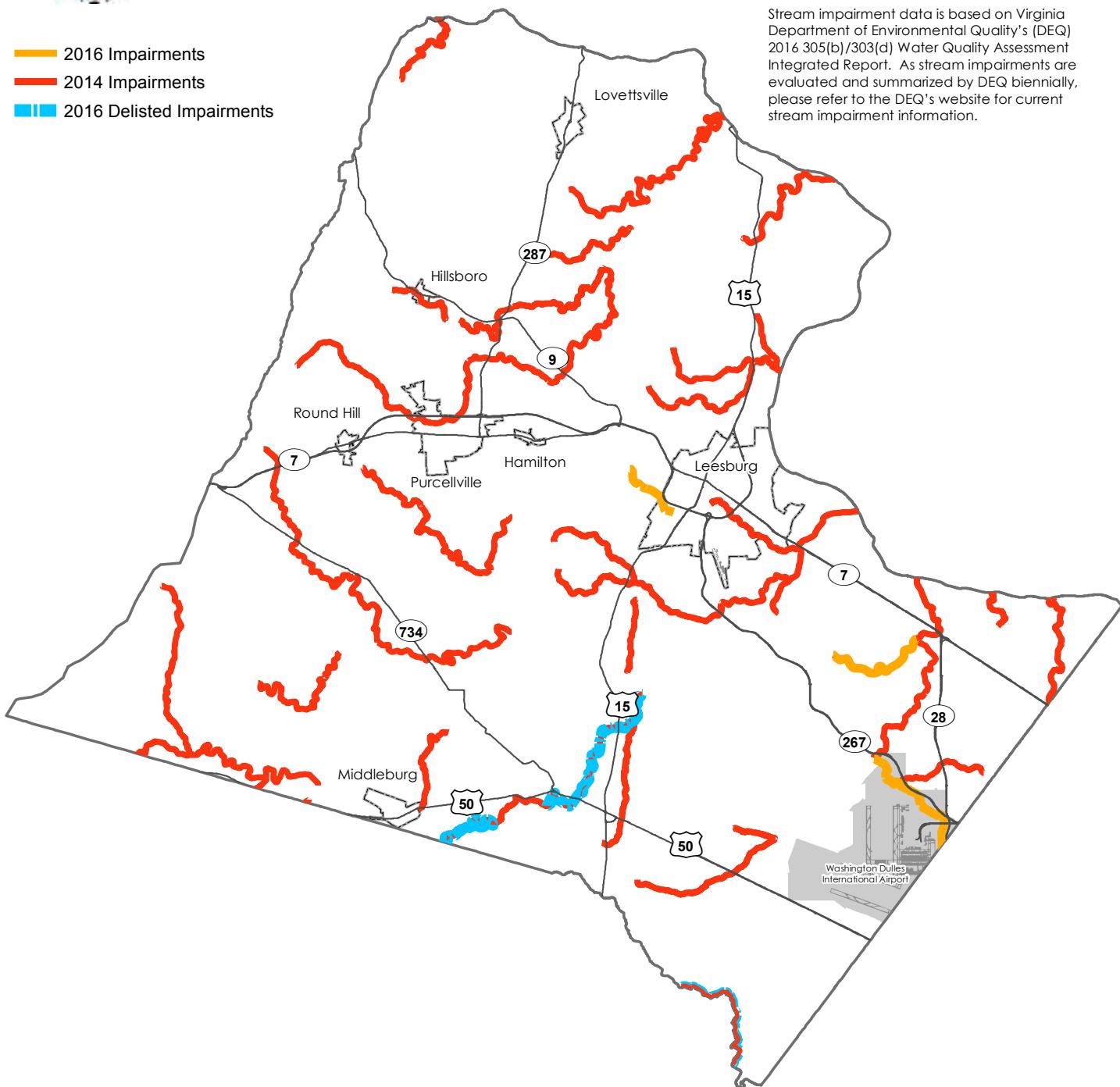
Impaired Streams

2019 General Plan



- 2016 Impairments
- 2014 Impairments
- 2016 Delisted Impairments

Stream impairment data is based on Virginia Department of Environmental Quality's (DEQ) 2016 305(b)/303(d) Water Quality Assessment Integrated Report. As stream impairments are evaluated and summarized by DEQ biennially, please refer to the DEQ's website for current stream impairment information.



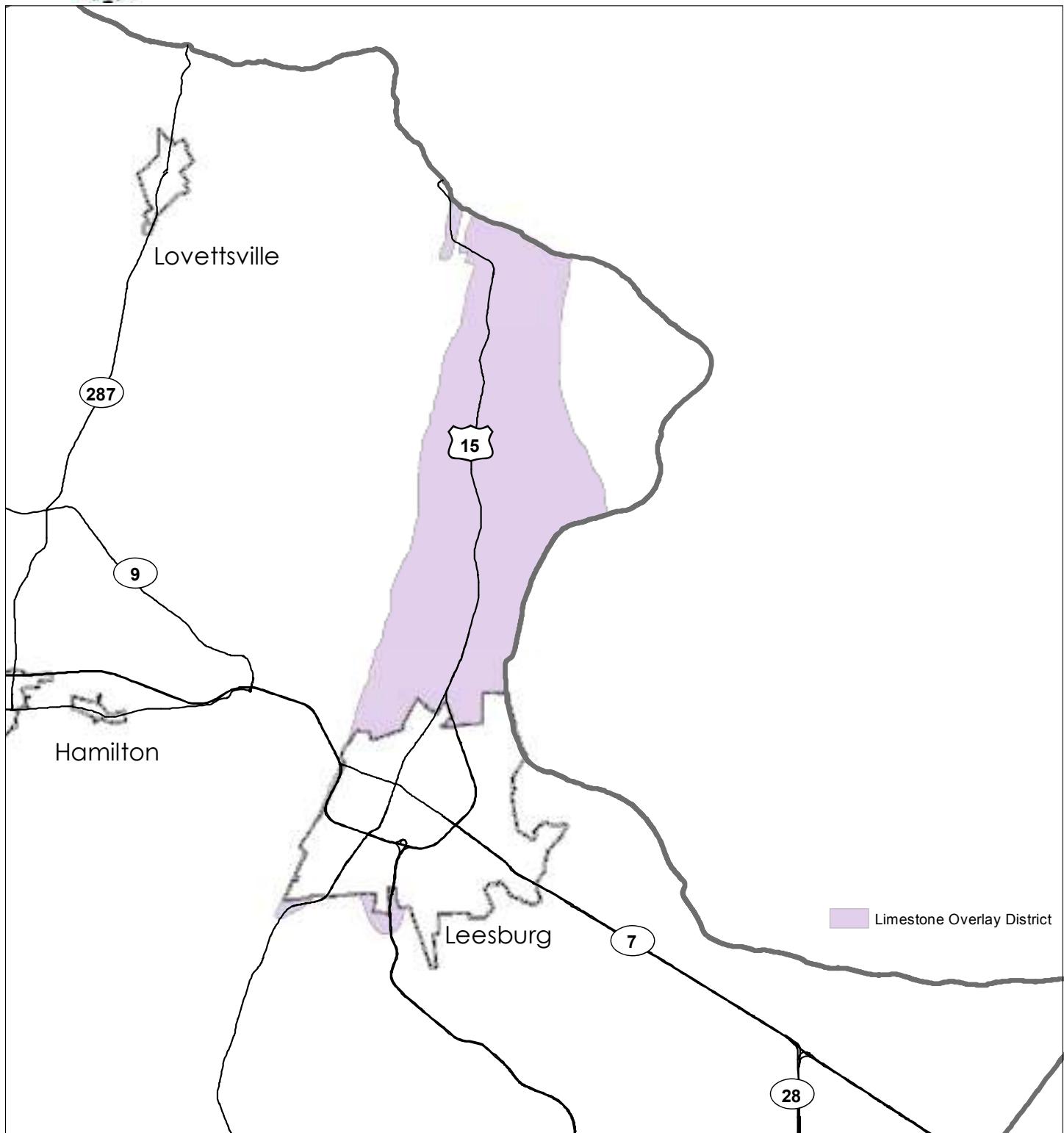
Loudoun County IS NOT LIABLE for any use of or reliance upon this map or any information contained herein. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles

Map Number 2018-203

Loudoun County
**Limestone
Overlay District**

2019 General Plan



Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

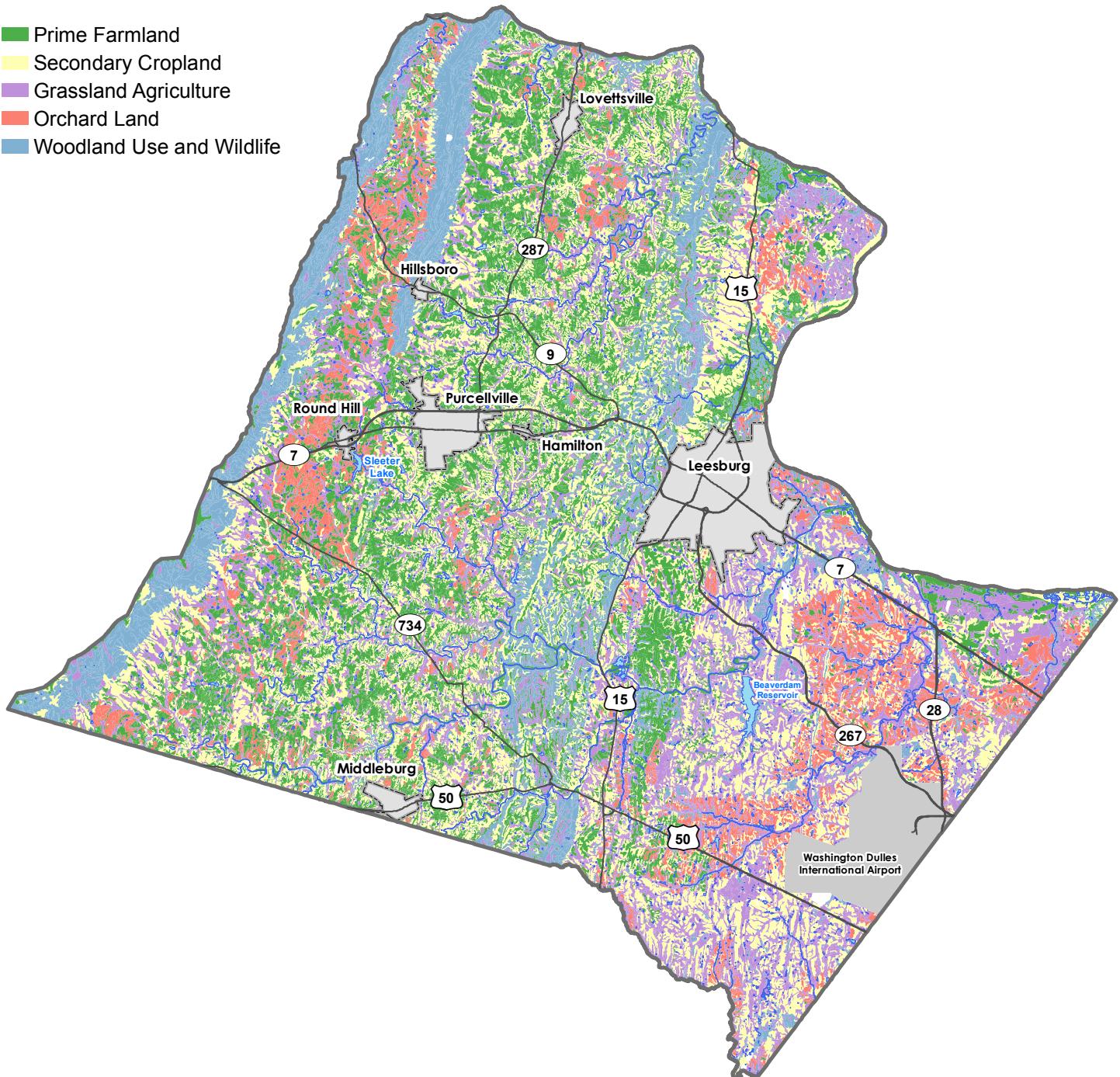
0 0.5 1 2 3 4 Miles

Map Number 2018-204

CHAPTER 3-41



- █ Prime Farmland
- █ Secondary Cropland
- █ Grassland Agriculture
- █ Orchard Land
- █ Woodland Use and Wildlife



Loudoun County IS NOT LIABLE for any use or reliance upon this map or any information contained herein. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles

Map Number 2019-263

Chapter 4 - Housing

Table of Contents

Vision.....	2
Introduction.....	2
Trends and Influences	4
Housing Demand and Inventory	4
Housing Affordability	5
Importance to the Economy	7
Planned Residential Growth Approach.....	12
Housing Needs of a Diverse Community	13
Housing Cost Impacts of Current Fiscal Policy.....	15
Policies, Strategies, and Actions	15

This page left blank for printing purposes.

Chapter 4 - Housing

Vision

Provide housing options that can accommodate a variety of lifestyles, households, ages, cultures, market preferences, incomes, and needs.



Introduction

The County's primary housing objective is to ensure that an adequate supply of housing—varied in type and price and located near necessary services and amenities—is available for existing and future residents. The fundamental concept of a *continuum of housing*¹ refers to the variety of housing types, sizes, and prices (both for rental and homeownership) required to meet the County's current and anticipated needs, and the County seeks to align housing availability along this continuum. The *Loudoun County 2019 General Plan* (General Plan) provides a renewed opportunity for the County to adopt a housing policy direction that promotes an inclusive, diverse, and flexible community..

Figure 1 illustrates the continuum of housing needs as discussed in this chapter. The General Plan takes a multifaceted approach to increasing the availability of diverse housing stock in the County and aligning housing affordability with the continuum of housing need. The General Plan anticipates that increases in the provision of a variety of housing types, facilitated through regulation and planned land use, will help fulfill the demand for housing and may temper rising housing costs overall. A variety of existing and planned County initiatives and programs, used in conjunction with state, federal, and private sector resources, will increase housing options that address affordability.

¹ This chapter introduces several new concepts and terms to facilitate the discussion of Loudoun County's housing trends, needs, and objectives. These terms are italicized and defined for clarity and emphasis and are also included in the glossary of this document.

Figure 1. The Continuum of Housing

The Code of Virginia requires that each locality's comprehensive plan include "the designation of areas and implementation measures for the construction, rehabilitation, and maintenance of affordable housing, which meets the current and future needs of residents of all levels of income" while also considering the current and future needs of the region in which the locality is located (Code of Virginia, Section 15.2-2223). A sufficient supply of housing that is *affordable*—that is, requiring no more than 30 percent of household income—for all households at all income levels is vital to the economic health of the entire community. A continuum of housing choices is necessary to attract and retain employers and workers and to create a resilient, inclusive, and diverse community. The approach to housing in the General Plan recognizes that the amount, type, location, and cost of housing is a critical consideration in Loudoun County's long-range planning, with major implications for land use, economic development, community form , and resident economic stability.

This chapter aims to address the housing needs of Loudoun's current and future population. The Trends and Influences section describes Loudoun's evolving housing landscape, identifying the challenges and opportunities that will continue to affect the provision of a continuum of housing to a diverse population. The Policies, Strategies, and Actions in the Plan support the use of the County's land use authority to facilitate the fulfillment of *unmet housing needs*, which are defined as the lack of housing options for households earning up to 100 percent of the *Area Median Income* (AMI).² The General Plan further acknowledges that addressing the County's current and future housing challenges will require collaboration among government, private sector, and non-profit stakeholders. Significant changes to the County's land use and zoning regulations will be necessary to address the County's housing needs, with a particular focus on identifying appropriate areas for new residential growth, redevelopment, and increased residential densities. This chapter

² Area Median Income is defined as the middle income in a specific metropolitan area; half of households of a particular size have incomes higher and half have incomes lower. AMI is used to determine eligibility for housing programs.

affirms policies, actions, and programs that have proven successful while setting forth new and innovative strategies and a commitment to implement them.

Trends and Influences

Since the late 20th century, Loudoun County has experienced tremendous growth because of its convenient access to Washington, D.C., high quality of life, and scenic environment. This growth creates strong demand for housing. The County, through land use policy, has promoted this growth in the eastern portion of the County where the market forces for new development have been strongest, mainly due to the area's proximity to Washington, D.C., an expanding regional job market, and the availability of central water and sewer. The development has resulted in a shrinking supply of available land for additional residential growth in traditional suburban development patterns. However, there remains strong market demand for housing in Loudoun County, necessitating housing strategies that increase density, incentivize innovation in unit types, facilitate affordability by design and price, and reduce development costs.

Since 2000, Loudoun County has experienced significant and increasingly diverse population growth. Age demographics have shifted as well, with young families and workers and adults over the age of 55 comprising a greater share of the population in 2017 than 2000. These factors, among others, drive housing preferences in Loudoun County now and in the coming decades.

Over the planning horizon, the County has many challenges to overcome in order to meet its goal of providing a continuum of housing choices. During the development of the Comprehensive Plan, the public expressed broad concerns regarding rising housing costs and the availability of diverse housing products to meet the needs of the County's growing populace. As development pressure grows, the County's older housing stock, which often comprises smaller and lower priced units, is also vulnerable to redevelopment. The policies of this chapter are designed to influence development to better meet residents' needs across the continuum of housing.

Housing Demand and Inventory

The County has undertaken two studies in recent years to project the future market demand for new housing units. The 2017 *Housing Needs Assessment* produced by Lisa Sturtevant and Associates, LLC, in collaboration with the George Mason University Center for Regional Analysis, assessed the County's current and future housing needs based on economic and demographic forces (<https://www.loudoun.gov/documentcenter/view/127559>). In January 2018, Kimley-Horn completed a *Market Analysis* as part of the Envision Loudoun effort (<https://www.loudoun.gov/DocumentCenter/View/131399>). Both studies confirm that the demand for new residential development will remain high and highlighted the demand for a continuum of housing to meet the demand of a growing population. Despite adding over 204,100 people and 67,600 housing units between 2000 and 2015, the *Housing Needs Assessment* concluded that the housing units provided were not keeping pace with the evolving needs and demands of Loudoun's populace in terms of availability, type, and price.

The residential rental *vacancy rate*, or the proportion of rental units that are available for rent or otherwise unoccupied, is an indication of supply in the home rental market. According to the *Market Analysis*, a rental vacancy rate of seven percent indicates a healthy balance in which there

is an adequate supply of vacant units to provide renters with options while still meeting the cash flow needs of the community. Low vacancy rates in the rental market can be an indication that demand exceeds the supply of housing units. According to the *Housing Needs Assessment*, the County's rental vacancy rate has remained below five percent since 2009, despite adding rental units during that time. The 2013-2017 U.S. Census Bureau American Community Survey (ACS) estimates that vacancy rates in Loudoun County were 3.9 percent for rental units as compared to five percent for the Washington D.C., Metropolitan Area overall. These consistently low vacancy rates indicate a tight rental market with high demand for units, which can result in higher rental prices.

Months of supply, which measures how many months would be needed to sell all of the existing home sales inventory available at the current rate of demand, is an indication of supply for the home sales market. Months of supply is calculated by dividing current inventory by current sales. A six-month supply indicates a balanced market. A market with fewer than six months of supply favors sellers, and a market with more than six months of supply favors buyers. In December 2018, there were 2.1 months of supply available in Loudoun County, compared to 1.9 in December 2017. Similar to the rental market, this limited supply puts upward pressure on the cost of homes.

Housing Affordability

Increased housing costs have outpaced wage growth nationally and locally over the last several decades.³ According to the Department of Housing and Urban Development (HUD), from 2000 to 2017, the AMI for the Washington D.C., Metropolitan Area increased by more than 30 percent. In that same time period, median existing home prices in Loudoun County jumped 116 percent and median rental prices increased 75 percent. In 2000, a household in Loudoun County would have required approximately 90 percent AMI to afford a home at the mean sales price. By 2018, a household would have needed to earn 148 percent AMI to affordably purchase a home at the mean sales price. If this trend continues, more households, including households of higher incomes, will have difficulty finding housing that is affordable to them. As detailed in this section, a growing proportion of households is unable to afford the housing that is available and are pushed to either live outside of the County or spend a greater proportion of their income on housing costs in order to live in the County. This has created an *affordability gap*, which is defined as the difference between the cost of housing and the amount households can afford to pay (assumed to be 30 percent or less of household income).

As indicated in the following table, the mean sales price across all housing units is not affordable to a growing number of households, even those earning more than the Washington D.C. Metropolitan AMI, which was \$117,200 in 2018. This is especially true of new construction, which commands an average cost more than seven percent higher than existing homes. Among homes sold in 2018, only multifamily units had an average price affordable to households earning 100 percent of AMI. In 2018, the estimated *purchasing power* – calculated as household income

³ 2018 State of the Nation's Housing, Joint Center for Housing Studies; http://www.jchs.harvard.edu/state-nations-housing-2018?_ga=2.56029803.1550908217.1547834228-1182365031.1547834228

multiplied by three – was \$351,600 for a household earning 100 percent AMI, while the mean sales price was \$520,681.

Table 1. Mean Home Sales Prices and Affordability, 2018⁴

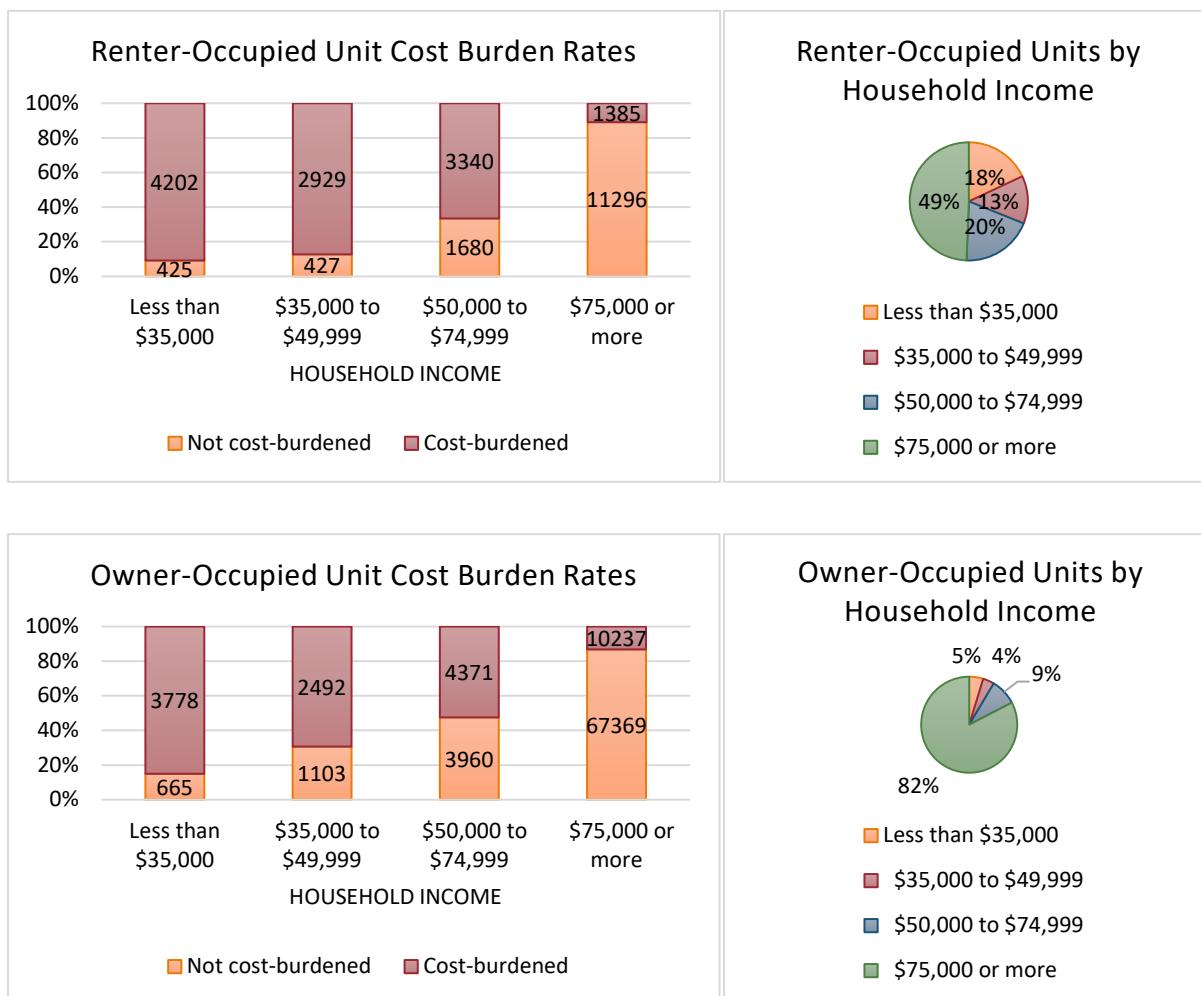
Unit Type	Mean Sales Price	% AMI Needed
All Types	\$520,681	148%
Single-Family Detached	\$647,364	184%
Single Family Attached	\$447,979	127%
Multi-Family	\$311,409	89%

The affordability gap is also apparent in rental housing costs: the unit sizes available for larger families require higher incomes and even the smallest rental units that would house a single person tend to be unaffordable. According to the Urban Institute's 2017 study of rental housing, Loudoun County has a deficit of approximately 2,500 rental units affordable to *extremely low income households (ELI)*, or those households with incomes at or below 30 percent of the AMI.⁵ Based on the data, 4,000 extremely low income households existed in the County, but only 1,550 units were available at rents those households could reasonably afford. For extremely low income residents unable to find housing they can afford in Loudoun, the options are to become *cost-burdened*, crowd several households into a single housing unit, or seek housing elsewhere.

The low supply of housing, both rental and for sale, across all price ranges contributes to the high cost of housing for the average County resident and is an ongoing issue in Loudoun, as indicated by persistently high numbers of *cost-burdened households*, or those that spend 30 percent or more of their income on their rent or mortgage. Households paying more than 50 percent of their income on housing are considered *severely cost-burdened*. Cost burden can occur at any income level along the housing continuum and affect both homeowners and renters. Cost burden calculations only include housing costs and do not consider other costs that a household must bear, such as the cost of transportation. The greater the percentage of income that households have to spend on housing, the less income that is available to spend on the other goods and services needed to live in the County. Residents that live outside the County as a result of their inability to find housing can strain County transportation systems and lose important social and employment connections. Renters who want to become homeowners in Loudoun County face similarly difficult choices. Figure 2 below, which was compiled using 2013-2017 ACS data, demonstrates that cost burden in the County varies by income level and between those who own and those who rent their homes.

⁴ Loudoun County Commissioner of the Revenue; Bright MLS

⁵ <https://apps.urban.org/features/rental-housing-crisis-map/detail.html?fips=51107>

Figure 2. Cost-Burdened Households by Income, 2013-2017⁶

Households with an income exceeding \$75,000—the highest household income category for ACS cost burden data—comprise approximately 75 percent of households and face cost burden rates of 13 percent among homeowners and 11 percent among renters. Cost burden increases precipitously among the remaining households with a median income below \$75,000. As an example, 85 percent of households earning less than \$35,000 are cost-burdened. Housing costs are especially burdensome for renters earning less than \$35,000 a year. This data highlights that households at all income levels face housing affordability challenges in the County, and this challenge is especially significant for households of lower incomes. The *Housing Needs Assessment* identifies demographic groups that face cost burden at a higher rate than County households overall to include young adults (age 25 or below) and older adults (age 62 and older) living alone.

Importance to the Economy

As discussed in Chapter 5: Economic Development, the County works to attract, grow, and retain targeted businesses of all sizes. Housing variety, availability, and affordability are among the

⁶ U.S. Census Bureau, American Community Survey 5-Year Estimates 2013-2017

factors that corporations, companies, and organizations use to determine where to locate. Housing availability, and affordability in particular, factor into companies' ability to attract and retain employees; companies are less likely to locate in a community where finding housing is a barrier for their employees and weakens the ability of employers to attract workers. Conversely, when the workforce is unable to find affordable housing or continue to afford the housing they have, they will explore other options, sometimes driving them away from the community. This causes workforce instability and adversely affects Loudoun's economic development prospects.

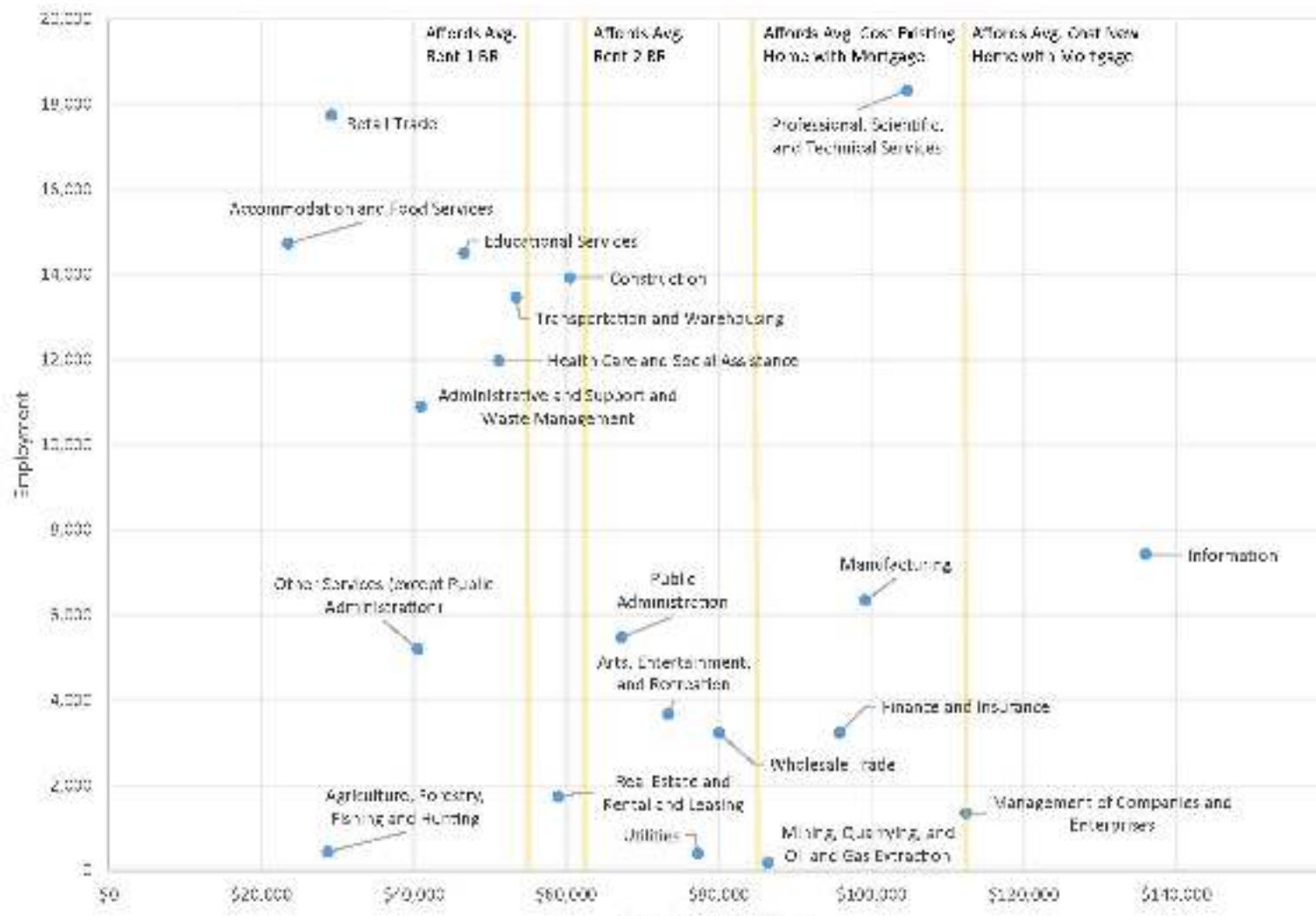
As shown in Table 2, households earning less than 100 percent AMI comprise significant segments of the County's workforce, including retail and service workers, skilled tradespersons, and various professional workers. According to the Department of Economic Development, in 2016 over 48 percent of Loudoun's workforce had occupations that earned less than 40 percent AMI. Additionally, approximately 55 percent of the workforce earned less than 65 percent of AMI.

As demonstrated in Figure 3, a Department of Economic Development analysis found that employees working in industries supplying the most jobs in the County—including Retail, Accommodation and Food Services, and Educational Services—do not earn enough to afford the average rent for a one-bedroom apartment in the County. Employees in higher wage sectors face housing affordability challenges as well. For example, newly constructed homes in the County are, on average, not affordable to employees in the Professional, Scientific, and Technical Services sector, which provides more jobs than any other sector in the county. This illustrates the challenge facing employers and their employees regarding the availability of jobs in close proximity to housing that is affordable at current wages.

Table 2. Incomes and occupations in the Greater Washington D.C. Metro Region⁷

Income Group (FY2018)	What type of household is this?
0-30 percent AMI Extremely low-income (ELI) \$0-\$35,150 family of four \$0-\$24,650 single person	People who are unable to work due to disability or age; Seniors on fixed incomes; or Low-wage workers, including many retail, restaurant, and day care workers.
30-50 percent AMI Very low-income (VLI) \$35,150-\$58,600 family of four \$24,650-\$41,050 single person	One person working as an administrative assistant, electrician or teacher's assistant; or Two workers in the retail, restaurant, or child care sectors.
50-80 percent AMI Low-income (LI) \$58,600-\$77,450 family of four \$41,050-\$54,250 single person	One or two workers in entry-level jobs including research associates, program managers, nursing aides, or nurses (LPNs).
80-100 percent AMI Moderate income (MI) \$77,450-\$117,200 family of four \$54,250-\$82,188 single person	One or two workers in entry-level or mid-level jobs, including police officers, fire fighters, school teachers, and IT support personnel
100-120 percent AMI \$117,200 - \$140,640 family of four \$82,188 - \$98,626 single person	One or two workers in mid-level jobs, including accountants, loan officers, and machinists

⁷ Table taken from *A Guidebook for Increasing Housing Affordability in the Greater Washington Region* – updated figures with HUD 2018 Income Limits.

Figure 3. Housing Costs and Employment/Annual Wages in Loudoun County by Industry

Created October 2017
Loudoun County Department of Economic Development

Affordability challenges can drive employees to seek housing in other jurisdictions and require that they commute into the County for work. As of 2016, approximately 56 percent of Loudoun's workforce resided in the County, while the remaining 44 percent commuted into the County daily. According to the *Housing Needs Assessment*, 61,600 workers commuted each day into Loudoun from 2009 to 2013. Ten percent had commutes that were 90 minutes or longer, compared to 5.5 percent for the Washington D.C. Metropolitan Area. Of these in-commuters, many worked in relatively low-wage industries such as Construction, Transportation and Utilities, and Leisure and Hospitality.⁸ According to the *Housing Needs Assessment*, only 30 percent of Construction jobs located in Loudoun County are held by County residents, and only one-third of Transportation and Utilities jobs are held by County residents. Workers in the Leisure and Hospitality sector were the least likely to commute from outside the County and almost 75 percent of these jobs are held by County residents. Leisure and Hospitality jobs are the second lowest average wage occupation in the County. Lower-wage employment sectors are growing, so the rate of in-commuting will increase if Loudoun does not have a continuum of housing to accommodate the workforce. As more workers find housing in more distant areas, congestion on roadways into and through the County will continue to increase.

The availability of a continuum of housing may also affect the economic viability of Loudoun's Metrorail stations areas. For the Silver Line Metrorail expansion to gain sufficient ridership, neighborhoods within close proximity to the Metrorail stations need a mix of housing types and prices to ensure greater housing affordability and provide access to a greater diversity of households. The availability of housing with access to transit can also increase employers' ability to attract and retain employees.

In addition to employees of local businesses, teachers, nurses, police officers, firefighters, and others who provide critical services in the community require housing. As shown in Table 3 such occupations are typically *moderate income*, or earning between 80 and 100 percent AMI. For many of these professions living close to work is important because of the need to respond quickly to emergencies or work long shifts. However, incomes in these professions do not align with the housing available in Loudoun County, creating quality of life concerns both for public servants and the communities they serve. Households above 100 percent AMI also struggle with housing affordability in the County; Table 3 shows that typical rents in the County do not align with what families can afford. Additionally, homeownership costs are not affordable to most households; even households earning up to 120 percent AMI face limited choices.

⁸ 2017 Housing Needs Assessment.

Table 3. Housing Affordability by AMI in the Greater Washington D.C. Metro Region⁹

Income Group (FY2018)	How much can they afford to spend on housing each month?
0-30 percent AMI	\$0-\$881 family of four \$0-\$617 single person
30-50 percent AMI	\$881-\$1,466 family of four \$617-\$1,027 single person
50-80 percent AMI	\$1,466-\$2,345 family of four \$1,027-\$1,644 single person
80-100 percent AMI	\$2,345-\$2,932 family of four \$1,644-\$2,055 single person
100-120 percent AMI	\$2,932 – 3,907 family of four \$2,055 - \$2,740 single person

Planned Residential Growth Approach

Between 2000 and 2016, Loudoun County's population and number of housing units more than doubled. Residences built during this time are primarily located along the western and southernmost portions of the Suburban Policy Area (SPA) and in parts of the Transition Policy Area (TPA), with other concentrations of new homes built within the Towns and in their JLMA. The vast majority of the land planned for residential uses in the SPA is either developed or approved for development. In response to these constraints, the General Plan seeks to provide new housing units through a combination of increased residential densities in the Urban Policy Areas (UPA) and SPA and targeted opportunities for clustered compact neighborhoods in the TPA.

As described in Chapter 2, the General Plan anticipates the majority of residential growth to occur in the UPAs, with limited higher density growth in the limited greenfield and redevelopment areas of the SPA and targeted areas of the Transition Policy Area (TPA). Throughout these areas, the General Plan emphasizes opportunities to create places that will meet the needs of the diversifying community, including housing affordability. The UPAs create opportunities for new housing types to locate in close proximity to planned Silver Line Metrorail stations, and anticipated employment centers, services, retail, and entertainment. A mix of compact single-family detached and single-family attached housing products in the SPA and limited areas of the TPA are envisioned to help address the unfulfilled demand for these housing types in the County.

Maturing neighborhoods, primarily concentrated in the SPA, may also provide limited opportunities for redevelopment or infill communities that better meets the housing affordability needs of the County's future residents. These opportunities are described in greater detail in the Infill and Redevelopment section of Chapter 2. As the County adopts policies and regulations that help guide such developments, it is important that such policies promote housing affordability and prevent removal of existing affordable housing.

⁹ Table taken from A Guidebook for Increasing Housing Affordability in the Greater Washington Region – updated figures with HUD 2018 Income Limits.

Housing Needs of a Diverse Community

Demand is growing for diverse housing types to address the needs of the County's future residents. As discussed in the Urban Land Institute's survey of American housing preferences *America in 2015*, *Millennials* have demonstrated a greater preference for walkable communities with convenient access to outdoor spaces and amenities that allow them to rely less on cars. The aging Baby Boomer generation (born between 1946 and 1964) creates a need to provide a range of senior housing opportunities. Multigenerational family living arrangements have risen considerably over the past several decades. As of 2016, approximately 20 percent of Americans lived in multigenerational households, up from a low of approximately 12 percent in 1980.¹⁰ In Loudoun County, at least 4.3 percent of households include three generations, and 11 percent of adults over the age of 18 are living with their parents.¹¹ The *Housing Needs Assessment* summarized these evolving housing market trends for Loudoun County through 2040, noting increasing demand for:

- Low-cost, small unit rental housing for entry level workers below the age of 35;
- Small, modestly-priced housing for young families;
- Accessible housing and communities for older adults and persons with disabilities;
- Multigenerational housing design;
- Housing options affordable to extremely low-income, very low-income, low-income and moderate-income households; and
- Single family housing for high-income earners.

Universal Design

Housing and community design is constantly evolving to meet the needs of populations with diverse abilities. Some past attempts to increase accessibility in the built environment have focused on conspicuous retrofits or the provision of "separate but equal" facilities for persons with disabilities or other access limitations. Increasingly, planners, designers, and advocates are emphasizing the importance of creating environments that are designed to meet the needs of all people as a basic principle of good design — a concept known as *universal design*. Universal design requires construction that is useable by all people without the need for adaptation or specialized design. In addition, universal design features increase safety and ergonomic use by residents.

Universal design is a particularly important consideration in the development of new housing. The provision of universally functional homes helps create more inclusive communities, supporting populations diverse in age and ability to live and interact in the same community. The Policies, Strategies, and Actions described in this chapter, as well as those in Chapter 2, promote the

¹⁰ <http://www.pewresearch.org/fact-tank/2018/04/05/a-record-64-million-americans-live-in-multigenerational-households/>

¹¹ 2013-2017 American Community Survey data.

provision of housing units that reflect these principles as an important step toward achieving the broad housing continuum needed to serve the entire community.

The Missing Middle

Suburban and urban localities are exploring new ways to meet the demand for diverse housing types close to services and amenities while maintaining the scale and community character of existing neighborhoods. One approach encourages the development of *missing middle* housing, which uses a mix of small-scale single-family units, accessory dwelling units, and multi-family units to create the perception of lower density. This approach is intended to help address the continuum of housing needs by providing housing choices and prices that fit in between large-lot, single-family detached units and high-rise apartment buildings, while fostering the neighborhood scale that many residents seek.

Missing middle housing is generally discussed in terms of design; specifically, it focuses on the form, scale, size, and massing of units, their relationship to the street, and the design of streets themselves. The General Plan envisions creative residential and mixed-use development proposals in appropriate areas of the County that will achieve the continuum of housing types and prices through the provision of missing middle housing products. Several place types envisioned in the UPAs, SPA, and TPA are intended to accommodate missing middle housing products, including Urban Transit Center, Suburban Compact Neighborhood, Suburban Mixed Use, Transition Compact Neighborhood, and Transition Commercial Center. Neighborhood place types provide opportunities for smaller housing types that would blend with the existing neighborhood scale of these areas. In mixed-use place types, missing middle housing can be used to create transitions between higher density nodes and adjacent residential neighborhoods. These elements are described in greater detail by place type in Chapter 2 of the General Plan.

The General Plan includes flexible land use policies and encourages streamlined regulations that facilitate the development of missing middle units, taking a form-based rather than a use-based approach to land development regulations. Regulations focusing on floor area ratio (FAR), lot size, and building and unit size rather than overall density will help accommodate a greater diversity of housing types that may yield affordable prices while ensuring compatibility with the scale and character of existing suburban and urban neighborhoods.

Figure 4. The Missing Middle Housing Spectrum



Courtesy of Opticos Design, Inc.

Housing Cost Impacts of Current Fiscal Policy

Development of new housing attracts new residents, and with new residents comes increased demand for public services such as law enforcement, fire protection, emergency medical services, and education. To implement these services, the County has developed Capital Intensity Factors (CIF) to estimate the anticipated per unit costs of new residential development to construct needed capital facilities (<https://www.loudoun.gov/cif>).

Where allowed by the Code of Virginia, the County works with the developers of residential projects to mitigate the capital facility impacts of their projects. This is typically done with contributions to capital facilities formalized in proffer statements. Since market conditions dictate the sales price of housing units, a developer adds the cost of the capital facility contribution in each unit's sales price, which increases the cost of housing. For *Affordable Dwelling Units* (ADU) provided pursuant to Article 7 of the Zoning Ordinance, which are restricted for occupancy by households whose income falls within 30 to 70 percent AMI, the County absorbs the capital facility impacts generated by that housing by crediting the developer the costs for each ADU's impacts.

Since the County's CIF has been based on unit type, rather than unit size, and developers intend to maximize profit margins, an incentive to develop smaller or modest sized housing has typically not been present. Instead, this has led to the construction of larger, higher cost residential housing units that are affordable to households with incomes greater than 100 percent of AMI. As reflected in the policies of this chapter, identifying these influences provides the County an opportunity to address the issues that impede or hinder market provision of smaller, more modestly sized houses that may be more affordable.

Policies, Strategies, and Actions

Loudoun County must take a collaborative approach to providing a full continuum of housing solutions to support the community. This approach will require collaboration and partnership within the government and with the private sector and the community. This approach affirms policies, actions, and programs that are successful and sets forth new and innovative strategies and a commitment to implement them.

Unless otherwise specified, the following policies, strategies, and actions apply Countywide.

Housing Policy I: Increase the amount and diversity of housing that is available in terms of unit type, size, and price and promote innovative designs throughout Loudoun County that are desirable and attainable to all income levels.

Strategy

1.1 Use innovative and flexible regulatory approaches to help fulfill the continuum of housing needs in a variety of locations and settings throughout the County.

Actions

A. Promote mixed-income housing developments that provide a continuum of housing types and prices.

- B. Amend zoning regulations to accommodate more innovative and flexible density, building height, lot size, lot line, parking, setback, and design standards through the implementation of a planned unit development (PUD) ordinance.
- C. Regulate multi-family development by floor area ratio (FAR) instead of by dwelling units per acre.
- D. Develop zoning regulations and design standards that facilitate innovative, lower cost, compact residential and mixed-use development that emphasizes the physical form and the character of the built environment and seamlessly integrates uses.
- E. Amend zoning regulations and design standards to permit accessory housing product types (e.g., carriage houses, accessory apartments, and cottages) in residential and mixed use zoning districts and incentivize the integration of universal design features in accessory units.
- F. Amend zoning regulations to expand the number of districts where manufactured housing, accessory units, and alternative housing types are allowed (e.g., small lot, zero lot-line, micro-units, maximum unit sizes, and innovative housing types).
- G. Develop regulations and standards by which affordable housing development can be approved as a by-right use.

Strategy

- 1.2 Promote dense housing products that are affordable by design and price, especially in urban settings close to transportation alternatives.

Actions

- A. Amend zoning regulations and design standards to incorporate density bonuses and other incentives into appropriate zoning districts to encourage the provision of housing to address the County's unmet housing needs in areas currently served by or planned for mass transit.
- B. Require fewer parking spaces in new developments located proximate to public transit that achieve a continuum of housing types and prices.

Strategy

- 1.3 Reevaluate Capital Facility Impacts to acknowledge the varied impacts of a broader diversity of unit types, sizes, and households.

Actions

- A. Identify alternatives in calculating the costs of development for the impact on capital facilities (such as a rating system) to reduce costs and to encourage diversity in unit types produced. Explore the use of square footage and/or number of bedrooms to assess capital facility costs associated with a broad range of unit types to encourage the development of needed unit types (for example, studio and one bedroom apartments, smaller homes).

Strategy

- 1.4 Ensure that housing for special needs populations is integrated within existing and planned communities.

Action

- A. Amend zoning regulations and design standards to incentivize the integration of universal design elements in residential units and in the design of neighborhoods.

Strategy

- 1.5. Provide for diverse housing options and prices with access to a range of amenities, services, and transportation options for older adults (55+).

Actions

- A. Encourage the provision of a diversity of housing types and prices within active adult and/or age restricted housing development projects.
- B. Incentivize the provision of age-restricted housing units for residential or mixed-use development proposals in transit centers and other areas planned for an integrated mix of uses to support older adults' option to live in close proximity to transit, retail, service, and entertainment uses.
- C. Ensure the provision of the following amenities and services on-site or within a safe and convenient distance for all age-restricted residential projects:
- i. Community space including meeting rooms and recreational facilities;
 - ii. Retail uses in direct support of the development;
 - iii. Health or fitness center;
 - iv. Healthcare services;
 - v. Active recreation space; and
 - vi. Resident programming and services.
- D. Provide access to amenities and services through alternate modes of transportation such as walkability and pedestrian access, bicycle facilities, and public and/or private mass transit facilities such as mini-bus or shuttle services.
- E. Integrate transit facilities into all senior housing developments such as shuttle or mini-bus service and/or direct local and regional transit service to ensure access to local and regional amenities and services.
- F. Incorporate covered bus shelters with seating or a covered space for seniors to congregate near building entrances into all senior housing developments.
- G. Incorporate universal design features into all age-restricted residential developments, in keeping with Quality Development Policy 8 and all subordinate strategies and actions (see Chapter 2).

Strategy

- 1.6. Support mixed-use development projects that provide a continuum of housing types, sizes, and prices as well as commercial uses such as retail, entertainment, and offices in a walkable environment.

Actions

- A. Provide incentives to encourage zoning map amendments or zoning concept plan amendments on previously entitled properties that increase the provision of a mix of smaller housing types and affordably priced housing.
- B. Research and implement effective incentives, such as appropriate density increases for the provision of housing focused on the County's unmet housing need proximate to major employment centers and public transit such as Silver Line Metrorail stations, as well as the offset of capital facilities contributions to reduce housing development costs to foster a continuum of housing affordability for workers in Loudoun.

Strategy

- 1.7. Ensure that infill and redevelopment projects provide a continuum of housing types and prices in areas with existing infrastructure and services.

Actions

- A. Develop zoning regulations and design standards to implement form-based approaches for infill and redevelopment areas that facilitate the development of "missing middle" housing product types and affordable prices.

Housing Policy 2: Preserve existing affordable housing stock and ensure housing remains safe and habitable.

Strategy

- 2.1. Leverage public and private resources to maintain housing that helps address unmet housing needs in Loudoun County.

Actions

- A. Bring existing housing in need of indoor plumbing, operational septic and water systems, and major system repair (e.g., new roofs or heating and cooling systems) up to safe and livable conditions.

Strategy

- 2.2. Preserve housing affordable to households earning less than 100 percent AMI that is currently provided by the market, and integrate it into redevelopment projects.

Actions

- A. Create an inventory of housing stock using County assessment data that identifies the type of unit, its location within the County, and general characteristics of the units.

- B. When redevelopment projects are proposed for areas with existing housing affordable to households earning less than 100 percent AMI in otherwise good condition, incentivize the preservation and rehabilitation of that existing housing stock.
- C. Require that redevelopment projects removing existing affordably priced units as a last resort provide a one-for-one replacement of similarly priced housing units in order to ensure no net loss of affordably priced units.
- D. Explore local funding options and implement housing programs that preserve and improve existing affordably priced housing.

Housing Policy 3: Ensure County residents are able to access housing they can afford.

Strategy

- 3.1. Focus County funding, resources, and programs on the unmet housing needs of households earning up to 100 percent of the Washington Metropolitan Area Median Income (AMI).

Actions

- A. Develop an Unmet Housing Needs Strategic Plan, consistent with the adopted *Loudoun County 2019 Comprehensive Plan*, that specifically identifies strategies, actions, programs, and best practices to address the County's current and future unmet housing needs. Such plan should include, but is not limited to, down-payment assistance programs, utilization of housing trust funds, and home purchase programs, and should be developed prior to the approval of any zoning map amendments requesting higher densities planned in the Urban Policy Area outside the Metrorail Service Districts, Suburban Policy Area, and the Transition Policy Area. The plan would include estimates on unmet housing needs, establish development targets, and evaluate how housing programs address those needs every five years.
- B. Emulate, when appropriate, successful housing programs in other jurisdictions.
- C. Develop zoning regulations and design standards that remove barriers and incentivize the development of housing affordable to households at or below 100 percent AMI in all residential and mixed-use development.
- D. Reduce capital facilities proffer expectations as a means of incentivizing the provision of housing affordable to households earning less than 100 percent AMI in new transit-oriented development.
- E. Create an expedited permit process to fast-track applications for developers who commit to providing additional units affordable to households earning less than 100 percent AMI.
- F. Provide incentives such as those included in the Affordable Dwelling Unit regulations of the Zoning Ordinance to support Low Income Housing Tax Credit projects to

encourage zoning map amendments or zoning concept plan amendments for properties subject to previous legislative zoning approvals when they increase the provision of housing affordable to households earning less than 100 percent AMI.

- G. Strengthen Affordable Dwelling Unit regulations in the Loudoun County Zoning Ordinance and the County Codified Ordinances, to the greatest extent that the Code of Virginia allows, to increase the development of housing that helps address the County's unmet housing needs in all residential and mixed-use development.
- H. Require housing units that help address the County's unmet housing needs to be provided in residential developments that contain 24 or more dwelling units and are served by public sewer and water.
- I. Develop effective incentives that enable development to meet unmet housing needs to include housing for households with incomes at or below 30 percent AMI and 50 percent AMI, which is the area of greatest need.
- J. Address the housing needs of extremely low-income or vulnerable households including older adults on fixed incomes and persons with disabilities by exploring partnerships with healthcare providers, local nonprofits, and philanthropic organizations to develop targeted housing for this population.
- K. Preserve the County's investment in ADUs by proactively purchasing ADUs approaching the end of the 15-year covenant period during which ADUs must first be marketed to ADU-qualified purchasers, and extend this 15-year period.
- L. Maximize the County's investment in ADUs by extending the time period under the covenants during which ADUs must first be marketed to ADU-qualified purchasers and reevaluating the appropriate fee-in-lieu model when developers opt not to provide physical units.

Strategy

- 3.2. Increase the financial resources gained from federal, state, local, and private sources to address the unmet housing needs in the County.

Actions

- A. Identify and designate dedicated local funding sources to support the County's plan to provide a continuum of housing.
- B. Use the Economic Development Authority (EDA) to issue tax exempt bonds for qualified residential rental projects and to make grants or loans of its own funds (or funds received from another governmental entity) with respect to single or multifamily residential facilities, in order to promote high-quality and affordable housing in the County.
- C. Leverage strategic geographies with federal programs, such as opportunity zones and qualified census tracts, and proactively pursue grants and other funding from federal,

- state, and private foundation sources, such as HOME, Emergency Solutions Grants, and State and Federal Housing Trust funds.
- D. Use public and private partnerships, programs, tools, and incentives to address unmet housing needs and increase the County's capacity to compete for federal, state, and private sector assistance.
 - E. Use the EDA to assist with property acquisition, tax exempt bond financing, and leverage gap financing, and stimulate cooperative partnerships toward the preservation and production of housing to address unmet needs.
 - F. Work in partnership with nonprofit, public, and private entities that are committed to provide a wide range of housing opportunities by offering technical and financial assistance such as loans, gap financing, tax credits, and grants.

Strategy

- 3.3. Explore offering free or subsidized public land to developers seeking to address the unmet housing need in the County.

Actions

- A. Explore the development of a proactive "public land for public good" program that offers public property to reduce the cost of housing development by reducing or eliminating the land cost.
- B. Explore the establishment of a community land trust/land bank and assemble properties, including tax sale properties, for the construction of housing that addresses the County's unmet housing needs.
- C. Use public property to offset the land costs to nonprofit and for-profit housing developers seeking to build housing for persons with special needs and/or households earning less than 50 percent AMI.
- D. Promote collocating public facilities with affordable housing.

Strategy

- 3.4. Expand the County's existing home purchase programs.

Actions

- A. Expand and increase the funding for the Down Payment and Closing Cost Assistance and Public Employee Grant programs to help households earning up to 100% AMI purchase a home.
- B. Create and implement home buyer readiness financial literacy classes to help educate first-time home buyers.
- C. Promote and facilitate the First-time Home Buyers Savings Plan which enables the establishment of a savings plan for the purchase of a home and exempts the earnings on the savings (Code of Virginia Chapter 32, sections 55-555 through 55-559).

- D. Work with employers located in the County to develop workforce housing financial assistance programs such as direct loans, gap financing, revolving loans, credits, and grants.

Strategy

- 3.5. Promote cross-sector collaboration to help address the County's unmet housing needs.

Actions

- A. Facilitate collaboration among residential developers, affordable housing developers, lenders, the Virginia Housing Development Authority, economic development agencies, and transportation officials.
- B. Develop a housing ambassador program to Loudoun's incorporated towns to raise awareness and provide technical assistance to assist them in establishing and maintaining programs that address their unmet housing needs.
- C. Conduct regular focus groups with the building industry, the CEO Cabinet, and major employers.
- D. Convene an Annual Housing Summit to check in with stakeholders on issues and successes.
- E. Coordinate with the Virginia Regional Transit and other transit providers to ensure access to and from housing to jobs and services.
- F. Implement a robust community outreach plan to promote the importance of housing to Loudoun's quality of life and the economy.

This page left blank for printing purposes.

Chapter 5 - Economic Development

Table of Contents

Vision.....	2
Introduction.....	2
Background.....	3
Trends and Influences	5
Local Opportunities and Challenges.....	5
Workforce	6
Globalization.....	7
Digitization	7
Tourism.....	8
Demographics	8
Policies, Strategies, and Actions	9

This page left blank for printing purposes.

Chapter 5 - Economic Development

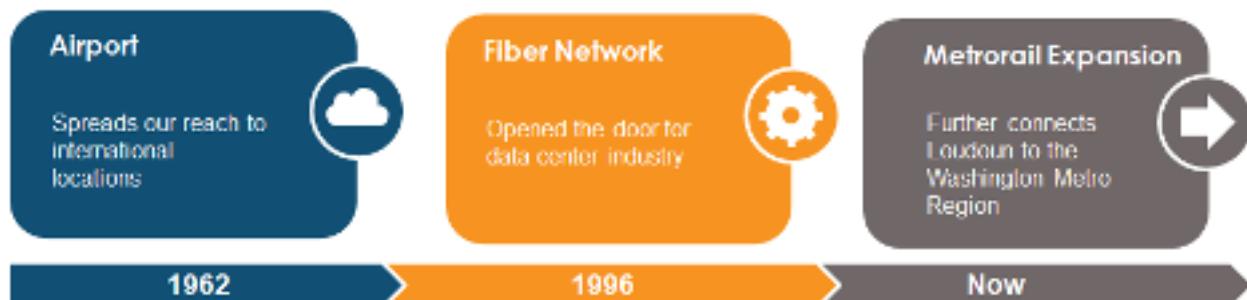
Vision

A diverse and globally competitive Loudoun economy.

Introduction

Loudoun County has emerged as a leading hub of economic activity in the Washington, D.C., Metropolitan Area. Two major economic drivers have helped Loudoun's economy grow exponentially – Washington Dulles International Airport and a world-class digital fiber network – and a third economic driver is on the horizon with the Metrorail extension to Ashburn.

Three Economic Growth Factors



Growth remains constant in technology sectors such as aerospace, cybersecurity, and data centers. The federal government continues to fuel employment for almost one-third of the County's rapidly expanding population. Loudoun continues to have a strong agriculture-based business sector, in large part due to the growth of value-added agricultural products. Start-ups and corporations that span all of these burgeoning industries are thriving due to Loudoun's location in the region, proximity to Washington Dulles International Airport, a highly-educated workforce, and business-friendly local regulations.

Loudoun's sustained economic growth generates significant local tax revenue from businesses that supports quality schools, parks, public facilities, infrastructure, and low residential tax rates. These assets help create a high quality of life for the County's residents, workers, and visitors. The list of accolades for Loudoun's economy is long, however there are eight "number ones" that set the County apart from the rest of the region, nation, and the world:

Eight Ways Loudoun County, Virginia is No. 1



Sources: U.S. Census, WTOP, MWCOG, SmartAsset, USDA, Loudoun County

The median household income in Loudoun is more than double the state average, and ranks number one nationally for jurisdictions with a population of 65,000 or greater. Part of that can be attributed to having one of the most educated workforces in the country (almost 60 percent have at least a bachelor's degree), as well as one of the lowest unemployment rates in the region.¹

Loudoun also leads the U.S. in investment for counties of its size.² Since the start of Fiscal Year 2014, Loudoun has announced more than 344 deals, representing approximately 13.5 billion dollars of commercial investment and 16,280 jobs created or retained.³

Much of this economic growth is fueled by the world's largest and fastest-growing data center hub, which is a strong revenue source for the County's General Fund; for every dollar in services Loudoun County provides for data centers, it receives back more than \$9.50 in tax revenue. Major industry leaders such as Amazon, Verizon Business, Google, Facebook, and Salesforce rely on the connectivity in Loudoun County.

In addition to the technology infrastructure, Loudoun has expanding economic roots in agricultural business, including almost 1,400 working farms. The quantity and quality of breweries, wineries, grapes, bees, and horses outpace all other jurisdictions in the state. This has helped Loudoun develop into a tourist destination, with an annual economic impact from domestic tourism of more than 1.7 billion dollars and approximately 17,000 tourism jobs.⁴

Background

In 2001, the Board of Supervisors adopted a guiding strategy for a sustainable economy in the County's *Revised General Plan*. This fundamental economic development strategy identified five goals for the Loudoun community: 1) foster a prosperous and diverse business environment, 2) create a globally recognized economy, 3) maintain sound fiscal health, 4) develop an innovative

¹ U.S. Census, 2012-2016 American Community Survey.

² International Economic Development Council, 2017.

³ Loudoun County Department of Economic Development, 2018.

⁴ Virginia Tourism Corporation, 2018.

rural economy, and 5) become a world-class visitor's destination. It also identified Loudoun's primary competitive advantages:

- Washington Dulles International Airport;
- Location in the Washington, D.C. Metropolitan Area;
- Qualified workforce skilled in advanced industries;
- Quality of life;
- Infrastructure that enables access to the region; and
- Greenfield land zoned for commercial development.

The County refines its economic strategy regularly with assistance from specialized research consultants.⁵ Continually refreshing economic development Policies, Strategies, and Actions is essential since economic climate, county assets and constraints, and projected trends for the future are dynamic.

Targeted Cluster Strategy

Since 2008, the Board of Supervisors has focused economic development efforts on targeted clusters and overlays of businesses that have the largest employment sectors, demonstrated past growth, or have potential for future gains based on innovations and trends in the market. This economic development approach is based on industries that are more concentrated in Loudoun relative to the state/nation, and industries that are adding firms because of Loudoun's strengths and opportunities. The County's targeted clusters and sub-clusters are:

- Cluster 1. Information & Communications Technology
 - a. Data Analytics and Technology Advancement
 - b. Cybersecurity
 - c. Data Centers
- Cluster 2. Highly Specialized Manufacturing
- Cluster 3. Agricultural Businesses

Overlays that are targeted for business intensification include: (1) major projects, headquarters, and associations; (2) small business and entrepreneurship; (3) international business attraction; (4) existing businesses (retention and expansion); and (5) Metrorail stations.

The Information and Communications Technology (IT) cluster continues to play a major role for Loudoun County in terms of employment, establishments, earnings, name recognition, and potential for future growth. The IT assets that Loudoun has cultivated over the last few decades, including infrastructure (e.g. data centers), workforce, and general economic environment, create a wealth of opportunities within the cluster for continued expansion.⁶

⁵ Camoin Associates, Atlas Integrated and ACDS are different economic consultants that have helped the County develop marketing, agricultural business, and cluster development strategies.

⁶ Camoin Associates, 2017.

The Highly Specialized Manufacturing cluster includes industries and companies that are producing goods that are high-value and specialized in nature and, therefore, typically need to be made in small batches and shipped to their supply chain or final destination quickly. This cluster continues to be an emerging opportunity based on the County's assets including Washington Dulles International Airport, existing manufacturing companies, a highly skilled labor force, and information technology strengths.⁷

The Agricultural Business cluster is made up of farms that provide value-add agricultural products⁸, traditional commodities, and agri-tourism. With direction and support of the Board of Supervisors, the County's Rural Economic Development Council (Council) developed a blueprint for strategies that support the agricultural economy. Along with multiple stakeholders, and with the assistance of the County's Department of Economic Development, the Council crafted the [*Rural Economy Business Development Strategy*](#) to guide marketing, research, and education; create financial tools to support agricultural entrepreneurs; provide resources; and inform public policy.

To strategically grow existing industry clusters or develop new ones, the County devotes resources (people and research) to becoming cluster experts that can anticipate the needs of businesses in a targeted cluster. This is achieved proactively through knowledge, relationships, and earned reputation. Cluster experts communicate the County's competitive advantages for a targeted industry, connect prospective businesses to other businesses or resources in their cluster, and seek solutions to any barriers to entry. The objective is to attract new businesses to the cluster so that the global competitive advantage of Loudoun is strengthened in the targeted industry.

Trends and Influences

Non-residential forecasts identify that short-term growth will be led by data center development. However, mid to long-term forecasts show data center construction slowing as land and resources become scarce. Diversifying the economic base, creating desirable places to attract new corporate headquarters, investing in the skill set of local workforce, marketing the County on a global scale, and promoting Loudoun as a tourism destination will help maintain a strong community for the next twenty years and beyond.

As part of the *Loudoun County 2019 General Plan* process, the County reevaluated its economic advantages, challenges, and opportunities based on existing local market conditions. Additionally, macro trends were analyzed that will impact economic development in the areas of workforce, globalization, digitization, tourism, and demographics.

Local Opportunities and Challenges

The IT cluster, which includes data centers, remains a strong local competitive advantage. Northern Virginia has an exceptionally high concentration of tech talent, as measured by the number of civilian employed persons in computer and mathematical occupations—more than

⁷ Camoin Associates, 2017.

⁸ Value-add implies that an agricultural business is taking a raw product and adding value in the manufacturing process to create a different product (e.g. craft beverages).

Seattle and comparable to that in the entire San Francisco/Silicon Valley area. Out of the cities and counties in Northern Virginia, Loudoun County has the highest concentration of people employed in computer and mathematical occupations.⁹ Other economic development advantages include: 1) Washington Dulles International Airport and future Metrorail stations; 2) business-friendly local regulations and services; 3) highly-educated workforce and top-notch schools; 4) farms and agri-tourism; 5) affluent and culturally diverse residents; and 6) exceptional quality of life.

Despite the high concentration of tech workers in the region, talent attraction is still one of the biggest challenges that existing and potential Loudoun businesses face. The emerging workforce desires walkable urban places with a mix of amenities and housing types. A recent survey by the County's Nighttime Economy Advisory Committee found that the younger workforce wants 1) special events; 2) arts, cultural, and entertainment districts; 3) attainable and desirable housing; 4) mixed-use and walkability; and 5) multimodal transportation alternatives.¹⁰ Lack of housing options and traffic congestion for commuting has also been cited by many business leaders as a challenge for employee recruitment.¹¹

Workforce

As of 2017, the number of Americans on unemployment rolls has dropped to a 17-year low, which indicates the labor market nationwide is tightening and companies are facing challenges recruiting skilled workers.¹² Some best management practices for economic development organizations to help address the expected talent shortage include: conducting a workforce sustainability study, collaborating with regional educational institutions, and developing industry-specific online portals for jobs.

The labor force participation rate in Loudoun is approximately 77 percent, which is higher than the national rate of 66 percent.¹³ Analysis of commuting pattern data illustrates just how interconnected the County's employment and labor force is with the larger region – with the region relying on Loudoun and Loudoun relying on the region for workers and places of employment. Data shows that over 86,000 people come into Loudoun County each day from surrounding areas, over 123,000 Loudoun residents travel out of the County to their jobs, and over 54,000 live and work in Loudoun. The most common home or work location, besides Loudoun County, is Fairfax County.¹⁴ As of 2016, 50 percent of the County's residents were working and living in Loudoun, which is a steady increase from approximately 41 percent in 2000.¹⁵

Self-employment in Loudoun accounts for approximately 7 percent of all employment; this is higher than within Maryland and Virginia (5.5 percent) and slightly higher than the rest of the nation (6 percent). Most of the self-employed individuals are government contractors and/or in the

⁹ U.S. Census, 2012-2016 American Community Survey.

¹⁰ Loudoun County Nighttime Economy Advisory Committee, 2016.

¹¹ Loudoun County Department of Economic Development, Business Community Interviews, 2017.

¹² U.S. Bureau of Labor Statistics, 2016.

¹³ U.S. Census, 2012-2016 American Community Survey.

¹⁴ Camoin Associates, 2017.

¹⁵ U.S. Census, 2012-2016 American Community Survey.

IT sector. Opportunities exist to encourage new start-ups and transition willing and interested companies from self-employment/sole-proprietorship to employing staff, which will support innovation, research and development, and job growth in the county.¹⁶

Loudoun County is home to seven institutions of higher education providing undergraduate, graduate, and continuing education opportunities. These include: George Washington Virginia Science & Technology Campus, George Mason Enterprise Center, Virginia Tech Equine Medical Center, Shenandoah University, Northern Virginia Community College, Strayer University, and Patrick Henry College. Local universities and colleges have partnered with local businesses and organizations to provide places for business ideas to incubate and grow, expand research and development opportunities, and provide targeted educational training opportunities. This continued collaboration strengthens the partnerships among government, business, universities, and public schools to ensure continued development of Loudoun's highly skilled workforce.

As part of an international strategy, attracting immigrants to the workforce helps ensure a steady flow of skilled and unskilled workers. Loudoun County is well on its way to diversifying its local employment base, as one out of every four residents are foreign-born.¹⁷

Globalization

The County's economic development strategies need to be prepared for the global economy. One in five American jobs are tied to international trade, and 95 percent of consumers – three-quarters of the world's purchasing power – is found outside United States borders.¹⁸ Locally, the percentage of Loudoun's gross domestic product devoted to exports (9.9 percent) is top five for the Greater Washington area. Loudoun is also top five in Greater Washington for numbers of jobs in foreign establishments.¹⁹

Best practices for increasing foreign direct investment, attracting international companies, and recruiting international workforce are straight-forward: devote full-time staff to international trade missions and developing leads and recruiting abroad. Furthermore, globalization is no longer confined to the coastal cities, so the future domestic workforce (students) should be prepared early by emphasizing foreign studies and learning different languages.

Digitization

Digitization of the local government development process has become standard for larger local jurisdictions, which helps businesses start and expand easier and faster. Electronic plan submittals, business license portals, and online permit or entitlement tracking increase accountability and provide more certainty for the business community.

The continual shift to digital information, communication, and transactions results in steady demand for data storage infrastructure and IT workers. Loudoun is thriving in both business areas as 30 percent of the world's physical data center buildings are in Loudoun County, and the

¹⁶ Ibid, 2017.

¹⁷ U.S. Census, 2012-2016 American Community Survey.

¹⁸ The Trade Partnership, 2015.

¹⁹ Brookings, 2014.

concentration of employees in IT as it relates to total County employment is stronger than the IT cluster in the states of Maryland and Virginia combined.

Tourism

Tourism and economic development are inextricably linked, as visitors to desirable destinations become repeat visitors, which can lead to relocation, entrance into the workforce, and potentially moving or starting a business. Loudoun County's tourism industry is thriving and ranks third in overall visitor spending in the Commonwealth with \$1.69 billion in 2016.²⁰ Loudoun is uniquely situated in the Washington, D.C., region due to its agricultural economy in the western half of the County that also supports regional tourism. Northern Virginia generates the most agri-tourism revenue of the 10 regions within the Commonwealth, contributing more than \$552 million to Virginia's \$2.2 billion agri-tourism industry. Loudoun County farm businesses make up 51 percent of Northern Virginia's agri-tourism venues.²¹

Best management practices for aligning economic and tourism development include using consistent "destination" branding across multiple lines of government, building recognition for year-round activities, and identifying the local community as a progressive tourism destination in marketing materials to business prospects.

Demographics

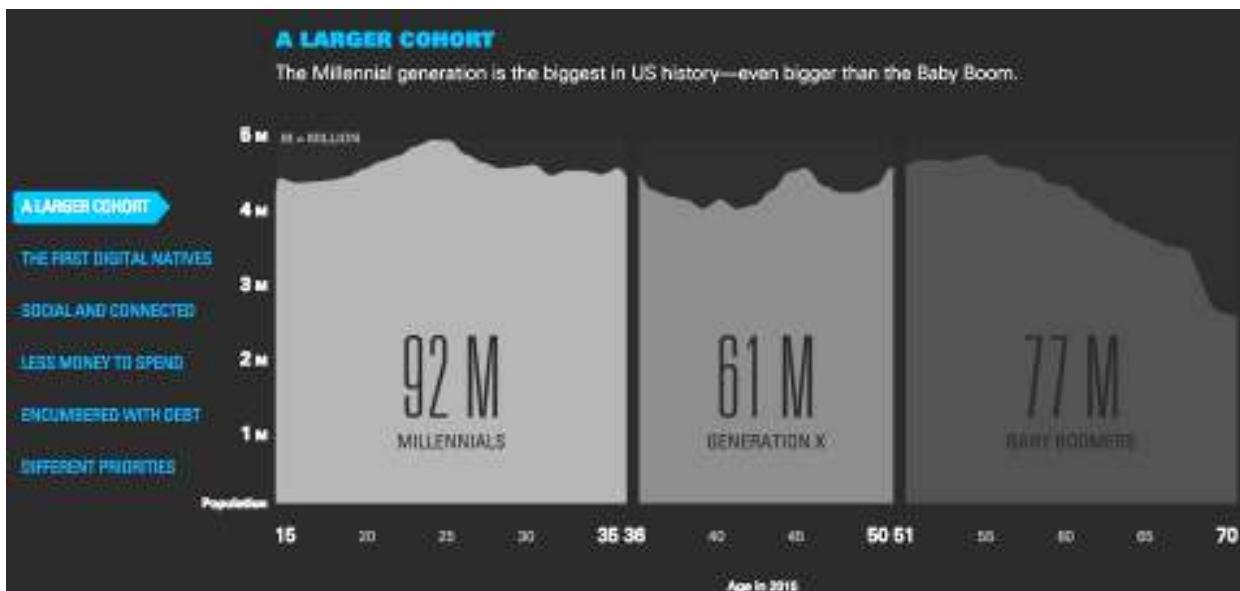
The generation still entering the workforce is the biggest cohort in United States history.²² The demographic shift brings changes in consumer spending, office amenities needed to attract workforce, housing preferences, and political ideologies. In general, the newest generation of workers are unique because of technological aptitude and reliance, propensity towards social tolerance, and high educational attainment.²³

²⁰U.S. Travel Association, 2016.

²¹ Virginia Tech, 2017.

²² Business Insider, 2015.

²³ Pew Research, 2015.

Figure 3. Population Comparison of Recent Generations

Most innovative companies looking to attract the next generation of workers are seeking “urban” places for their expansion or relocation efforts because they cluster offices, retail, entertainment, cultural attractions, services, and housing options in close proximity. The emerging workforce desires this amenity-rich environment and expects transportation options such as walking, biking, or transit for commuting or consuming daily goods and services. Transit-oriented developments in Northern Virginia have seen remarkable growth, and Loudoun County is poised to capture this trend with the opening of the new Metrorail stations.

The key demographics of Loudoun County, including the growing population, lower median age, high education levels, and high income levels present opportunities to support a variety of well-paying knowledge and skills-based industries in addition to creating the demand for high-quality place and related amenities. Being able to attract and retain employees in Loudoun County will ensure companies will continue to choose Loudoun for their business.

Policies, Strategies, and Actions

The following Policies, Strategies, and Actions help achieve the County’s economic development mission and vision, as well as the overall economic development priority set by the Board of Supervisors to grow the commercial tax base.

Across all departments and within each economic development policy emphasis is placed on providing a stable and predictable business environment through customer-focused solution-oriented public service. Unless otherwise specified, the Policies, Strategies, and Actions apply Countywide.

Policy 1: Diversify the economy by strengthening targeted industry clusters.

Strategies

- 1.1. Attract new businesses in key industries so that the global competitive advantage of Loudoun is strengthened in the targeted industry clusters.
- 1.2. Work with existing businesses proactively and retain businesses that may be considering leaving Loudoun by helping with relocation or expansion efforts.
- 1.3. Catalyze start-ups and entrepreneurial growth by providing quality resources.
- 1.4. Continue to sustain economic growth at and around the Washington Dulles International Airport and the Leesburg Executive Airport, including support of land use restrictions in noise-sensitive areas located within the Ldn 65 or higher noise contours.
- 1.5. Expand international relationships and attract foreign businesses within targeted clusters.

Actions

- A. Embed staffing resources in each cluster/overlay to attract or expand businesses using industry expertise, relationships, and earned reputation.
- B. Use marketing and research to create promotional materials, conduct market analysis, assist with site selection, and provide ombudsman services.
- C. Provide assistance with the regulatory process and streamline when possible using electronic plan submittals and online portals to get clients to market more quickly, provided all public safety, health, and welfare regulations are met.
- D. Create mechanisms for the rural economy to maintain its status as a regional agricultural leader and local advantage.
- E. Focus on providing resources, networking/education events, and other programs to startup companies that place a high value on growth, including assistance with establishing additional incubators, accelerators, co-working spaces, and makerspaces.
- F. Reserve adequate amounts of developable commercially-zoned land for growth of targeted industry clusters.
- G. Strategically use economic incentives as needed for attraction and retention.
- H. Ensure new development does not create flight obstructions, or otherwise impede flight operations at Washington Dulles International Airport and Leesburg Executive Airport, notwithstanding building and height standards recommended elsewhere in the Comprehensive Plan.
- I. Implement regulations to require a development that is subject to Federal Regulation 14 CFR Part 77 to provide the County with certification from the Federal Aviation Administration (FAA) that it will not constitute a hazard to air navigation, and to comply with any recommendation(s) found in an FAA decision that results in a no hazard determination.

Policy 2: Create desirable places in key corridors and employment centers.

Strategies

- 2.1. Ensure that the design and infrastructure of key economic corridors and employment centers creates desirable places for workers, businesses, residents, and visitors.
- 2.2. Support development projects near the Ashburn and Innovation Metrorail stations that provide a continuum of housing types, retail, entertainment, and employment options in a walkable environment.
- 2.3. Be flexible, customer-focused, and timely in review and approval of commercial or mixed-use projects to keep pace with business innovations and reduce time to market.
- 2.4. Encourage multimodal infrastructure design, especially within biking distance of Metrorail stations and near other employment and major hotel centers, which minimizes impact to development potential of land.
- 2.5. Support a diversity of available commercial products to improve attraction of a multifaceted business base.
- 2.6. Accommodate all types of critical infrastructure when planning and designing for transportation; complete streets, power, water, and fiber.

Actions

- A. Establish “Technology Zones” for the encouragement of new and expanding technology businesses through tax incentives and regulatory flexibility.²⁴
- B. Periodically update the County’s zoning regulations and design standards to keep pace with innovation in the marketplace.
- C. Extend support to the Towns to plan for enhancing the economic base.

Policy 3: Invest in the skilled workforce needed for continued economic growth.

Strategies

- 3.1. Support continual growth of the workforce through recruitment assistance, training, and placement programs.
- 3.2. Proactively attract workforce, develop existing pipeline, and explore ways to increase access to qualified job applicants in targeted clusters.
- 3.3. Cultivate partnerships with schools, colleges, and businesses to link all levels of education (including K-12) to targeted industry needs.
- 3.4. Develop housing programs to create a continuum of housing types that are attainable and desirable to all levels of the workforce.

²⁴ Code of Virginia § 58.1-3850. Creation of local technology zones.

Actions

- A. Collaborate with community and academic partners on connecting people to careers, expanding “learn by doing” programs, securing funding sources for training, and developing vocational training and industry certification and degree programs.
- B. Actively engage local businesses to determine workforce challenges and needed skills.
- C. Develop programs to incentivize construction of attainable workforce housing.
- D. Consider using the Economic Development Authority for property acquisition to bank land for public-private partnerships on workforce housing projects.

Policy 4: Market the County as a world-class business ecosystem.

Strategies

- 4.1. Market the County as a world-class place to do business using a variety of tools and communication platforms.
- 4.2. Promote gender and ethnic diversity of the local business community.
- 4.3. Market Washington Dulles International Airport as a destination portal to a diverse Loudoun economy.

Actions

- A. Tailor messaging to decision makers and influencers who play a role in starting, expanding, or relocating businesses (e.g., owners, executives, site selectors, or brokers).
- B. Post and respond on the County’s economic development website and social media channels in a timely fashion to maintain credibility.
- C. Maintain economic development brands for custom professional-grade collateral.

Policy 5: Support the promotion and development of Loudoun County as a tourism destination.

Strategies

- 5.1. Collaborate with Visit Loudoun to support the development and enhancement of tourism and hospitality infrastructure, including hotels, bed and breakfasts, event facilities, and cultural attractions.
- 5.2. Encourage and support tourism destination development and marketing.

Actions

- A. Establish “Tourism Zones” that would enable the County to provide tax incentives and regulatory assistance, and would provide a mechanism to assist developers of authorized tourism projects to obtain gap financing and make payments thereon.²⁵

²⁵Code of Virginia § 58.1-3851. Creation of local tourism zones.

- B. Refresh online content and optimize for search engines regularly, translate into multiple languages, and focus design to reflect Loudoun's unique personality and strengths.

Chapter 6 - Fiscal Management & Public Infrastructure

Table of Contents

Vision.....	2
Introduction.....	2
Public Facilities.....	3
Open Space Assets.....	6
Utilities & Infrastructure.....	9
Fiscal Management.....	11
Policies, Strategies, and Actions.....	14
Reference Maps.....	29

This page left blank for printing purposes.

Chapter 6 - Fiscal Management & Public Infrastructure

Vision

Provide high quality, efficient, and environmentally sensitive infrastructure systems supporting growth management goals and delivering innovative services to the community.

Introduction

Sustained growth since 2000 requires Loudoun County to meet a significant demand for new public facilities, such as parks and recreation, fire and rescue, and schools. While the County has maintained a reputation for quality facilities and services and sound fiscal management, funding and competing priorities have led to a shortfall or delay in certain public facilities. As the County has grown, the increasing scarcity of land and the diversity of facility and service needs has further affected the County's ability to meet demands. Service providers have employed various measures to adapt to these challenges. Schools are being designed to fit on smaller parcels. Libraries are sharing commercial space in Brambleton and Stone Ridge and Sheriff's Office substations co-locate with Fire and Rescue stations. The *Loudoun County 2019 Comprehensive Plan* (Comprehensive Plan) supports continued innovation, particularly in co-location and site design to not only add new facilities but to better adapt to changing community design, particularly in compact mixed use and transit-oriented developments.

Loudoun County maintains close connection between land use and fiscal planning. Managing utilities, principally sewer and water, has directly influenced where new development occurs. Consistent policies and close collaboration with Loudoun Water has allowed the County to maintain an urban growth boundary and to subsequently focus other investments in roads and public facilities in eastern Loudoun. Loudoun Water's strategy for a long-term water supply and its investment in high-quality water and sewer treatment has provided the County with a strong basis for growth decisions. The Comprehensive Plan does not address the fiscal management and operational priorities of entities that operate key utilities serving County residents but are independent of the County. Nonetheless, the cooperative relationship between the Board of Supervisors (Board), Loudoun Water, the Virginia Department of Health (VDH), the Virginia Department of Environmental Quality (DEQ) and other entities continues to ensure a close connection between infrastructure and land use planning.

The County's fiscal policy requires the Board to adopt a ten-year Capital Needs Assessment (CNA) every four years and adopt a six-year Capital Improvement Program (CIP) during the Board's budget deliberations. The annual CIP funding plan and budget then align annual capital expenditures with County fiscal policy. The County has relied on proffers to mitigate capital and transportation costs, consistent with the authority granted through state enabling statutes. That funding mechanism has proven less effective in recent years due to state-imposed constraints on use of proffers as well as a changing development environment. The Comprehensive Plan supports the continued use of proffers and proposes changing the calculation of capital facilities impacts to address transportation needs and expanding the proffer process to the Transition Policy Area. The

Plan also encourages the Board to seek legislation authorizing a reasonable impact fee program that would apply to all residential building permits throughout the County.

Loudoun County maintains a strong commitment to preserving open space and agricultural land and protecting natural, environmental, and heritage resources. Conservation easements in 2018 protect over 72,000 acres of land throughout the County. The County holds over 26,000 acres of these easements. Over the years, County policies have emphasized preserving open space in its natural setting, undisturbed, to protect the environmental value of the space. The Comprehensive Plan recognizes the community desire and economic value to expanding public access to and enjoyment of open space through trails and recreational uses. A key objective is to create a connected network of parks, trails, and natural areas, which can offer expanded environmental, design, and recreational benefits.

Public Facilities

The County's fiscal management strategy is designed to anticipate and accommodate the impacts of increased demand for public services and facilities. As discussed in the Fiscal Management section of this chapter, careful development forecasting—including its location, type, and timing—is essential to anticipating facility needs. The County projects the capital needs associated with development proposals to determine expected impacts on public facilities and to calculate anticipated contributions to mitigate a project's "fair share" of those impacts. Major components of the land use picture in Loudoun are public schools, parks and recreation, libraries, and emergency services. These important elements of the community fabric typically require land proximate to new development.

Loudoun County Public Library

Loudoun County Public Library (LCPL) is the information center of the community, providing free and equal access to innovative technologies and a full range of library resources to enhance the quality of life and meet the informational, educational, and cultural interests of the entire community. LCPL provides library materials, programs, technology, and services. It promotes the joy of reading and lifelong learning through early literacy programs, teen initiatives, humanities and arts events, technology training, and other educational opportunities.

LCPL currently has ten branches ranging in size from 4,000 square feet to 42,000 square feet. The Ashburn, Cascades, Lovettsville, Middleburg, Purcellville, and Rust branches are standalone facilities, while Gum Spring, Law Library, Brambleton, and Sterling share structures with businesses or other County facilities. LCPL Administration shares space in Leesburg with the Leesburg Senior Center.



Brambleton Library is a 40,000 square foot facility located in Brambleton Town Center. The state-of-the-art facility includes a "maker space" with 3D printer, laser cutters, recording studio, and other creative technologies.

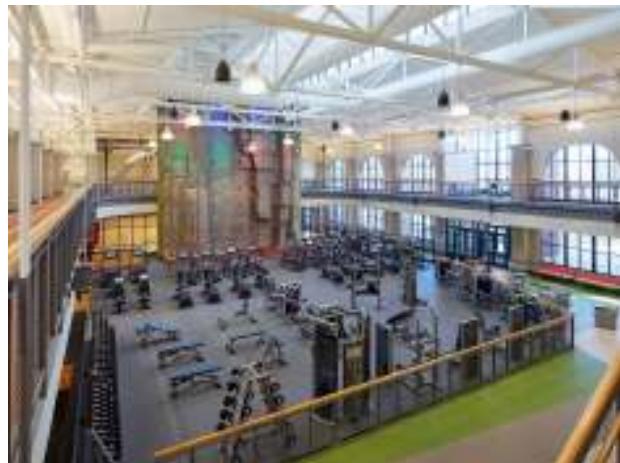
LCPL continues to evolve to meet the needs and expectations of the community. The Library is expanding language learning services to non-native speakers. It also offers more Science, Technology, Engineering, and Math (STEM) programs, which are complemented by “maker spaces” that include 3D printers, robotics, recording studios, design software, computer labs, and other equipment for creating and learning. High-speed wireless internet access is essential to customers and is available at every facility. In addition, demand for conference and study rooms continues to rise; thus large, multi-purpose rooms are an essential component for current and future branches. Also, as the number of residents without personal transportation increases, locations that offer ease of access through public transportation are increasingly important.

LCPL recognizes the need to locate in high community activity areas and adapt to the County’s changing development patterns. For example, in recent years LCPL has opened facilities in commercial space in Brambleton Town Center and in Stone Ridge. Libraries have also located with or near senior centers, parks, and schools. Library programming is similarly evolving to accommodate community activities and educational programs that meet new needs of area residents.

Department of Parks, Recreation, and Community Services

The Department of Parks, Recreation, and Community Services (PRCS) operates a system of County-owned or maintained facilities that includes over 1,700 acres of open space, more than 60 miles of trails, 200 athletic fields, 27 parks (including three regional parks), 18 playgrounds, 10 community centers, six sports complexes, two indoor and two outdoor swimming pools, four historic/heritage sites, three adult day centers, and three senior centers. PRCS also operates a senior activity center, a recreation center, a nature preserve, a nature center, a performing and visual arts center, an industrial catering kitchen, and administrative offices.

PRCS and Loudoun County Public Schools cooperatively offer activities at County school sites. Programs and services comprise childcare, preschool, after-school care, sports and recreation, community outreach, aging services, youth services, adaptive recreation, summer camp, health and fitness, planning and development, facility maintenance, customer service, and environmental stewardship. Offerings include sports activities for youth and adults, instructional and interpretive classes, programs for senior citizens, visual and performing arts, child care, preschool, after school activities, trips, camps, special events, volunteer opportunities, educational and prevention programs for youth, and programs for individuals with disabilities. In 2018, annual park visits for special events totaled 875,000. Over 55,000 children participated on sports teams and over 156,460 meals were served to senior residents.



Dulles South Recreation and Community Center features the latest fitness equipment, climbing wall, competition swimming pool, leisure pool with lazy river, vortex, 125-foot slide, hot tub, sports courts, and indoor jogging track. The Center also offers licensed preschool classes, full-day childcare, after-school programs, summer camps, trips, and other recreational opportunities.

PRCS faces significant challenges securing additional parks and trails to meet the service demands of the County's growing population. A lack of available land in eastern Loudoun, where the facilities are needed most, complicates the County's ability to provide the desired facilities. A decreasing supply of land also means rising land values, which affects contributions of land for parks facilities. Changing development patterns in eastern Loudoun, such as the urban development around the Metrorail stations and other high-density developments, will require new recreation concepts. Changing demographics will likewise necessitate new types of facilities. For example, the population of residents 55 years and older increased nearly 50 percent from 2010 to 2016, resulting in higher numbers of older adults seeking not only recreational programs, but also other support services. PRCS offers community outreach events and increasingly serves as a conduit for a variety of services to the senior population.

Loudoun County Public Schools

Loudoun County Public Schools (LCPS) is the third largest school division in the Commonwealth of Virginia. Each year, approximately 2,500 new students enroll and one-to-three new school facilities are opened to accommodate them. In 2018, LCPS served more than 83,000 students in 92 facilities including 15 high schools, 16 middle schools, 57 elementary schools, and four special purpose schools (Academy of Engineering and Technology, Academy of Science, C.S. Monroe Technology Center, and Douglass School).

The LCPS student Class of 2017 had an on-time graduation rate of 95.5 percent and earned more than \$54.7 million in scholarships. The



Loudoun County Public Schools employs 11,577 people, including 10,900 school-based staff and 710 non-school based and administration staff.

Virginia Department of Education reports that 100 percent of LCPS schools were fully accredited in 2017. The student body is ethnically and economically diverse, with 52 percent of the population reporting as African American, Asian, Hispanic, or multi-racial. Approximately 19 percent of the student population is identified as economically disadvantaged. This cultural and economic diversity raises the need for a variety of academic and extracurricular programs to assist students, particularly in elementary schools, which have the highest percentage of economically challenged students.

Increasing demand for services is placing significant pressure on the school system, which each year must hire hundreds of additional classroom teachers and staff, expand support systems, and open multiple new schools. Families continue to endure shifting school boundaries as new students are assimilated into the school system. Securing building sites for new schools that are cost-effective but that also reflect their important social and civic functions in terms of location and design is an ongoing challenge. Changing development patterns in eastern Loudoun further complicate these issues. In the past, the County has relied on the donation and timely delivery of proffered school sites from the development sector. However, the supply of sites has not kept up with demand or with the LCPS construction timetable.

Urban development around the Metrorail stations and other high-density developments will require innovative designs for new school facilities using less land and more vertical designs. Alternative school configurations that established urban communities have used successfully, such as shared space and public/private facilities, will become increasingly important.

As the population increases and continues to diversify, schools will likely continue to play a larger community role, such as accommodating a variety of non-school activities, sharing recreational facilities with the public, co-locating with compatible uses such as libraries, affordable housing and other services, and opening classrooms and space to other organizations.

Loudoun County Fire and Rescue

Loudoun County Fire and Rescue (LCFR) delivers essential emergency and non-emergency Fire and Emergency Medical Services (EMS) from 19 stations, responding to more than 29,000 incidents annually. LCFR, as part of the Loudoun County Combined Fire and Rescue System (LC-CFRS), provides administrative, operational, and logistical support to the County's 15 volunteer fire-rescue companies, the LC-CFRS Executive Committee, and its governance structure. Through the Oliver Robert Dubé Training Academy, LCFR coordinates the delivery of certification and continuing education programs for all LC-CFRS members. LCFR functions as the Public Safety Answering Point (PSAP) for the County's 9-1-1 system and operates the County's emergency communications system. The Fire Marshal's Office (FMO) has a multifaceted mission that includes fire prevention; fire lane plans review; life safety education; community risk reduction; investigation of fires, explosions, and hazardous materials releases; and an oversight of the bomb squad.



The Loudoun County Combined Fire and Rescue System represents a joint effort of volunteer and career personnel responding to emergency incidents 24 hours a day.

LCFR has been in a consistent state of transition as the County has grown, moving from an all-volunteer system to a combined system, serving an increasingly suburban environment, and responding to growing service demands. As areas of the County transition to a more urban development pattern, LCFR will continue to adapt to different demands and environments. Compact and higher density development and the introduction of Metrorail will affect emergency response times and equipment and training needs, and introduce other new challenges. In rural Loudoun, ongoing areas of attention will include updating existing stations and meeting service demands associated with growth in the rural economy.

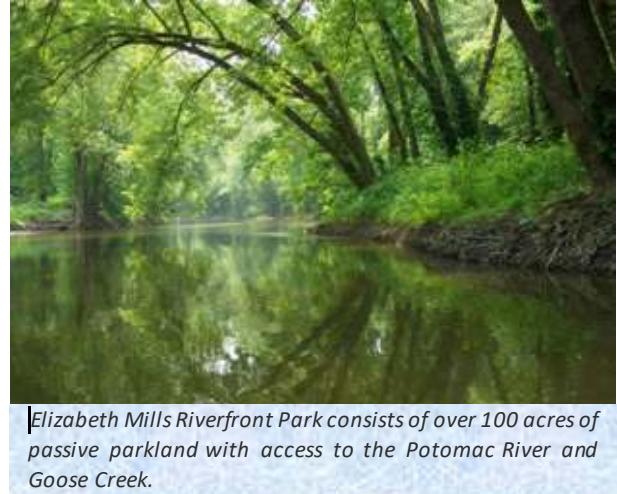
Open Space Assets

Open space assets as defined in this chapter include linear parks, trails, recreational areas, and passive open space. These assets make up much of the County's network of natural resources and

may be held in private or public ownership. The County, conservation partners, and individual property owners manage these elements through the regulation of protective buffers, performance standards, and stewardship of open space easements.

The open space assets addressed by this Chapter are aimed at enhancing and encouraging public interaction with the County's network of natural resources through:

- a. A network of linear parks and other recreational resources along or extending from the banks of the Goose Creek, Broad Run, Bull Run, Catoctin Creek, Potomac River, and other river and stream corridors to form an interconnected system of linear open space.
- b. Trails within and among communities that offer potential for walking and bicycling, and connecting neighborhoods to parks, schools, and other community destinations.
- c. Forested areas along public rights-of-way, within neighborhoods, and elsewhere to filter air pollutants, provide shade, screen uses, and define communities and places.
- d. A network of active and passive parks of various sizes and functions throughout each community to beautify neighborhoods and offer opportunities for recreation.



Elizabeth Mills Riverfront Park consists of over 100 acres of passive parkland with access to the Potomac River and Goose Creek.

NOVA Parks

NOVA Parks is a regional park authority that is steward to over 12,000 acres of parkland in Northern Virginia, with over 3,800 acres within Loudoun County making a significant contribution to recreation and open space in the County. NOVA Parks' 16 Loudoun offerings include a large portion of the W&OD Trail, a working farm, two golf courses, a group camping site, a water park, and several historic properties. Annually, millions enjoy a ride or walk along the 45-mile W&OD Trail, which is a recreation and transportation artery for visitors and commuters year round. Many thousands camp, hike, boat, golf, swim, or otherwise spend their time in a regional park. Many of NOVA Parks' lands were acquired with the idea to preserve shoreline properties. With over 30 miles of river frontage, many of NOVA Parks' land holdings are among the most environmentally important areas and, with 12 parks region-wide with water access, its parkland is a hub for boating in and around the area.

NOVA Parks is the only regional park authority in the commonwealth and excels at partnerships. Three Counties and three Cities support the regional park system: Loudoun, Arlington, and Fairfax Counties, and the Cities of Alexandria, Fairfax and Falls Church. NOVA Parks' foundation of conservation, enterprise, and regionalism has served the public since 1959. As a public sector government agency, only 13% of operating revenue comes from tax dollars; the rest is generated from enterprise operations. Its member jurisdictions contribute \$1.89 per capita for operating support.

NOVA Parks' contributions to parks, open spaces, and trails in Loudoun County include:

Aldie Mill Historic Park. Aldie Mill offers visitors and students a glimpse of life during a time when the Mill served as a vital center of the community. Aldie Mill emerged as the largest manufactory of its kind in Loudoun County and survives today as one of the best preserved historic mills in the Commonwealth.

Algonkian Regional Park. Loudoun County joined NOVA Parks in 1973, after NOVA Parks purchased 511 acres of land along the Potomac River that became Algonkian Regional Park.

Ball's Bluff Battlefield Regional Park. Preserves the site of the largest Civil War engagement in Loudoun County.

Battle of Upperville/Goose Creek Bridge Historic Park. In 2017, NOVA Parks acquired the Battle of Upperville/Goose Creek Bridge Historic Park, not far from Mt. Defiance.

Blue Ridge Regional Park. Located on the eastern slope of the Blue Ridge Mountains, this property offers an escape to the mountains for group camping.

Brambleton Regional Park and Beaverdam Reservoir Park. Loudoun Water has partnered with NOVA Parks to manage recreational activities and public access at Beaverdam Reservoir. When completed, the park will be among the largest NOVA Parks facilities offering rowing, a public boat launch, and an 8-mile hiking trail.

Gilbert's Corner Regional Park. Immediately adjacent to the Mt. Zion property is Gilbert's Corner Regional Park, which was the site of Civil War history.

Mt. Defiance Historic Park. Through a partnership with the Civil War Trust, NOVA Parks acquired Mt. Defiance Historic Park outside of Middleburg, a key point of the Battle of Middleburg.

Mt. Zion Historic Park. Mt. Zion Old School Baptist Church, built in 1851, sits at the intersection of the Old Carolina Road and the Little River Turnpike. The church was an eyewitness to much of the history of this area, in particular the Civil War.

Red Rock Wilderness Overlook Regional Park. This park is home to several historic buildings, native plants and wildlife, and scenic vistas of the Potomac River.

Rust Nature Sanctuary and Manor House. In 2013, NOVA Parks and the Audubon Naturalist Society entered into a partnership to manage Rust Sanctuary. The sanctuary has nature trails, event space, and education programs.

Seneca Regional Park. 104 acres of this park are located within the County at its border with Fairfax County. The park includes the remnants of George Washington's Potowmack Canal and is bisected by the Potomac National Heritage Trail.

Springdale. Located on the Potomac River, this 150-acre land holding with historic antebellum structures will become Springdale Regional Park as funding becomes available.

Utilities & Infrastructure

Sewer and Water (See also Chapter 2, Towns and JLMA)

On May 27, 1959, the Board took action to create the Loudoun County Sanitation Authority as a public body politic and corporate under the provisions of the Virginia Water and Waste Authorities Act. This body, now known as Loudoun Water, is chartered by the State Corporation Commission and is responsible for providing water and wastewater service to unincorporated areas of Loudoun County. As a political subdivision of the State, Loudoun Water is not a department of the County government and receives no tax money from the County. All Loudoun Water income is received from customers as payment for water and sewer service or as connection (tap) fees from land developers. Loudoun Water is governed by a Board of Directors consisting of nine members, each appointed by the County Board. Members of the Loudoun Water Board of Directors serve four-year terms and can be reappointed.

Loudoun Water owns and operates water and wastewater treatment facilities and systems and has purchased capacity for wholesale water supply from Fairfax Water and wastewater treatment from DC Water. These water and wastewater systems serve the eastern region of Loudoun County. The Potomac River is the primary source of water for Loudoun County and the greater Washington, D.C. Metropolitan Area. Loudoun Water further benefits from using the Goose Creek and Beaverdam Creek Reservoirs, and may use reservoirs created from retired rock quarries for storage in the future. With numerous water supply sources and local reservoirs, Loudoun Water has a resilient system to meet the demand for safe and healthy drinking water. To ensure the overall environmental quality of the water supply (watersheds and aquifers), Loudoun Water supports broad-based source water protection, management, and stewardship programs.



Loudoun Water's plans to ensure an adequate supply of quality drinking water for a growing population include utilizing retired rock quarries to store up to 8 billion gallons of water.

In the western region of the County, Loudoun Water currently owns and/or operates smaller water and wastewater treatment systems. Community water and wastewater systems are freestanding systems usually serving residential developments that were installed by developers and are now operated and managed by Loudoun Water. These systems are also funded in part by the County, which has an active program of rectifying public health issues in a number of historic villages. There are additional expenses and inefficiencies associated with building and operating such systems and historically the cost was borne by the relatively few system users. In April 2016, the Loudoun Water Board of Directors adopted a single rate for all customers; that is, those served by the central facilities as well standalone community systems, the costs of which are materially greater to install and operate. Land use policies going forward need to recognize the added cost burden that central system customers bear due to standalone community systems.

Incorporated towns in the County operate their own municipal water and sewer systems. Water is drawn from springs or wells and, in the case of Leesburg, also drawn from the Potomac River.

Leesburg, Hamilton, and Round Hill have extended utilities into the surrounding Joint Land Management Areas (JLMA). The Comprehensive Plan does not recommend extending municipal systems into adjacent rural areas except when necessary to resolve public health issues in existing communities.

Loudoun Water's Capital Improvement Plan (CIP) is a 10-year roadmap for creating, maintaining, and funding present and future infrastructure needs.¹ The Loudoun Water CIP is approved by the Loudoun Water Board of Directors. Capital water and wastewater improvements are complex and interrelated and often require a great deal of planning over many years to define their extent, location, and cost. The underlying strategy of the CIP is to plan for facilities necessary for the safe and efficient delivery of water, wastewater, and reclaimed water services in accordance with policies, goals, and objectives adopted by Loudoun Water. A critical element of a balanced Capital Improvement Plan is to preserve and enhance existing facilities as well as provide new assets to respond to growth of the community and changing service needs as outlined in the Comprehensive Plan and other Board policies.

Waste Management

The Loudoun County Department of General Services, Waste Management Division operates the Solid Waste Management Facility ("landfill") and provides recycling opportunities for residents and businesses. Landfill operations are fee-supported. The County also offers recycling drop-off centers, household hazardous waste collection events, collection of seven materials for recycling or diversion at the landfill, and educational programs. The County anticipates continuing operations at the Evergreen Mills Road landfill site and relying on continued recycling and commercial facilities to redirect a significant amount of waste material. International demand for recycled material is, however, a key factor in the success of recycling programs. Continued review and updating the County's Solid Waste Management Plan will provide the more detailed management and planning necessary to meet State requirements to anticipate future needs.

Energy and Communication

Electrical demand in the County has grown dramatically in recent years with the development of data centers in eastern Loudoun. Demand is expected to continue to grow with new data center construction, the operation of the Silver Line Metrorail, and other land development. Changes in data center technology have resulted in electrical demand increasing from 100 watts up to 300 watts per square foot. Demand for data center development within the County is anticipated to be strong for the foreseeable future.

Electrical and communication services are provided under the purview of state and federal agencies. This limits the County's ability to mitigate certain impacts. For example, the County regulates the location of electrical substations but not the high voltage distribution lines to and from the substations. Similarly, the County may review the location of cell towers and monopoles for impacts on surrounding properties, but cannot prescribe locations and, therefore, cannot require broadband or communication service in underserved areas. The County does, however, work with the providers to encourage improved service and locations.

¹ The Loudoun Water Capital Improvement Plan can be accessed at www.loudounwater.org.

Rather than a centralized, regional substation to serve the County's growing electrical demands, smaller substations have been constructed for individual providers. As demand for electrical power continues, consideration should be given to the appearance of substations and power lines and adequate screening of these facilities to reduce the visual impact upon the community.

Broadband internet service is an increasingly important asset to business in Loudoun as e-commerce grows throughout the nation. The lack of broadband service in western Loudoun is cited as a major constraint on the rural economy. It also puts western households and students in particular at a disadvantage. County efforts to extend broadband service have included regulatory changes to support new technologies. With limited control over market factors and federal regulation, the County will encourage landowners to put in place the conduits and other infrastructure to help minimize the cost of extending the service, and will explore other incentives to encourage network expansion.

Fiscal Management

Loudoun County uses an integrated approach to land use and fiscal planning. This approach uses economic and demographic forecasting models, as well as service and facility standards, to help determine current and future capital facilities needs in the County. The Board established Loudoun County's Fiscal Impact Committee (Committee) in 1992. This advisory committee reviews assumptions about future growth and capital facility needs. The Committee provides recommendations to the Board on four key documents that the County uses to coordinate land use and financial planning: 1) long-range forecasts and demographic, economic, and financial information included in the Fiscal Impact Committee Guidelines; 2) Capital Facility Standards (CFS); 3) CNA; and 4) Capital Intensity Factors (CIF).

The capital facility planning and budgeting processes are different, but completely interrelated. CFS, CNA, and CIF are the three main aspects of the capital facility planning process that shape the CIP budget. The capital planning processes are integral in the development of:

1. Capital-facility-related cash, land, and other in-kind proffer dedications to the County as a result of land use applications;
2. The development of the type, timing, and geographical placement of capital projects to be considered for funding in the CIP; and
3. The programmed use of proffers for capital facility development in the CIP.

Capital Needs Assessment

The CNA divides the County into ten planning subareas and uses the County's forecasted population growth and adopted CFS to identify the type and quantity of facilities needed in each subarea. The CNA time period extends for ten years beyond the most recent CIP period. Using the population standards set by the CFS and factoring in facilities that already exist or are funded in the CIP, the CNA determines which facilities are needed to meet the adopted CFS standards. The CNA is generally updated every two years.

The population within each subarea drives the demand for facilities. In this way the County can identify more accurately where the demand is greatest and plan accordingly. The subareas define broad communities such as Leesburg and its environs or the three western towns along Route 7.

The boundaries are based on Traffic Analysis Zones (similar to census tracts), which sometimes divide smaller communities. Furthermore, while the CNA is based on population, it does not account for the diversity of Loudoun's population and the associated variations in facility needs and community desires. For these reasons, the Planning Commission, during their review of the FY 2020-2030 CNA, recommended the Board investigate a more community-driven planning approach that could address demographic differences, development constraints, and community expectations.

Capital Facilities Standards

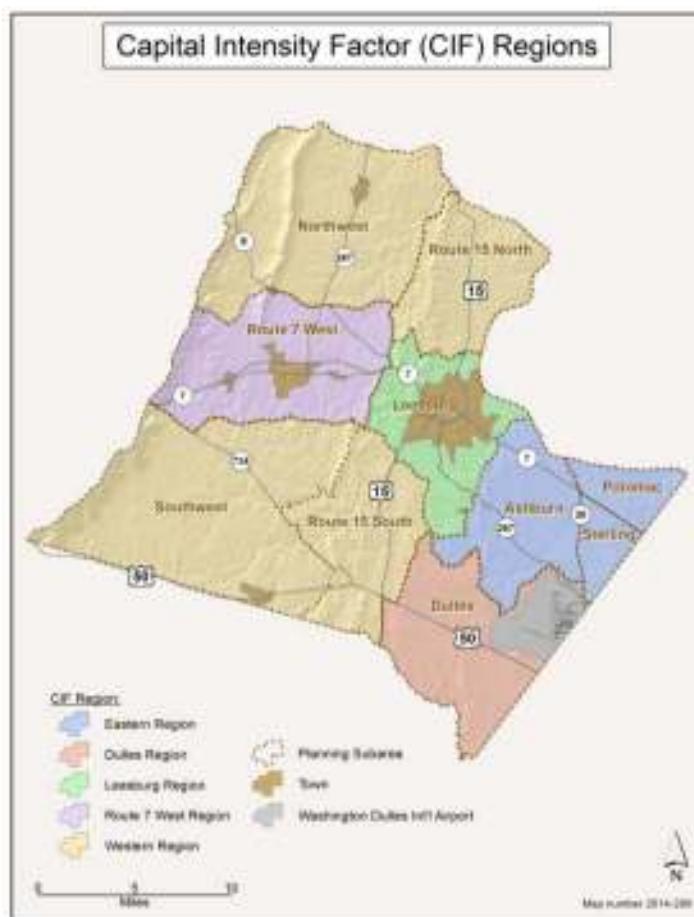
The CFS determines the general size and scope of facilities by establishing a maximum land use area (acreage) and construction footprint floor area. As design and engineering of a facility progresses, and specific sites are chosen, acreage and floor area may differ from the CFS standard. County departments provide information on what standards to use for each of their facilities. The CFS also establishes a population threshold ("trigger") for each type of facility. A fiscal analysis of the Comprehensive Plan estimated 4,171 acres will be needed by 2040 using the 2016 adopted Capital Facilities Standards.

Example: The CFS determines a need for one fire station for every 25,000 persons in the Ashburn planning subarea. The current population forecast for Ashburn is 83,000 persons in 2017 and is projected to increase to 125,000 persons by 2023. As of 2017, the current need for fire stations is 3.32 (83,000 divided by 25,000). There are currently three fire stations existing in Ashburn and another one funded in the CIP (for a total of 4.0). The total need for fire stations will increase to 5.0 (125,000) by 2023, therefore, the CNA would identify one additional fire station by 2023.

Capital Intensity Factor

The CIF translates the anticipated capital cost and land requirements derived from the CFS into a per-housing-unit cost. The calculation determines costs per capita and costs per student, which then helps estimate the cost associated with different housing unit types based on average household sizes. The resulting cost per housing unit is valuable during development review to estimate impacts of individual applications and to evaluate proffer packages proposed by a rezoning applicant.

1993 Choices and Changes General Plan standardized the County's use of a



CIF to calculate capital facilities proffers. The County, by policy, anticipated a landowner contribution of 25 percent of the anticipated capital impact of each residential unit over a base density of 1.6 units per acre. At that time, the CIF was a countywide number. The Comprehensive Plan carries forward the County proffer policy established in the *2001 Revised General Plan* (RGP), which called for landowners to mitigate 100 percent of the capital facilities impact for each unit above a base density established by existing zoning or one unit per acre, whichever is lower. The RGP also featured a separate CIF for each policy subarea. The refinement acknowledged notable differences in land costs and other differences associated with constructing facilities in each subarea. The Board has also incorporated a separate CIF for age-restricted housing and additional housing types. Recognizing a pressing need for certain transportation improvements, the County also allows landowners to redirect capital facilities contributions to transportation infrastructure in certain situations.

Capital Improvement Program

The six-year CIP refines the County's CNA-forecasted future capital facility growth, providing a six-year program of the County's general government and public schools' land, facility, and equipment needs, and a financing plan to implement each need. The CIP schedules land acquisition, design, construction, and capital equipment procurement for each project. Potential projects are evaluated in relation to each other to prioritize funding of specific projects. Essential improvements are planned in a manner commensurate with the County's ability to pay.

The CIP is developed biennially, with the six-year period moving out an additional two years every other fiscal year. The CIP is a multiyear plan that does not constitute or require an appropriation of funds beyond those for the current fiscal year. Funding decisions concerning the CIP are made in conjunction with decisions regarding the County's operating budget. Most new facilities require an ongoing commitment in operating funds for new employees, utilities, and other costs.

The proffer guidelines as set out in the Comprehensive Plan accommodate urban development concepts and more diverse housing into the CIF. Going forward, the County will pursue additional refinements. In light of state legislation adopted in 2016 that limits the use of proffers, the County will also explore other mechanisms to diversify funding opportunities, including impact fees, which could apply to residential developments whether permitted by-right or through legislative action. Additional state enabling authority would be necessary to effectively use impact fees; existing legislation is limited in scope and imposes difficult implementation requirements, leading very few localities to take advantage of this tool.

As part of its strategic planning efforts on growth management, the County will consider expanding discussion of net impacts, including the capital needs and costs of individual projects on countywide infrastructure and the economic and revenue benefits of new development. As such, the County would evaluate 1) the impact of a rezoning application on the local transportation network and public facilities, 2) what the application is or is not doing to mitigate the impact, and 3) what facilities exist and/or are funded to serve the subject property and surrounding area during the development review process. Additionally, the County is developing an analysis model to assist with evaluating the fiscal impact of future development.

Policies, Strategies, and Actions

Unless otherwise specified, the following policies, strategies, and actions apply Countywide. All of the Policies, Strategies, and Actions set forth in all of the following paragraphs of Chapter 6 shall apply and be applied by the County only subject to and in compliance with the limitations established by Virginia Code Section 15.2-2303.4 as applicable. In its consideration and acceptance of all proffers, the County will apply the standards of Virginia Code Sections 15.2-2297, 15.2-2303, and 15.2-2303.4, as applicable, to evaluate the reasonableness of proffered conditions, and for those applications subject to Section 15.2-2303.4, the County shall accept only those proffers permitted or deemed reasonable under Virginia Code Section 15.2-2297 and not deemed unreasonable under Section 15.2-2303.4.

Fiscal Policy I: Provide public facilities to meet identified needs.

Strategy

- 1.1. Use the CNA Program to plan and coordinate facility needs and location criteria to ensure adequate dispersal and timely availability of County facilities.

Actions

- A. Support LCPS acquisition of needed sites through the fiscal planning and land development processes.
- B. Co-locate public safety and other public facilities whenever it will improve service efficiencies.
- C. Make school-related open space and athletic fields available for joint use by PRCS.
- D. Combine public open space and parks with public facilities and civic buildings, in community centers, town centers, and other gathering places and include amenities such as seating areas, public art, playgrounds, gardens, etc.
- E. Design public facilities to be a distinguishing feature of the community using sustainable materials, context-sensitive design, and attractive architectural features.
- F. Design new public facilities to 1) be functional and efficient to persons with diverse abilities, 2) to reflect the physical character of the surrounding community, and 3) to maximize the broader social and cultural role the facility can play in the community.
- G. Establish an expansion plan for the Fire and Rescue Training Academy based on a needs assessment of the existing campus as the needs of LCFR and the County increase. Ensure the requirements of Fire and Rescue training remain a priority during the development of surrounding areas.
- H. Support proactive acquisition of sites for public facilities and to “bank” property for potential projects that may not yet be scheduled on the CIP.

Strategy

- 1.2. Support continued use of existing public facilities through ongoing capital asset replacement, renovation, and modernization, particularly where facilities play an

important role in social and economic activity of the local community or are historically significant.

Action

- A. Maintain and modernize existing County facilities to meet resource demands, and changing customer and community needs.

Strategy

- 1.3. Strategically locate public facilities where they can serve the community efficiently and effectively.

Actions

- A. Locate new public facilities on sites that can accommodate future expansions and allow co-location with other public agencies with similar activities or clients when possible. Use the expansion space around new public facilities for parks, commuter parking, and other interim uses that are compatible with the new facility until expansion is required.
- B. Investigate co-locating County facilities with complementary uses that would create a mutually beneficial relationship; for example, locate schools with affordable housing or libraries with parks and make surplus County lands available for affordable housing projects.
- C. Locate Fire and Rescue and Sheriff's Office facilities in accordance with adopted response time goals and at the most strategic point in a proposed service area.
- D. Locate "high traffic" public facilities in highly visible, accessible locations with adequate automobile and pedestrian access; examples of such locations include mixed-use centers, towns, and villages.
- E. Integrate housing, human services facilities, and services for special needs populations in the Urban, Suburban, and Transition Policy Areas, Towns, and JLMA to provide ease of access to associated commercial services, jobs, and amenities.
- F. Link new public facilities and adjacent neighborhoods with sidewalks, greenways, and trails.
- G. Locate new public facilities in western Loudoun in close proximity to the Towns and JLMA when suitable land is available and locations can meet response time and other service standards.
- H. Establish and maintain effective levels of public open space in all residential and mixed-use communities.
- I. LCPS will determine the need for new public school sites and public facilities in Loudoun County. The County will coordinate with LCPS to identify suitable sites based on the *Loudoun County 2019 Comprehensive Plan* and its land use and growth policies in concert with LCSB's standards and levels of service as adopted by the Board of Supervisors.

- J. The County will acquire school sites in advance of LCPS's recognized short and long-term future needs to minimize school transportation costs and to structure future planned growth.

Strategy

- 1.4. Encourage partnerships that contribute toward significant, meaningful, shared public facilities.

Actions

- A. Support and encourage partnerships that develop sustainable housing for special needs populations, including the elderly, the mentally and physically handicapped, low income persons, and the homeless.
- B. Support the acquisition of land and development of facilities such as the Potomac Heritage National Scenic Trail.
- C. Work with the United States Department of the Interior, the Virginia Tech Conservation Management Institute, the Virginia Department of Historic Resources, NOVA Parks, and other local, regional, and state organizations and the incorporated Towns to define and recommend areas for open space preservation and development of a trail network that links the County's natural, historic, and recreational resources.
- D. Work with homeowners' associations (HOA) and other property owner associations (POA) to encourage greater public access to association open space and facilities.
- E. Collaborate with Loudoun Water and NOVA Parks to support safe, compatible public access and recreation at water supply reservoirs.
- F. Coordinate recreation planning efforts with the Towns to prevent duplication of services.
- G. Identify opportunities, such as public/private partnerships and co-location, to work with the private sector to provide public facilities.

Emergency Services Development Standards

Fiscal Policy 2: Enhance efficient and effective public safety and emergency services response through the implementation of appropriate development standards.

Strategy

- 2.1. Ensure adequate fire suppression for residential uses that are not served by an on-site water source and/or are located outside minimum response times of existing stations.

Actions

- A. Create and maintain development regulations that require an adequate water supply, such as dry hydrants or tanks, for new residential subdivisions of more than five dwelling units when an alternative water source is not available on site.
- B. Encourage and offer incentives to voluntarily provide sprinklers in new residential construction.

- C. Higher densities proposed in compact and mixed-use communities, and design concepts such as narrower streets, reduced yards, and less space between buildings, should be contingent on installation of sprinkler systems in all buildings.
- D. As part of residential rezoning applications in areas that are subject to approved small area plans or approved Metrorail service districts, recommend that sprinklers be installed in all new residential construction that is located outside of the recommended emergency services response times established in agency services plans.

Strategy

- 2.2. Ensure adequate and efficient access for emergency vehicles.

Actions

- A. Eliminate non-contiguous street names, duplicate street names, and sound-alike street names, and ensure that addresses reflect the access location.
- B. Coordinate with Virginia Department of Transportation (VDOT) to ensure that all new traffic signals are equipped with signal preemption equipment to provide priority access to emergency vehicles responding to a call.
- C. Establish a program that retrofits existing traffic signals, subject to VDOT approval, with signal preemption equipment to provide priority access to emergency vehicles responding to a call.
- D. Require development applications to demonstrate adequate access for emergency apparatus.
- E. Ensure that development regulations address the installation and maintenance of emergency apparatus access roads for fire and rescue resources.
- F. Discourage the use of “emergency access only” gates and other roadway barriers.

Open Space (see also Chapter 3, Natural, Environmental, and Heritage Resources)

Fiscal Policy 3: Retain the County’s unique combination of urban, suburban, and rural communities by using open space to protect natural resources and habitat, to create a network of high-quality active and passive recreation spaces, and to delineate our built environments.

Strategy

- 3.1 Use contiguous linear parks, connected trails, and natural open space corridors to improve public access to open space, encourage healthy lifestyles, and link destinations throughout the County.

Actions

- A. Build on and encourage links to current planned trails and park areas, placing greater emphasis on connected, publicly usable, and accessible open space and identify desired

- locations and connections of future trails and parks to facilitate acquisition and development.
- B. Establish programs and regulatory mechanisms to increase publicly accessible open space through easements, land dedications, and purchase; ensure that such programs and mechanisms are consistent with County facilities plans.
 - C. Incorporate open space amenities into the design of stormwater facilities and link such facilities by trails to create a network of water-based parks and greens.
 - D. Ensure that new developments extend publicly-accessible trails and linear parks into and through their projects with the intent of creating a network of public trails that is consistent with the County plans.
 - E. Encourage applicants requesting residential rezonings to include language in HOA/POA bylaws that allows public access to some or all linear parks and trails, particularly those connecting to public facilities and to outside trails or parks.
 - F. Establish and maintain desirable levels of usable, public open space in all residential and mixed-use communities.
 - G. Increase the number of access points to key trail systems from adjacent neighborhoods and destinations.
 - H. Seek through public purchase, proffer, donation, or third-party easement, the preservation of natural areas and the development of linear parks, recreation space, and trails.
 - I. Continue the Open Space Preservation Program, to the extent permitted by Virginia Code Section 15.2-2303.4, linking the loss of open space associated directly with low-density land use to the provision of open space or funds towards the purchase of open space that provides publicly accessible and usable open space as follows:
 - i. In the Suburban Policy Area, residential neighborhoods or land bays proposing densities lower than 4 dwelling units per acre or floor area ratios of less than 0.4 should augment required open space with voluntary participation in the Open Space Preservation Program by providing:
 - a. The equivalent of 40 percent public open space in the Suburban Neighborhood place type and 20 percent in the Suburban Compact Neighborhood and Suburban Mixed Use place types, consisting of onsite open space required by development regulations and additional usable and publicly accessible open space proximate to the development, or
 - b. A cash contribution, equivalent to the value of the additional open space, towards the Open Space Preservation Program.
 - ii. In the Urban Policy Area, projects in areas planned for Urban Mixed Use and Urban Transit Center place types that propose floor area ratios of less than 1.0

should augment required open space with voluntary participation in the Open Space Preservation Program by providing:

- a. The equivalent of 20 percent open space consisting of on-site open space required by the zoning regulations and design standards, and additional usable and publicly accessible open space proximate to the development, or
 - b. A cash contribution, equivalent to the value of the additional open space, towards the Open Space Preservation Program.
- iii. Link modifications reducing on-site open space, buffer widths, or landscaping requirements with the provision of an equivalent or greater amount of open space or an equivalent cash contribution towards the Open Space Preservation Program.
 - iv. Use open space easements or funding provided by projects in the Urban and Suburban, Policy Areas through the Open Space Preservation Program to extend existing public trails, provide active and passive parks or to protect priority sites (see 3.1.K., below).
- J. Institute a program whereby the County facilitates acquisition of conservation easements by others by providing assistance such as a revolving loan program to reduce or defer the landowner cost of establishing conservation easements. The program should emphasize protecting the priority open space areas that are identified in this Plan that are not otherwise protected.
- K. Encourage protection of the following priority open space areas through conservation easements acquired by the County or others, participation in the Open Space Preservation Program, development design, and other means:
- i. Key natural, environmental, and heritage resource features not already protected from development by conservation easements or regulation;
 - ii. Rural areas immediately adjacent to the Towns, JLMAs, and Rural Villages that help form greenbelts and gateway buffers;
 - iii. Areas adjacent to the Potomac River, Catoctin Creek, Bull Run, Goose Creek, and Broad Run floodplains, to protect water quality;
 - iv. Properties on or eligible to be listed on the State or National Registers of Historic Places and within local historic districts;
 - v. Corridors and sites identified for trails and parks and additions to existing parks; and
 - vi. Other areas of local natural, historic, or cultural significance including but not limited to designated scenic rivers and roads, ridgelines, and battlefields.
- vii. Amend the zoning ordinance and development regulations as needed to permit a percentage of the open space required on an individual site to be met through off-site permanent open space that creates a more usable, desirable, or environmentally significant open space (see 3.1.J, above) located in the same planning subarea identified in the latest Capital Needs Assessment.

Sewer and Water (see also Chapter 2, Towns and JLMA)

Fiscal Policy 4: Work with Loudoun Water and the Health Department to ensure timely provision of central, community, or on-site sewer and water in accordance with the land use policies of this Plan. The County will encourage water and wastewater service to be provided in the most efficient and effective manner possible and promote the use of the best utility system in accordance with the policies of this Plan.

Countywide Strategies

Strategy

4.1 Implement strategies to resolve sewer and water issues in existing communities.

Action

- A. Pursue funding sources to rehabilitate homes that currently lack adequate sewer and water systems.

Strategy

4.2 Define specific service areas for utility systems to protect the viability of County land use goals.

Actions

- A. Establish the geographic limits of standards-based utility service, and ensure adequate capacity and supply safeguards through the Commission Permit process prior to expanding existing service boundaries, or adding new boundaries in the case of the Rural Policy Area.
- B. Prohibit connection to water distribution and wastewater collection systems when such requires crossing land outside a defined water or sewer service area, except as allowed herein.

Strategy

4.3 Prohibit the use of any standalone or community system that does not ensure long-term safe, sustainable, and environmentally sound water supply and wastewater treatment.

Actions

- A. Require development proposals outside of areas served by central system facilities to demonstrate a safe, adequate, and long-term sustainable potable water supply and sewage treatment capacity in accordance with the land use policies of this Plan.
- B. Encourage concentrating development away from water supply reservoirs and water supply sources.
- C. Implement a pollution prevention and mitigation program to protect and improve the County's surface water quality.

- D. Permit pump-and-haul operations only as a last resort and a temporary wastewater disposal method and only to address a proven public health issue.

Urban, Suburban & Transition Policy Areas – Central Sewer and Water Strategy

- 4.4 Loudoun Water will be responsible for the provision of central water and sewer service in the Loudoun Water Central System area as shown on the Water/Sewer Service Areas Map.

Actions

- A. Collaborate with Loudoun Water to ensure safe and adequate long-term water supply and wastewater treatment systems to meet County development goals.
- B. Facilitate development and efficient operation of retired quarries as water supply reservoirs and protect reservoirs by establishing effective and sustainable watershed protection measures.
- C. Expand the use of Loudoun Water's reclaimed water network.
- D. Require new development in the Urban, Suburban, and Transition Policy Areas to connect to Loudoun Water's central water supply and wastewater treatment systems.
- E. Encourage existing residences and communities served by onsite or community facilities to connect to central water or sewer facilities when such facilities become available via long-term financing or other incentives.
- F. Assist existing communities or residences to connect to a nearby central water or sewer system if on-site water supply or waste treatment capability has deteriorated to a point where there is a potential public health risk.
- G. Construct new central wastewater and water lines and facilities in a manner that causes the least environmental risk and visual disruption.

Rural Policy Area – On site and Community Systems Strategy

- 4.5 Protect the rural character of western Loudoun by considering the ability of an area to support onsite or community water and wastewater systems for any areas proposed for development.

Actions

- A. Prohibit extension of central water and wastewater service into the Rural Policy Area, except to address a public health threat to an existing rural community or to serve public facilities on contiguous parcels immediately adjacent to the western boundary of the Transition Policy Area.

- B. Institute a wellhead protection program in all areas not served by central system facilities to ensure adequate water quality.
- C. Discourage the use of groundwater for nonagricultural irrigation such as automated lawn sprinklers and swimming pools and other nonessential purposes.
- D. Maintain oversight of siting, design, installation, and maintenance of conventional and alternative on-site sewage disposal systems.
- E. Require the installation of technology that treats groundwater to a surface water level of treatment standard, in accordance with Loudoun Water's Engineering Standards Manual, as a condition of approval for development of potable water supplies in any portions of the Limestone Overlay District and/or where subsurface karst geology exists.
- F. Implement an inspection and maintenance program for conventional on-site sewage disposal systems and provide homeowner educational materials on this and related well and septic safety for residents in the Rural Policy Area, particularly in the Limestone Overlay District.

Strategy

- 4.6 Collaborate with the Health Department in conjunction with Loudoun Water to identify viable alternative water supply and wastewater treatment methods to individual well, septic and drainfield-based systems, including community treatment plants and onsite treatment to support clustered residential development.

Actions

- A. Implement water and wastewater treatment and disposal standards for alternative systems that protect water quality.
- B. Allow community water and wastewater systems in the Rural Policy Area:
 - i. to serve rural economy uses and residential clusters as defined in this Plan,
 - ii. to solve potential public health risks, and
 - iii. to serve public facilities.
- C. Support construction of community systems for existing rural communities facing a potential public health risk. In such cases, the community system may be available to undeveloped lots within the existing community to support development that extends the viability of the community and is consistent with the scale, density, and character of the community.
- D. Require Loudoun Water to own and operate all public community water and wastewater systems with more than 15 connections.
- E. Require a Commission Permit, establishing a defined service area, prior to the construction of any community water or wastewater system.
- F. Permit the extension of municipal (town) sewer and water into the Rural Policy Area to serve public facilities or to address a potential public health risk.

- G. Require financing of community water and wastewater systems by the developer or by those who will be directly served by the system. A financing plan will be required to address initial capital costs and operating costs. The system must be designed, organized, and operated to be financially self-sustaining to pay all costs incurred by Loudoun Water for operation and maintenance and to provide appropriate reserves. The County may provide financial assistance in the form of loans or grants to assist in the construction of such a facility for existing rural communities if the system is needed to solve a significant public health threat.

Solid Waste Management

Fiscal Policy 5: Continue to implement an integrated solid waste management strategy that prioritizes reduction, reuse, and recycling of solid waste above resource recovery, incineration, and disposal into landfills.

Strategy

- 5.1 The County Solid Waste Management Plan will identify the type and level of service to be provided in the community.

Actions

- A. Continue to ensure that the County always has an acceptable means of local waste disposal through the County landfill operations, should other waste disposal alternatives fail or become ineffective.
- B. Continue to seek private sector support for the provision of current and future Solid Waste Management Services.
- C. Develop a hazardous waste education program and increase residential access to the safe disposal of hazardous waste to protect groundwater resources.
- D. Reduce landfill waste by promoting recycling and composting.

Electrical

Fiscal Policy 6: Support expanded electrical capacity through generation facilities that use clean burning and environmentally sound fuel sources and energy efficient design.

Strategy

- 6.1 Encourage local electrical generation in appropriate locations throughout the County.

Actions

- A. Establish zoning regulations and design standards that permit alternative electrical generation such as wind and solar generation by and for individual users.
- B. Encourage the safe grouping and burying of utility lines and facilities.
- C. Work with electrical providers to identify potential high voltage distribution lines and substation locations that minimize impacts on key travel corridors, sensitive cultural

and historic resources, and existing residential communities or to place high voltage distribution lines underground when approaching such areas; and where possible, use existing transmission corridors and substation sites to expand capacity.

- D. Encourage the use of design techniques that will minimize the visual impact of electrical substations adjacent to major travel corridors or residential communities including the use of stealth design techniques.
- E. Continue to monitor and minimize energy use in County facilities and create a program that would encourage benchmarking energy use in private buildings.

Communication

Fiscal Policy 7: Support the development of a high-quality wired and wireless telecommunications network to serve businesses, residents, and visitors.

Strategy

7.1 The County's *Strategic Land Use Plan for Telecommunication Facilities* and other regulations and standards will be regularly updated to address emerging technologies, to create an environment attractive to businesses, and provide high-quality services to meet the demands of the County.

Actions

- A. Review and update the County's *Strategic Land Use Plan for Telecommunication Facilities* to facilitate the expansion of fiber and broadband service throughout the County.
- B. Adopt zoning regulations and design standards requiring open access conduit to all development projects to facilitate future broadband extensions.
- C. Establish performance standards for wireless communication facilities to minimize the need for legislative action.
- D. Incorporate the capacity to locate broadband and wireless facilities into the design, approval, and construction of all public facilities.
- E. Locate telecommunications facilities and equipment associated with public safety agencies in accordance with communication utility standards and the Comprehensive Plan.

Fiscal Management

Fiscal Policy 8: Link the goals of the Board of Supervisors' adopted Fiscal Policy and the County's Comprehensive Plan.

Strategy

8.1 Maintain a diversified and stable revenue structure by balancing residential and non-residential development.

Actions

- A. Seek further revenue diversification to increase fiscal stability and thereby mitigate tax burdens on Loudoun County taxpayers.
- B. Direct the majority of public investments into currently developed communities, Towns and non-residential areas of the County where development is planned according to the Comprehensive Plan and give priority to the redevelopment and enhancement of existing infrastructure, capital facilities, and services.
- C. Where permitted by law, continue to seek private sector support for improvements or provision of current and future public facilities and sites, including proposals of cash and in-kind assistance for public facilities in addition to the timely provision of dedicated sites.
- D. Seek authority from the state legislature to establish impact fees and a reasonable implementation process applicable in areas of the County where rezonings are not anticipated or where the provision of improvements and facilities through proffers associated with rezonings for new residential development is restricted by State legislation.

Strategy

- 8.2 Capital facility planning and budgeting will reflect anticipated needs based on forecasted development.

Actions

- A. Update financial and planning tools regularly to evaluate long-term land use, fiscal, and demographic issues under the oversight of the Board and its advisory committee, the Fiscal Impact Committee.
- B. Maintain long-range forecasts of residential and non-residential development, population, households, and employment.
- C. Develop demographic, economic, and financial data that are used as inputs to demographic forecasts and for fiscal impact modeling.
- D. Develop and regularly update the CIF—the dollar amount of the capital facilities impact measured by unit type or unit characteristics and geographic location that is calculated using County CFS and demographic inputs. The County uses the CIF to assess the capital facilities impacts of new residential development and provide a guideline to evaluate and consider residential rezoning applications and proposed proffers.
- E. Regularly refine CFS, including the type, acreage, and size of future capital facilities, along with “triggers” based on population, policy area, place type, community characteristics, or other community factors.
- F. Regularly refine the CNA, including the type and number of capital facilities needed over a ten-year planning period beginning at the end of the current six-year CIP.

- G. Where permitted by law, seek to ensure that an equitable and proportionate share of public capital facility and infrastructure development costs that are directly attributable to a particular development project will be financed by the users or beneficiaries.
- H. Evaluate, consistent with the Virginia Code Sec. 15.2-2283 and 15.2-2284 and other applicable law, the adequacy of existing and planned public facilities and services when assessing impacts of any legislative application for more intensive use or density. To fairly implement and apply this policy, the County will consider the following:
 - i. existing facilities;
 - ii. facilities included in the CIP;
 - iii. the ability of the County to finance facilities under debt ratios and limits established by its fiscal policies;
 - iv. CFS and the effect of existing and approved development, and the proposed development, on those standards;
 - v. service levels of the existing transportation system – the effect of existing and approved development and the proposed development on those service levels and the effect of proposed roads which are funded for construction;
 - vi. commitments to phase the proposed development to the availability of adequate services and facilities;
 - vii. the availability of non-profit or HOA facilities to provide equivalent public access and programming; and
 - viii. other mechanisms or analyses as the County may employ that measure the adequacy of such services and facilities for various areas or that measure the County's ability to establish adequate services and facilities.

Strategy

- 8.3 Until such time as the General Assembly grants authority for other options, the County will consider landowner proposals of cash and in-kind assistance to mitigate capital facilities costs associated with new development, subject to the limitations established by Virginia Code 15.2-2303.4.

Actions

- A. Consider proposals of the timely dedication of land, cash, and in-kind assistance from a landowner through proffered conditions submitted in accord with Virginia Code Sections 15.2-2303, 15.2-2303.4, and 15.2-2297, as applicable, in the provision of public facilities identified in the CIP or CNA.
 - i. The County expects that such proposals of public facility and utility assistance by developers will occur in conjunction with any rezoning request seeking approval of densities above the existing zoning regulations and design standards.

- B. Ensure that an equitable and a proportionate share of public capital facility and infrastructure development costs that are directly attributable to a particular development project are financed by the users or beneficiaries.
- C. Apply all of the proffer policies and actions and guidelines set forth in this document subject to and in compliance with the limitations established by Virginia Code Section 15.2-2303.4 as applicable. In its consideration and acceptance of all proffers, the County will apply the standards of Virginia Code Sections 15.2-2297, 15.2-2303, and 15.2-2303.4, as applicable, to evaluate the reasonableness of proffered conditions.
- D. For those land development applications subject to Virginia Code Section 15.2-2303.4, the County shall accept only those proffers permitted or deemed reasonable under Section 15.2-2297 and not deemed unreasonable under Section 15.2-2303.4.
- E. Where and to the extent permitted by law, the County will structure residential proffer guidelines based upon the respective levels of public cost of capital facilities generated by various factors such as size, location, and type of dwelling units.
- F. To assist the County in an equitable and uniform evaluation of developer proffers and other proposals, for proposed densities above the specified base density for each planning policy area, which otherwise conform with the policies of this Plan, the County anticipates developer assistance valued at 100 percent of capital facility costs associated with such increased densities.
- G. The County will consider differentiating between conventional suburban housing and other types of housing such as age-restricted, accessory, and micro units, and consider commitments to small unit sizes or affordability in estimating the capital facility needs and CIF.
- H. Review the Capital Planning Subarea boundaries to ensure, to the extent feasible, that they do not divide existing communities and to consider service standards that provide flexibility in response to demographics, land availability, and other characteristics of specific communities.
- I. Consider developing capital standards for roads to incorporate into the CIF.

Strategy

- 8.4 Adoption of this Plan establishes the boundaries for Small Area Plans, authorized under Code of Virginia Section 15.2-2303.4, encompassing the Urban Policy Areas, Suburban Policy Area, Transition Policy Area, Leesburg JLMA, and the three Silver Line Metrorail Stations within the County as shown on the Small Area Plan Boundaries Map. The planned land use within these Small Area Plan boundaries will reflect the land uses developed in the *Loudoun County 2019 Comprehensive Plan* for each policy area until such time as the Board adopts more detailed plans.

Strategy

- 8.5 Use the following capital facilities proffer guidelines to evaluate proposed capital facility proffers subject to and in compliance with the limitations established by Virginia Code Section 15.2-2303.4 as applicable.

Actions

- A. Use the following definition of “Capital Facility Proffer” to evaluate proffers: “A contribution consistent with County policies and service needs, in cash or in kind (land or improvement), that is intended to mitigate capital facility impacts of the development and is agreed to as a condition of a rezoning.”

To be considered a proffer based on this definition, the following criteria shall apply:

- i. The proffered facility is dedicated to the County or to a local, state, federal, or regional authority or otherwise satisfies a need identified in the CFS, CNA, or CIP;
 - ii. The measure of credit will be determined based on the service needs of the proposed development and should not exceed what the County would expect to supply given the CFS and the population served at the date of official acceptance of the application or at the date of reactivation of an inactive application;
 - iii. The contribution has a quantifiable value;
 - iv. The value of land contributed for public use or use as a public facility site is recognized as a capital facility proffer;
 - v. Land for County facilities should be conveyed to the County or its designee;
 - vi. Cash contributions should be the equivalent of the capital facility impacts of the proposed development as determined by the Capital Intensity Factor adopted by the Board of Supervisors at the time the applications is considered;
 - vii. The contribution would not be required under existing statutes or ordinances; and
 - viii. The proffer is irrevocable.
- B. Seek annual adjustments for proffers involving cash contributions based on the Consumer Price Index (CPI).
- C. Base density thresholds beyond which capital facilities proffers will be anticipated are specified by planning policy areas as follows:

- i. Rural Policy Area: The planned density for the Rural Policy Area is implemented by the existing zoning pattern and zoning amendments are not anticipated. However, for zoning map amendment applications within existing villages and other similar applications, include capital facility proffers for units above the density permitted by current zoning regulations.
 - ii. Transition Policy Area: Evaluate capital facilities proffers against the base density permitted by current zoning regulations.
 - iii. Suburban and Urban Policy Areas: Evaluate capital facilities proffers against the base density permitted by the current zoning regulations or a base density of 1.0 dwelling unit per acre, whichever is lower.
 - iv. Joint Land Management Areas: Evaluate capital facilities proffers against the base density permitted by the current zoning regulations or a base density of 1.0 dwelling unit per acre, whichever is lower.
- D. To evaluate proffers for public use sites, determine the per-acre value of unimproved land by a market appraisal of the site compared to properties with the same densities proposed by the applicant. The appraisal shall be conducted by an appraiser agreed to by the County, paid for by the developer, and the results provided to the County. For improved sites, consideration will be given as applicable to:
- i. Site-preparation including clearing and grubbing, grading, erosion control, and related engineering and permitting costs.
 - ii. Project infrastructure such as stormwater management ponds, sanitary sewer lines, and major off-site and on-site roadways serving the site.
 - iii. A proportional share of improvements directly related to providing access to the site (pedestrian underpasses, construction of adjacent streets, trails, and sidewalks).

Reference Maps

Existing and Planned Facilities (Map #2018-147)

Small Area Plan Boundaries (Map #2023-062)

Trails and Parks (Map #2018-157)

Water/Sewer Service Areas: 2023 (Map #2023-064)

Loudoun County

Existing Facilities

2019 General Plan



▲ Animal Control

✗ Comm Facility

☛ Courts

■ Fire & Rescue

■ General County Facility

■ Historic Site

■ Library

■ Park

■ Park & Ride

■ Parking

■ Recreational

■ School: Administration

■ School: Elementary

■ School: High

■ School: Middle

■ School: Technology Center

■ Sheriff

■ Social Service

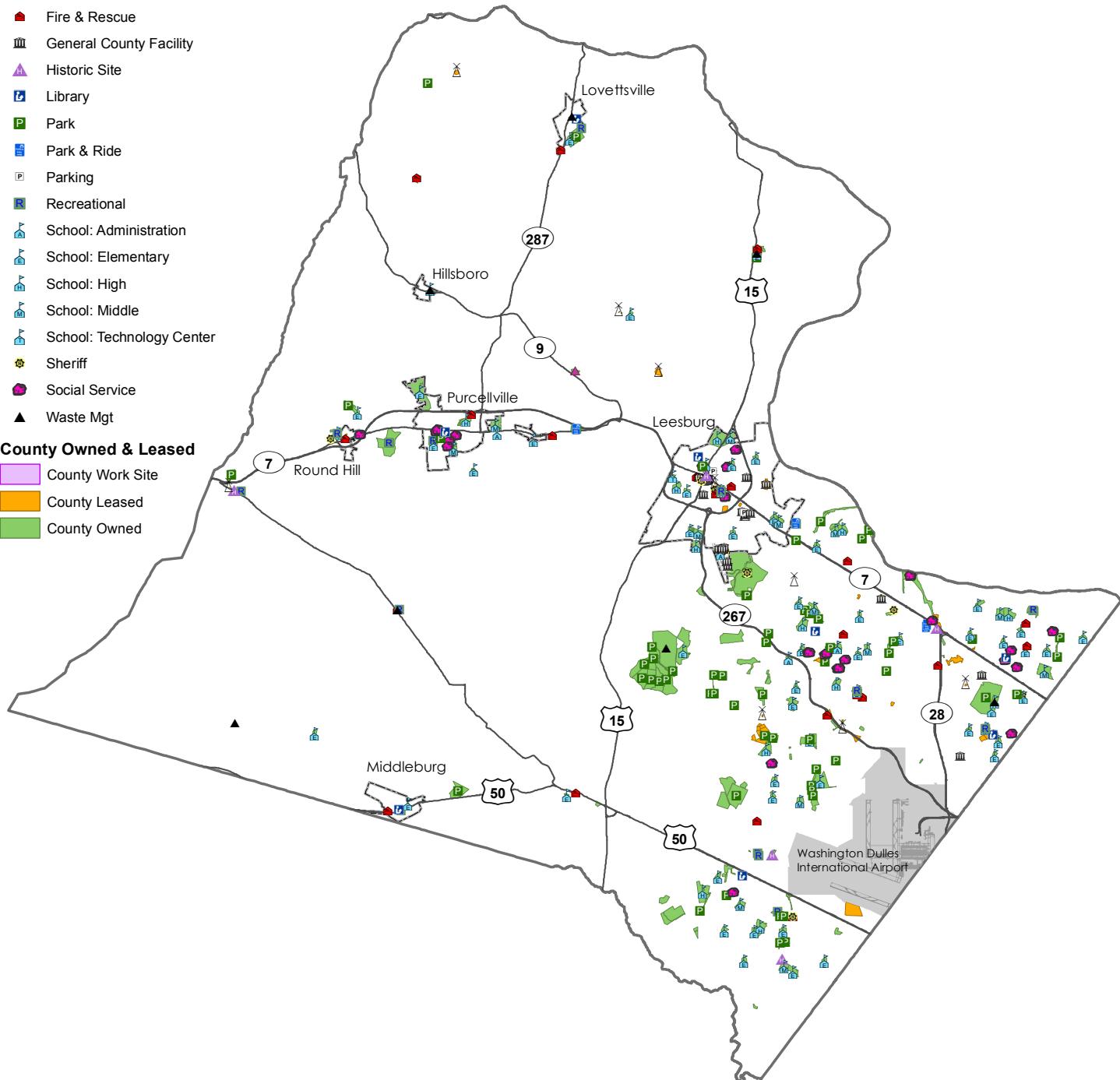
▲ Waste Mgt

County Owned & Leased

■ County Work Site

■ County Leased

■ County Owned



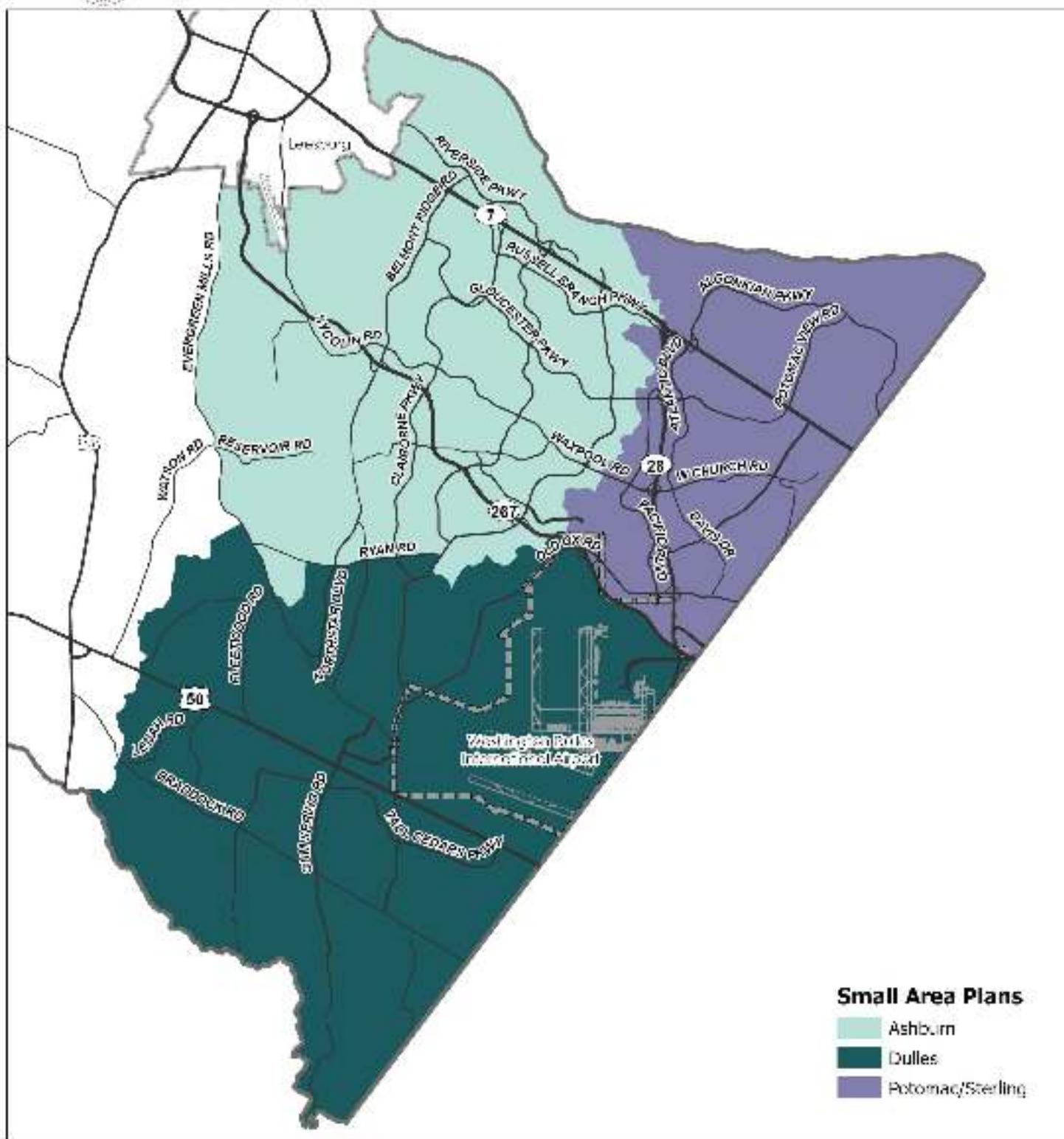
Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles
Map Number 2018-147

Loudoun County

**Small Area
Plan Boundaries**

2017 General Plan



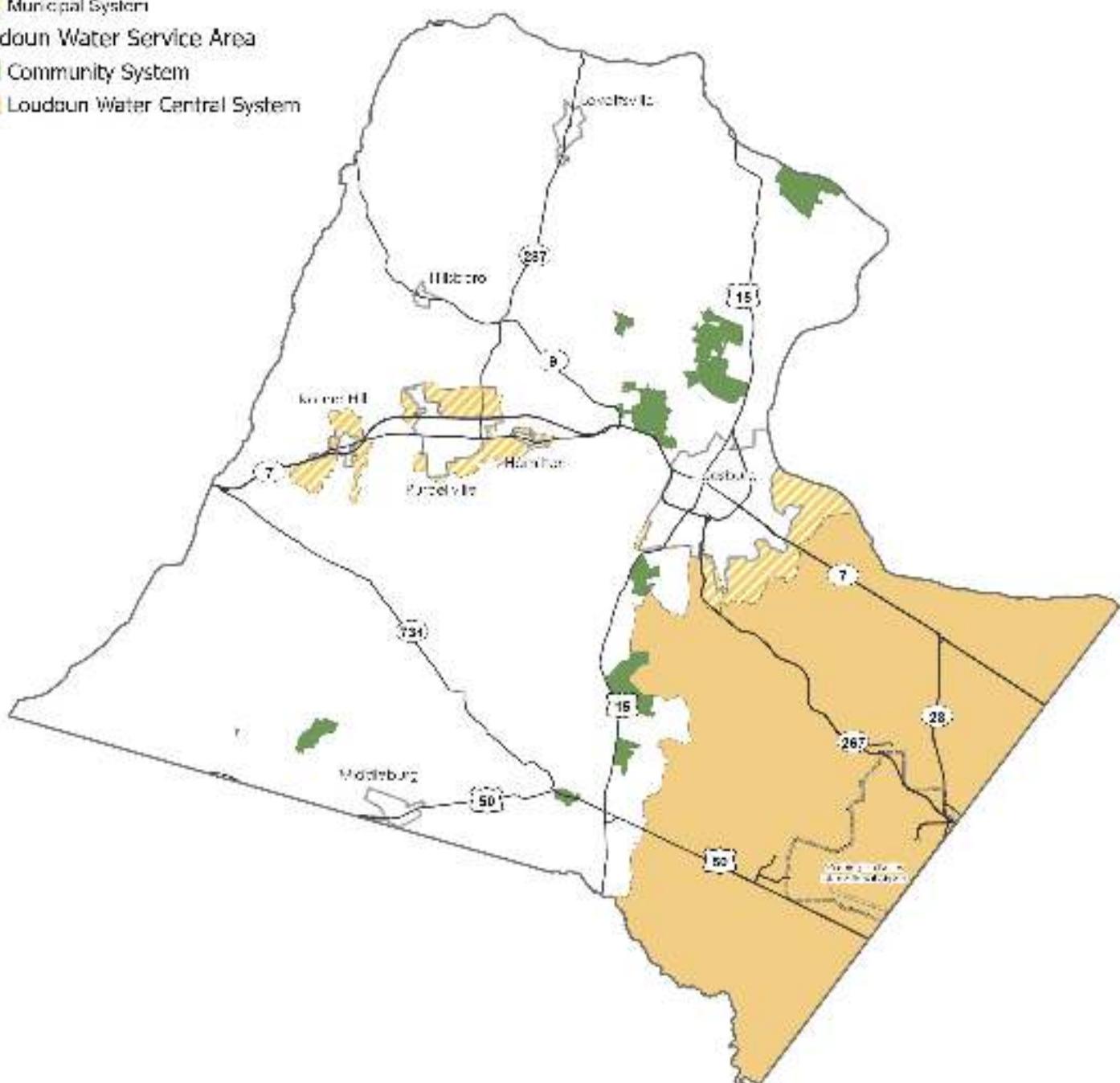
Loudoun County Small Area Plan Boundary
Information Report. This map is only intended for
internal use by the responsible officials; it has
been made available publicly due to the County's
policy to warranty express or implied use to its
accuracy, completeness, or fitness for use of any purpose.

0 0.5 1 2 3 4 Miles
Map Number 2002-049

Loudoun County
Water/Sewer
Service Areas: 2023
2019 General Plan



- Municipal System
- Loudoun Water Service Area
- Community System
- Loudoun Water Central System



Loudoun County is NOT LIABLE for any use or interpretation you may make of this information contained here. While reasonable efforts have been made to obtain accurate data, the County makes no warranty, expressed or implied, as to its accuracy, completeness, or fitness for any purpose.

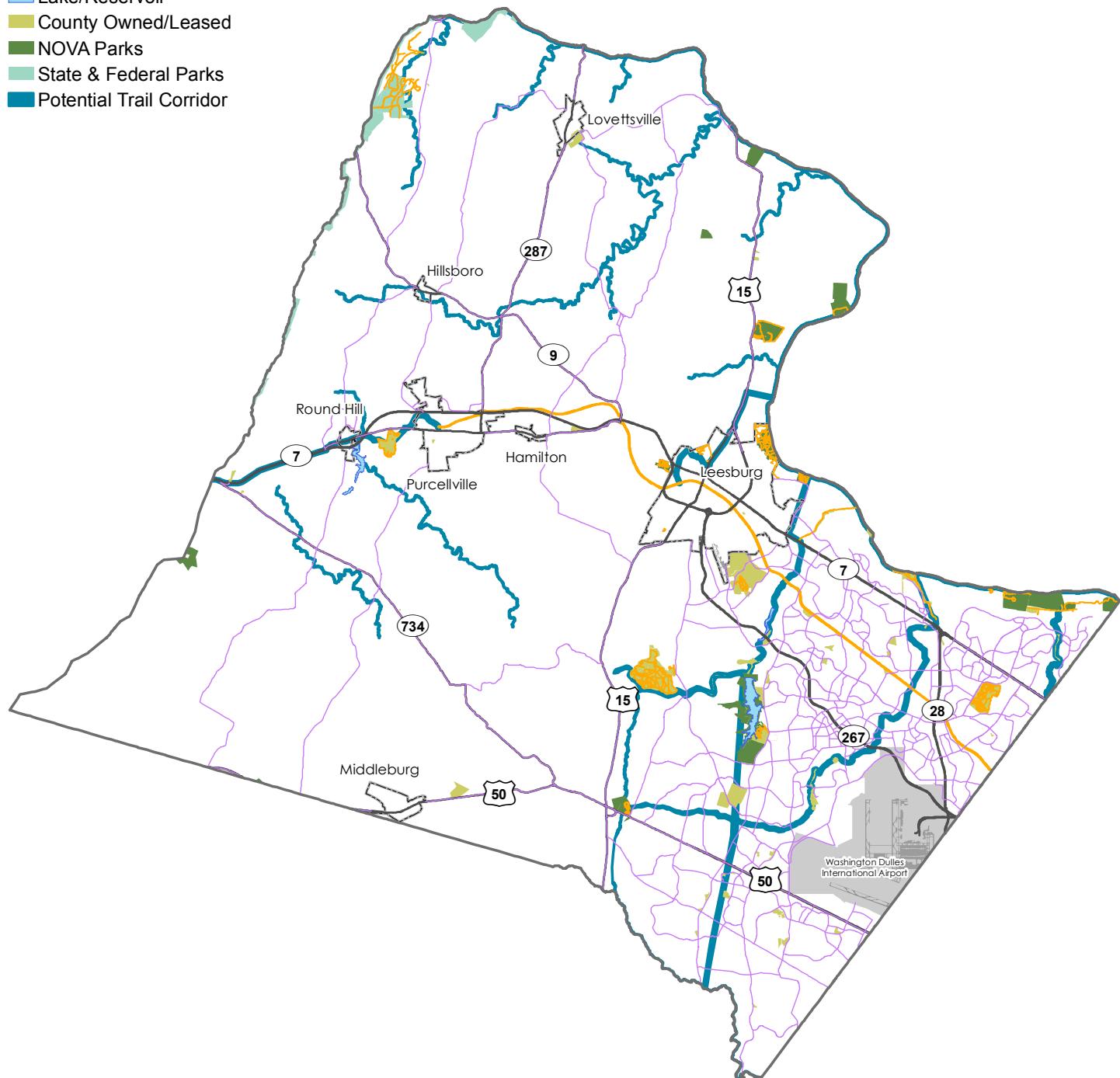
0 2 4 6 8 Miles
Map Number 2023-004

Loudoun County
Trails and Parks

2019 General Plan



- Existing/Planned Bike Lane/Roadside Trail
- Existing Recreation Trail
- NOVA Parks Trails
- Lake/Reservoir
- County Owned/Leased
- NOVA Parks
- State & Federal Parks
- Potential Trail Corridor



Loudoun County IS NOT LIABLE for any use
of or reliance upon this map or any information
contained herein. While reasonable efforts have
been made to obtain accurate data, the County
makes no warranty, expressed or implied, as to its
accuracy, completeness, or fitness for use of any purpose.

0 1 2 4 6 8 Miles
Map Number 2018-157

Chapter 7 - Implementation

Table of Contents

Vision.....	2
Introduction.....	2
Implementing the Plan	2
Implementation Strategy	2
Implementation Matrix	4

This page left blank for printing purposes.

Chapter 7 - Implementation

Vision

Loudoun County continues to flourish as a prosperous and inclusive community with a well-deserved reputation for great places—natural and built as well as historic and new—in a variety of settings. The County will foster economic innovation, fiscal strength, and sustainability.

Introduction

The contents of the *Loudoun County 2019 General Plan* encompass the County's desire to preserve the principles that have led to Loudoun's success, while also addressing trends and influences that will impact Loudoun's future. Chapters 2 through 6 of the *Loudoun County 2019 General Plan* include policies, strategies, and actions designed to achieve the Plan's vision and goals.

The implementation of the *Loudoun County 2019 General Plan* begins with plan adoption. The Board of Supervisors identified two top implementation priorities to follow the adoption of the *Loudoun County 2019 Comprehensive Plan*: a comprehensive review and overhaul of the County Zoning Ordinance, and the development of an Unmet Housing Needs Strategic Plan. Additionally, community plans, design guidelines, continued outreach and coordination with Loudoun's Towns, and efforts to address the goals of the *Loudoun County 2019 Countywide Transportation Plan* are all actions that may contribute to the implementation of the *Loudoun County 2019 General Plan*. The County will periodically monitor and evaluate the Plan's progress to ensure that visions and goals are being met.

Implementing the Plan

Implementation Strategy

The Implementation Strategy provides an outline of the key actions that must occur to implement the *Loudoun County 2019 General Plan*'s policy direction. It gives broad, general guidance as to the key regulations, future planning efforts, studies, and programs that will need to be developed and implemented to achieve the Plan's objectives. Many of these actions are explicitly identified in the policies, strategies, and actions of the Plan and are also contained in the Implementation Matrix described below which includes a more detailed list of implementation actions.

The implementation actions can be integrated with the Board of Supervisor's (the Board) annual strategic planning efforts, during which the Board can identify and prioritize implementation actions. The *Loudoun County 2019 General Plan* also anticipates the establishment of an annual update for staff to provide implementation status to the Board. This will provide opportunities for staff to keep the Board apprised of the evolving planning and development environment, review implementation progress to date, and advise the Board on future priorities, as needed.

The following list identifies key implementation actions:

- Staff is to provide regular updates on the various elements of the *Loudoun County 2019 Comprehensive Plan*-which will allow the Board to direct a comprehensive review of the Plan at least every five years to ensure that the Plan is kept current. The order and sequence of the review of the chapters and policy area sections of the *Loudoun County 2019 General Plan* will be determined by the Board. Focus areas can be identified and prioritized by the Board annually during its strategic planning sessions. As part of the Board's deliberations on the Plan, two initial implementation priorities have been identified, as detailed below.
- Conduct a comprehensive review of the County Zoning Ordinance and prepare a Zoning Ordinance consistent with the Plan's policies, strategies, and actions for the Board's consideration as one of the two initial implementation priorities of the Board.
- Develop an Unmet Housing Needs Strategic Plan consistent with the *Loudoun County 2019 Comprehensive Plan* as one of the two initial implementation priorities of the Board. This plan will identify the strategies, actions and programs that can best address the County's current and projected unmet housing needs and should include but is not limited to providing guidance on down-payment assistance programs, utilization of housing trust funds, and home purchase programs. The strategic plan will also address the potential of a change to the continued use of a base density credit during evaluation of zoning map amendments. This plan should be developed prior to the approval of any zoning map amendments requesting the higher densities planned in the Urban Policy Areas outside of the Metro Tax District, Suburban Policy Area, and the Transition Policy Area.

Other priority implementation actions are as follows:

- Begin community planning and design initiatives consistent with the policies, strategies, and actions identified in this Plan, including development of strategic plans focused on particular topics and community plans for all or portions of the Urban, Suburban, Transition, Rural, and Joint Land Management Policy Areas. Community plans may include plans for specific areas noted in the Plan such as the Rural Historic Villages and gateway areas around the Towns. The order and sequence of new plans and other initiatives will be determined by the Board.
- Update the *Heritage Preservation Plan* for consistency with this Plan.
- Update the *Strategic Land Use Plan for Telecommunications Facilities* for consistency with this Plan.
- Reconvene the Fiscal Impact Committee to evaluate standards relative to the new place type service demands and specifically address the demand for public infrastructure in the Urban Policy Area.
- Conduct studies to identify focus areas for redevelopment, infill development, and reinvestment.
- Create a master plan for parks, open space and trails including inter-connected open space areas throughout the County.

- Update the Land Subdivision and Development Ordinance and Facility Standards Manual to align with the policies, strategies, and actions of this Plan.
- Continue to create and update watershed and environmental corridor management plans.
- Provide a resolution of intent to amend the Zoning Ordinance to the Board to consider replacing the existing noise contours for Washington Dulles International Airport and consider adopting the noise contours in the 2019 Washington Dulles International Noise Contour Map Update. **[Implemented with CPAM-2021-0001, ZMAP-2021-0011, and ZOAM-2021-0002, Airport Impact Overlay District Update]**
- Continue outreach and coordination with Loudoun's Towns as described in Chapter 2.
- Develop a strategy to facilitate the development of high-speed wired and wireless telecommunication networks, including broadband technology, in the RPA.
- Develop performance standards for data centers to address design, landscaping, and compatibility that could eliminate the need for a special exception.
- Consider reducing the maximum allowable accessory dwelling unit square footage to the lesser of 1,200 square feet or 70 percent of the principle structure gross square footage and ground floor footprint for applicable zoning districts in the Suburban Policy Area, subject to performance standards.
- Develop performance standards to address design, landscaping, and compatibility for industrial uses in the Suburban Industrial and Mineral Extraction adjacent to residences and primary roads.
- Deployment of implementation strategies set forth in the *Loudoun County 2019 Countywide Transportation Plan*.

Implementation Matrix

The ability to monitor and evaluate the progress of the *Loudoun County 2019 General Plan* is crucial to determining whether the Plan is achieving the community's vision and goals. The implementation matrix that follows summarizes all action items found in the Plan that require subsequent County action, such as studies, analyses, program development, and regulatory changes. The implementation matrix is provided as a tool for the Board to use as the framework for developing a work program to implement the Plan.

This page left blank for printing purposes.

IMPLEMENTATION MATRIX

Chapter 2 Quality Development	
Action	Responsibility (Loudoun County Department or Agency)
1.1.A. Develop user-friendly, illustrative design guidelines. The design elements will promote an overall sense of place through design elements that in-part relate to block size, circulation and connectivity, streetscape and street sections, building form, placement (setbacks), orientation, articulation, parks and open spaces, public and civic uses, landscaping, and sustainability that give high quality form to the built environment.	Planning & Zoning, Transportation & Capital Infrastructure, Parks & Recreation, Design Cabinet, Economic Development
1.1.B. Create incentives that provide the opportunity to implement design guidelines.	Planning & Zoning, Economic Development
1.1.C. The County will consider the development of zoning regulations and design standards that implement the design guidelines of this plan and any design guidelines that may be created in the future.	Planning & Zoning, Economic Development
2.1.A. Develop and implement zoning regulations or design guidelines that support a compact, walkable development pattern in areas appropriate for pedestrian activity.	Planning & Zoning, Building & Development, Economic Development
3.1.A. Develop flexible guidelines, regulations, and design standards that support diverse environments and experiences.	Planning & Zoning, Parks & Recreation, Design Cabinet, Economic Development
3.1.B. Create incentives to ensure a mix of environments and experiences within a development.	Planning & Zoning, Public-Private Partnership, Economic Development
4.1.A. Create guidelines, zoning regulations, and/or design standards that ensure bike lanes, shared spaces, and paths of travel are created in areas where multimodal activity should be encouraged.	Planning & Zoning, Transportation & Capital Infrastructure, Parks & Recreation, Economic Development

4.1.B. Create guidelines, zoning regulations, and/or design standards that ensure traffic calming designs.	Transportation & Capital Infrastructure, Design Cabinet, Economic Development
5.1.A. Develop design guidelines, zoning regulations and/or design standards, and additional design elements that contribute to the quality of the human experience in the built environment.	Planning & Zoning, Design Cabinet, Economic Development
6.1.A. Create guidelines that address public seating, art, landscaping, outdoor rooms, safety, and other innovative elements that can maximize opportunities for the public.	Planning & Zoning, Design Cabinet, Building & Development, Economic Development
7.1.F. Amend zoning regulations and design standards to implement place types. It may be necessary to utilize incentive provisions in order to achieve the maximum development intensity or residential density stated in this Plan for any individual place type.	County Government, Planning & Zoning, Economic Development
8.1.A. Amend zoning regulations and design standards to require the provision of continuous, accessible, step-free paths of travel throughout new employment, retail, and mixed use development proposals.	County Government, Planning & Zoning, Economic Development
8.1.B. Amend zoning regulations and design standards to incorporate accessible and inclusive design features into public and civic spaces such as community centers, parks, plazas, and playgrounds.	County Government, Planning & Zoning, Economic Development
8.1.D. Review and revise county sign regulations to facilitate signage and way-finding at appropriate heights that incorporates Braille, tactile markings, and other accessibility improvements.	County Government, Planning & Zoning, Economic Development
8.2.A. Incentivize the use of design mechanisms that ensure universal functionality within new construction.	County Government, Planning & Zoning, Economic Development
8.2.B. Examine the feasibility of establishing a technical and financial assistance program that assists property owners and tenants of older structures in removing impediments to accessibility and incorporating universal design elements into renovation projects.	County Government, Planning & Zoning, Economic Development

Infill and Redevelopment	
Action	Responsibility (Loudoun County Department or Agency)
1.1.A. Develop criteria to identify and prioritize areas for redevelopment, infill development, adaptive reuse, and reinvestment, with the Priority Commercial Redevelopment Areas Map serving as the source for initial areas of focus.	County Government, Planning & Zoning, Economic Development
1.1.B. Create a common vision and objectives for areas identified for redevelopment, infill development, adaptive reuse, and reinvestment through a public process.	County Government, Planning & Zoning, Economic Development
1.1.C. Address redevelopment, infill development, adaptive reuse, and reinvestment as part of community plans. Pay particular attention to a community's historic assets and function in areas with under recognized historic resources or limited historic resources protections, such as the legacy village cores of Ashburn, Arcola, and Old Sterling (see Legacy Village Cores Map).	County Government, Planning & Zoning, Economic Development
1.1.D. Identify methods for ensuring developers will follow through on commitments to communities that are products of a facilitated engagement process between the developer and the surrounding neighborhoods and developments.	County Government, Planning & Zoning, Economic Development
1.1.E. Evaluate the creation of overlay districts to encourage reinvestment investment in priority/targeted areas where there is community support and buy-in.	County Government, Planning & Zoning, Economic Development
1.2.A. Conduct analysis of local market demands to determine what is needed to foster successful redevelopment.	Planning & Zoning, Economic Development
1.2.B. Identify priority redevelopment areas and targeted strategies through the community planning process.	Planning & Zoning
1.2.E. Develop strategies to address displacement and housing affordability, when redevelopment occurs.	Family Services, Planning & Zoning
1.2.H. Develop criteria, such as site constraints, important resources, and community amenity gaps, to identify infill sites appropriate for use as park, civic, and open space rather than private development.	Planning & Zoning, Transportation & Capital Infrastructure, Parks & Recreation

1.3.A. Identify and prioritize neighborhoods with an emerging need for reinvestment and work with these communities to identify needs and desires and build support for reinvestment.	County Government, Public-Private Partnership
1.3.B. Identify strategies to preserve and enhance a community's sense of place, social fabric, and historic assets and functions.	Planning & Zoning, Design Cabinet, Transportation & Capital Infrastructure
1.3.C. Identify, and include in the Capital Budget, capital facilities improvements necessary to support reinvestment in targeted areas.	County Government, Transportation & Capital Infrastructure, Planning & Zoning, Parks & Recreation
1.3.D. Identify and utilize funding sources for community reinvestment strategies.	County Government, Management & Budget
1.3.E. Educate the community about funding sources for home improvement and repair.	County Government, Family Services
1.3.G. Develop incentives that encourage the private sector to improve retail and commercial establishments in targeted areas.	Public-Private Partnerships, Economic Development, County Government
1.4.B. Develop and maintain a redevelopment webpage with information and resources for residents and developers.	Planning & Zoning
1.4.C. Develop flexible zoning regulations and design standards that account for existing conditions, allow for creative design and emerging development types, and provide certainty and clear direction for developers.	County Government, Planning & Zoning
1.4.D. Develop creative incentive programs for projects located within the priority areas for redevelopment identified on the Priority Commercial Redevelopment Areas Map and other qualifying projects, such as increases in permitted density where infrastructure is available, reduced fees, or expedited review processes.	Planning & Zoning, Building & Development
1.5.A. Evaluate and implement the use of fiscal tools to incentivize redevelopment, such as tax increment financing (TIF) and public improvement districts (PID).	County Government, Management & Budget, Economic Development
1.5.C. Direct public investment and resources to priority areas to facilitate redevelopment.	County Government
1.5.D. Establish programs to assist in business retention, expansion, and recruitment when commercial redevelopment projects occur.	Economic Development

1.6.B. Create incentives for parcel assembly and funding opportunities for infrastructure improvements associated with redevelopment projects to alleviate private sector risk and costs.	County Government, Economic Development, Transportation & Capital Infrastructure
1.7.A. Develop zoning regulations and design standards that emulate existing lot patterns in the village cores of Ashburn and Arcola with buildings oriented to the street, encouraging pedestrian activity.	Planning & Zoning
1.7.B. Develop zoning regulations and design standards that promote a mix of land uses including residential, retail, office, institutional, public facilities, parks, playgrounds and other uses in the village cores where such uses do not otherwise conflict with existing uses or anticipated noise impacts from Washington Dulles International Airport.	Planning & Zoning, Economic Development
1.7.C. Develop or maintain zoning regulations and design standards for the legacy village core of Ashburn that limit residential densities to four (4) units or fewer per acre.	Planning & Zoning
1.7.D. Develop zoning regulations and design standards that limit commercial, flex, or industrial building footprints to 10,000 SF and building heights to three (3) stories.	Planning & Zoning
1.7.E. Develop zoning regulations and design standards that discourage new automobile-oriented retail uses in the village cores.	Planning & Zoning
1.8.A Develop zoning regulations and design standards that discourage the displacement of legacy flex, industrial, and employment uses by new large-scale uses.	Planning & Zoning, Economic Development
1.8.B. Develop zoning regulations and design standards that expand opportunities for small-scale manufacturing in place types allowing flex, light industrial, industrial, and employment uses.	Planning & Zoning, Economic Development
1.8.C. Amend zoning use definitions in industrial, flex, and employment-centered zoning districts to accommodate makerspaces, emerging small-scale manufacturing sectors, and the marketing and retail of goods produced on-site.	Planning & Zoning, Economic Development
2.1.B. Establish collaborative programs and partnerships for adaptive reuse projects to foster entrepreneurship and encourage innovative ways to reuse buildings and sites.	Planning & Zoning, Economic Development
2.3.A. Review zoning regulations, design standards, and building code regulations to identify regulatory encumbrances to adaptive reuse projects.	Planning & Zoning, Economic Development
2.3.B. Develop zoning regulations and design standards that provide ample flexibility for adaptive reuse projects without compromising the health, safety, or welfare of users.	Planning & Zoning, Economic Development

Urban Policy Areas	
Action	Responsibility (Loudoun County Department or Agency)
3.1.A. Create partnerships with universities and private sector companies to foster growth of an Innovation District at the Loudoun Gateway Metrorail Station that supports workers and students in the advanced technology and science industries.	Economic Development, Public, Private & Vocational Schools, Colleges and Universities, Public-Private Partnership
Suburban Policy Area	
Action	Responsibility (Loudoun County Department or Agency)
1.1.A. Update the County's adopted Small Area Plans and create new Community Plans and other appropriate plans which address the particular needs and guide the remaining build-out and/or redevelopment of specific areas within the Suburban Policy Area.	Planning & Zoning, Economic Development
1.1.B. Establish design principles for individual communities within the Suburban Policy Area which ensure a high quality of development and redevelopment is achieved.	Planning & Zoning, Design Cabinet, Economic Development
2.1.A. Provide incentives for redevelopment, infill development, and adaptive reuse projects that will enhance quality of life and neighborhood character, fulfill community needs, and improve economic opportunities (see Infill and Redevelopment section).	County Government, Transportation & Capital Infrastructure, Economic Development
2.1.H. Create a regulatory framework that limits bed count and/or square footage of new housing unit to achieve affordability by design.	Family Services, Planning & Zoning, Economic Development

3.1.D. Establish an “opt-in” period to encourage owners of property in the Route 28 Highway Transportation Improvement District to opt into the updated/new Loudoun County Zoning Ordinance that is planned to be adopted to implement the 2019 Comprehensive Plan.	County Government
Transition Policy Area	
Action	Responsibility (Loudoun County Department or Agency)
1.1.B. Develop zoning regulations and design standards to accommodate Transition Community Centers and Transition Compact Neighborhood Place Types to expand housing diversity and improve commercial viability.	Planning & Zoning, Economic Development
1.1.C. Require new development to connect to Loudoun Water’s central water and wastewater systems and encourage existing development to connect.	Planning & Zoning, Health Department, Loudoun Water, General Services
1.1.H. Continue to perform watershed management plans to determine appropriate water quality and quality controls.	County Government, Planning & Zoning
1.1.I. Consider adoption of reservoir protection overlay districts that provide buffering and storm water quality controls.	County Government, Planning & Zoning
2.1.A. Develop a Master Plan for parks, open space, and shared-use trails in the TPA that: 1) builds on and links current planned trails and park areas, and 2) places greater emphasis on quality, connected, usable, and publicly accessible open space.	Parks & Recreation, Planning & Zoning, Transportation & Capital Infrastructure,
2.1.D. Establish programs and regulatory mechanisms to increase publicly accessible open space, consistent with County facilities plans, through easements, land dedications, and purchase.	County Government, Parks & Recreation, Planning & Zoning, General Services
3.1.A. Create new Community Plans and other appropriate plans which address the particular needs and guide development within the Transition Policy Area.	County Government, Planning & Zoning
4.1.C. Establish zoning regulations and design standards that ensure new development does not hinder the operation of quarries.	Planning & Zoning, Economic Development

Rural Policy Area	
Action	Responsibility (Loudoun County Department or Agency)
1.1.A. Provide incentives for the consolidation of underutilized or undeveloped small lots into larger parcels for agricultural and rural economy uses.	Planning & Zoning, Economic Development
1.1.B. Consider cost-share initiatives to assist in establishing conservation easements, in order to reduce the land that is available for residential development and to provide landowners with financial options to support working farms, rural economy uses, and/or stewardship of the land.	Economic Development, Private Land Conservation Trust, Public-Private Partnership
2.1.A. Evaluate and revise zoning regulations and design standards to improve the design of subdivisions and clustered residential development by incorporating natural features and buffering from roadway and scenic byways.	Planning & Zoning, Building & Development
3.1.A. Evaluate and revise zoning regulations and development standards for rural economy uses. Such regulations and standards will address traffic capacity, safe and adequate road access, number of employees, site design standards (e.g., land disturbance, buffering, use intensity, siting, and architectural features), and public health, safety, and welfare.	Planning & Zoning, Design Cabinet, Transportation & Capital Infrastructure
3.2.A. Adopt zoning regulations and design standards that include new types of rural business and agricultural uses, permit flexibility for the sale of farm products, and promote rural tourism, hospitality uses, and similar kinds of rural business uses that are compatible with the character of the RPA.	Planning & Zoning, Economic Development
3.2.B. Evaluate and revise zoning regulations and design standards to permit a variety of accessory residential unit types, such as accessory apartments for seasonal farm laborers and year-round tenant housing, that support the rural economy.	Planning & Zoning, Economic Development
3.2.C. Create zoning regulations and design standards for existing and new types of rural recreational uses to evaluate their appropriateness and ensure their compatibility with the character of the RPA.	Planning & Zoning
3.2.D. Develop County parks with trail networks, cross country courses, and equestrian riding rings or other equestrian-related features.	Parks, Recreation & Community Services
3.2.E. Develop a publicly accessible multi-use trail network (i.e., pedestrian, bicycle, and equestrian) to link private and public lands in the RPA in partnership with nonprofit entities, landowners, and developers of rural properties.	Parks, Recreation & Community Services

3.3.C. Develop additional incentives to retain and encourage agricultural enterprises and support land preservation.	Economic Development, Planning & Zoning, Building & Development
3.3.D. Retain the Rural Economic Development Council (REDC) as an advocacy and advisory committee on initiatives, programs, and policies that affect the economic growth and development of rural Loudoun County.	Economic Development
3.3.F. Develop a strategy to facilitate the development of high-speed wired and wireless telecommunication networks, including broadband technology, to support rural businesses and residents in the RPA.	County Government
3.3.G. Develop an update to ensure the Loudoun County Economic Business Development Strategy is updated on a regular basis.	Economic Development
3.4.A. Regularly review, update, and enhance the Land Use Assessment Program and other voluntary agricultural programs, such as the Agricultural and Forestal District (AFD) program, to strengthen the rural economy, preserve rural character, and maintain the viability of farming.	Commissioner of the Revenue, Planning & Zoning
3.5.A. Adopt zoning regulations and design standards that facilitate the use of existing agricultural and historic structures.	Planning & Zoning
3.7.A. Maintain zoning regulations and design standards that protect the right to farm.	Planning & Zoning, Economic Development

Rural Villages

Action	Responsibility (Loudoun County Department or Agency)
1.1.A. Develop criteria to evaluate existing Rural Historic Villages and other historic crossroads communities, such as Airmont, Bloomfield, Howardsville, Morrisonville, Unison and Willisville, to determine if their current designation is warranted, define and/or redefine community boundaries as necessary, and amend the Comprehensive Plan and Zoning Ordinance as appropriate.	Planning & Zoning, Economic Development, HDRC, Heritage Commission
1.1.B. Work with Rural Historic Villages to develop community plans that will support their community goals and address issues related to land use and zoning; economic development; natural, environmental, and historic resources; community facilities and services; water and wastewater; and transportation to maintain the character of the villages.	Planning & Zoning, Economic Development, HDRC, Heritage Commission
1.1.C. Evaluate and revise existing Rural Commercial (RC) zoning district regulations to implement Plan policies and design standards for development in the Rural Historic Villages that ensure compatibility with the settlement patterns and neighborhood scale.	Planning & Zoning

1.1.F. Evaluate and revise existing Rural Commercial (RC) zoning district regulations to implement Plan policies and design standards for commercial uses in the Rural Historic Villages that ensure compatibility with the settlement patterns and neighborhood scale.	Planning & Zoning
1.2.B. Evaluate the establishment of additional County Historic Districts in the Rural Historic Villages.	Planning & Zoning , Local Preservation Organizations
1.3.A. Adopt zoning regulations and design standards to encourage housing on smaller lots, allow accessory apartments attached to single-family residential units, and allow residential units above commercial/retail uses within the Rural Historic Villages to provide housing options.	Planning & Zoning and Family Services
1.4.A. Adopt zoning regulations, design standards and performance criteria that are specific to the types of small-scale, community-related commercial uses that the County encourages within the Rural Historic Villages.	Planning & Zoning, Design Cabinet

Towns and JLMA

Action	Responsibility (Loudoun County Department or Agency)
1.1.A. Continue to refer to jointly approved area management plans and refer to applicable Town policies on matters within the JLMA.	County Government
1.1.B. Establish a regular coordination program with Towns to anticipate, monitor, and address development and planning matters.	County Government
1.1.C. Undertake joint planning efforts in the JLMA.	County Government
1.1.D. Participate as a partner with the Towns in their negotiations with VDOT and other agencies for road maintenance, safety improvements, and traffic calming, particularly along Routes 15, 50, 7, 9, and 287 in proximity to the Towns, and other changes in roads and/or transportation services that are consistent with both the Town's and the County's goals and priorities.	County Government
1.1.E. Assess the effectiveness of the JLMA approach and associated zoning in protecting town character, maintaining a defining edge between the town and the rural areas, and/or as a tool for expanding economic development objectives. The defining edge is the boundary between two distinct land use patterns, whether	County Government

existing or desired. The edge may encompass an area that establishes a visual distinction, either as perceived from the road or from broader views of the landscape.	
1.1.F. Add provisions to the rural and JLMA zoning districts specific to gateway corridors leading into each town that would establish deeper building setbacks variable building and lot configuration and orientation, hedgerow landscaping and buffering along the road, and other measures that retain or create a traditional rural or natural appearance leading into the town.	County Government
1.1.G. Work with the Towns, interested group, and nonprofit foundations to identify open-space and agricultural-preservation strategies such as: donation of conservation easements, fee-simple purchase, clustering, and the possible creation of a conservation service district.	County Government
1.2.A. Encourage the maintenance, improvement, or adaptive reuse of existing building stock in a manner that supports social and economic diversity within the community.	County Government
1.2.B. Promote the commercial areas within the Towns as the preferred location of retail and service businesses, office development, and public and civic uses, as deemed appropriate by the Towns.	County Government
1.2.C. Work with the Towns to enhance their economic base and maintain viable commercial areas through marketing, capital investments, and business attraction.	County Government
1.2.D. Support annexations by the Towns when water and sewer extend into a JLMA in accordance with the annexation guidelines in this section and to resolve jurisdictional questions for property owners.	County Government
1.2.E. Encourage site layouts in a JLMA that extend the existing and planned development patterns of the Town and surrounding JLMA.	County Government
1.3.A. Encourage the continued use of existing public facilities located in the Towns and JLMA and seek to maintain existing community-based schools as an important social and economic component of the communities.	County Government
1.3.B. Cooperate with the Towns providing local law enforcement to ensure a coordinated enforcement strategy within the Town JLMA.	County Government
1.3.C. Support development of sidewalks and recreational, multi-use, and equine trails connecting the Towns to each other, to regional trail networks such as the W&OD and C&O Canal, and to area destinations.	County Government
1.4.A. Collaborate with the Town of Leesburg on locating new facilities in the Town or JLMA.	County Government

1.4.B. Maintain the planned land use of the JLMA consistent with Town of Leesburg land use policies; maintaining an emphasis on employment uses south of Route 7 and residential to the north of Route 7.	County Government
1.4.C. Prohibit power generation plants in the Leesburg JLMA.	County Government
1.4.D. Define the Town of Leesburg and JLMA as a distinct community separate from the Suburban and Rural Policy Areas by retaining rural policies and zoning to the north and south of the Town boundary and west of Evergreen Mills Road, and protecting the Goose Creek and Sycolin Creek floodplains to the east and south of the JLMA.	County Government
1.4.E. Preserve the rural character of the viewsheds along Route 15 as it approaches the Town of Leesburg from the north and south by encouraging additional conservation easements and instituting design guidelines.	County Government
1.4.F. Cooperate with the Town of Leesburg to complete the Potomac Heritage Trail and conserve open space along the Potomac River within the Town boundary and JLMA area.	County Government
1.4.G. Coordinate with the Town of Leesburg and VDOT on the feasibility of planning and building Edwards Ferry Road as a two-lane facility with on-road bicycle accommodations. The County will work with the Town and VDOT to designate the road as a scenic by-way.	County Government
1.4.H. Protect the viability of the Leesburg Airport by ensuring development in the JLMA does not impede Airport operations by continuing to prohibit residential development inside the 65 Ldn noise contour.	County Government
1.5.A. Maintain the Town of Hamilton authority over subdivision applications within 1 mile of its corporate limits.	County Government
1.5.B. Work with the Town of Hamilton to update the Comprehensive Plan for the Town and JLMA after the adoption of the <i>Loudoun County 2019 Comprehensive Plan</i> (within 2 years).	County Government
1.5.C. Support the Town of Hamilton efforts to develop an identifiable town center to serve as a community focal point for the Town of Hamilton and the JLMA.	County Government
1.5.D. Seek to improve street connectivity as the redevelopment and infill development occur in the JLMA and connect to the existing streets in the Town of Hamilton, where feasible, with roads that are compatible with traditional town designs.	County Government
1.5.E. Work with the Town of Hamilton to effectively manage transportation systems around the Town and to explore methods of traffic calming on Business Route 7 through town including the possible use of a traffic circle at Route 7 and St. Paul Street.	County Government

1.5.F. Maintain a distinct identity for the greater Hamilton community separate from the adjacent rural areas by establishing a greenbelt around the Town of Hamilton and the JLMA using conservation easements, passive and active parks and other means.	County Government
1.5.G. Work with the Town of Hamilton to achieve a balanced land use pattern that will retain Hamilton's historic small-town character in a rural setting and maintain its unique sense of place.	County Government
1.5.H. Work with the Town of Hamilton to plan for a shared-use trail connecting to the Town of Purcellville.	County Government
1.6.A. Encourage the establishment of a greenbelt around the Town using conservation easements, development design techniques and other means to help maintain the distinct edge and rural community identity of the Town of Hillsboro.	County Government
1.6.B. Support the development of entry features into the town, to enhance the identity of the Town of Hillsboro as a gateway community.	County Government
1.6.C. In recognition of Hillsboro's historic role and future development as the center of a robust agricultural region, support expanded productive farming and rural economic development that will encourage new farmers, preserve and expand area farmland, boost tourism, stimulate county and regional markets for locally produced products and jobs, and expand entrepreneurial opportunities to Hillsboro area residents.	County Government
1.6.D. Encourage the preservation of the natural, environmental, and heritage resources that contribute to the identity of Hillsboro.	County Government
1.6.E. Oppose any increase in density and development outside of the Town of Hillsboro that does not retain the low density, farm landscape that provides the historic rural context for the Town.	County Government
1.6.F. Work with the Town of Hillsboro and with VDOT to establish context-sensitive roadway design standards and to identify short and long-term solutions for improving the safety of Route 9 in western Loudoun and through Hillsboro that do not compromise the rural character of Hillsboro.	County Government
1.6.G. Promote safety measures for pedestrians, cyclists, and farm vehicles along and across Route 9, Route 690, Route 719, and Route 812.	County Government
1.6.H. Work with the Town of Hillsboro to establish a safe and adequate water supply and modern community wastewater collection and treatment system.	County Government

1.7.A. Retain and recruit businesses that serve the needs of Lovettsville and northern Loudoun County residents and align with Town plans.	County Government
1.7.B. Collaborate with the Town of Lovettsville in the planning and regulation of development along Route 287 north and south of Lovettsville to protect the scenic quality and the rural character of the road as it approaches the Town.	County Government
1.7.C. Link the County's greenways and trails system with the Town of Lovettsville's internal trail and bikeways network to link Lovettsville with the C&O Canal in Brunswick, Maryland, and the W&OD bike path in Purcellville.	County Government
1.7.D. Plan the location and design of County facilities within Lovettsville, in consultation with the Town of Lovettsville.	County Government
1.7.E. Collaborate with the Town of Lovettsville and VDOT on transportation planning in and around Lovettsville to improve traffic safety in the Town of Lovettsville and to improve regional road networks and access to employment centers.	County Government
1.7.F. Cooperate with the Town of Lovettsville, pursuant to County/Town Annexation Agreement/Corporate Boundary Line Adjustment Guidelines on boundary-line adjustments to resolve jurisdictional questions, to serve public and civic uses, and to support the Town of Lovettsville's economic goals and priorities.	County Government
1.8.A. Collaborate with the Town of Middleburg on zoning and development activities outside the Town but in its vicinity, with the goal of preserving the rural character of its gateways and surrounding environs.	County Government
1.8.B. Be an active partner with the Middleburg community and interested preservation groups to identify open-space and agricultural preservation approaches such as conservation easements, land acquisition, and development standards to promote and implement open-space preservation around the Town of Middleburg that helps establish a greenbelt and protect the rural appearance of roadways leading into the Town.	County Government
1.8.C. Protect rural roads and scenic views through measures such as revised state road improvement standards; scenic easements; historic corridor overlay zoning for John Mosby Highway (Route 50), Foxcroft Road (Route 626), and the Plains Road (Route 626); and development setbacks.	County Government
1.8.D. Assist, when requested, in the promotion of tourism, as a means of increasing public support for preservation of the scenic and historic Middleburg area.	County Government
1.8.E. Work with the Town of Middleburg to implement strategies that will preserve and enhance agriculture as the predominant use in the RPA around Middleburg.	County Government

1.9.A. Establish a “defining edge” by implementing the uses and development pattern of the Rural North Place Type and by identifying the lands adjacent to the Town of Purcellville as priority open space areas for conservation easements.	County Government
1.9.B. Work with the Town of Purcellville to plan for a trail extension that connects the W&OD Trail with Franklin Park.	County Government
1.9.C. Include setbacks, height limitations, and landscaping standards along Route 7, Route 287, and the Route 7 Bypass to establish and maintain a greenbelt or defining edge around the Town of Purcellville characterized by open space and tree-lined roadways.	County Government
1.9.D. Encourage the use of frontage roads, coordinated development plans, and other means of minimizing the number of driveways along Route 7 and Route 287 leading into Purcellville.	County Government
1.9.E. Encourage new commercial uses to locate in the Town of Purcellville before locating in the JLMA.	County Government
1.9.F. Encourage owners of historic projects in the JLMA to place properties into a Purcellville or County Historic District.	County Government
1.9.G. Protect historic structures in the context of their natural settings.	County Government
1.9.H. Work with the Town of Purcellville to expand broadband connectivity for citizens and businesses.	County Government
1.10.A. Development within the Round Hill JLMA will comply with the Round Hill Area Management Plan and Round Hill Comprehensive Plan and adopted policies applicable to the JLMA.	County Government
1.10.C. Encourage housing for the elderly that will allow residents to remain in the Town of Round Hill.	County Government
1.10.D. Encourage rural economy business development in the greater Round Hill Area to provide local goods, services and jobs to Town of Round Hill residents and visitors.	County Government
1.10.E. Oppose any increase in density and development outside of the JLMA that is not consistent with the traditional rural character of western Loudoun County.	County Government
1.10.F. Avoid high density development between the current boundaries of Purcellville and Round Hill and expand open space around Franklin Park to help maintain a greenbelt between communities.	County Government
1.10.G. Enhance the gateways to the Town of Round Hill by developing features or retaining a clear distinction between the surrounding rural area and the edge of the town. Techniques may include measures to protect existing	County Government

trees, hedgerows, viewsheds, and vistas; design guidelines for lot configuration to retain the rural lot pattern; new landscaping and entrance features and other techniques.	
1.10.H. Support development of sidewalks, trails, and linear parks that connect civic and public facilities with residential and commercial neighborhoods in the Town of Round Hill and JLMA and extend to Franklin Park and the W&OD Trail.	County Government
1.10.I. Coordinate transportation planning with the Town of Round Hill to ensure that traffic generated from development within the County does not adversely affect Round Hill. The County will work with the Town of Round Hill on traffic calming measures.	County Government
2.2.A. Prior to approval of development in the JLMA beyond current zoning, require written assurance from the central system provider or the adjacent town, for a municipal system, that water and sewer will be provided.	County Government
2.2.B. Consider potential impacts of surrounding development on Town wells during the development review process.	County Government
2.2.C. Any future expansion of municipal (Town) sewer and water into the County JLMA will support development that is consistent with the goals and policies of the County and Town adopted plans.	County Government
2.2.D. Retain the option to use shared or alternative sewer and water facilities to serve Town and County owned and operated public facilities upon agreement between the Town and the County.	County Government
2.2.E. Permit the extension of municipal sewer and water into the Rural Policy Area only to serve public facilities or to address a potential public health risk. (See also, Chapter 6, Fiscal Management and Public Infrastructure, Rural Sewer and Water)	County Government

Chapter 3

Natural, Environmental, and Heritage Resources

Action	Responsibility (Loudoun County Department or Agency)
1.1.C. Adopt zoning regulations and development standards that implement a process identifying natural, environmental, and heritage resources worthy of preservation and developing around those resources as part of all land development.	Planning & Zoning

1.1.D. Update the <i>Facilities Standards Manual</i> , the <i>Land Subdivision and Development Ordinance</i> , and other development standards to implement the natural, environmental, and heritage policies in this Plan.	Building & Development and Planning & Zoning
1.1.G. Direct public investment and resources toward completing a natural, environmental, and heritage resource network and recapturing natural and heritage resources in developed areas.	Public-private partnerships
1.2.A. Study and, if feasible, aid in the establishment of a public-private conservation partnership to facilitate communication, grants, easements, education, and partnership opportunities to conserve and protect natural, environmental, and heritage resources.	Planning & Zoning, Management & Budget
1.3.A. Provide incentives for innovative design and support collaborative public-private-community partnerships for program implementation including provisions for awards of certificates of excellence in environmental design for the public and private sectors.	Planning & Zoning, Economic Development

River and Stream Corridor Resources

Action	Responsibility (Loudoun County Department or Agency)
2.1.A. Amend zoning regulations and development standards, including but not limited to the Floodplain Overlay District (FOD) and Scenic Creek Valley Buffer sections, to address the objectives of the RSCR policies. Zoning regulations and development standards will establish performance standards and best management practice (BMP) requirements to ensure the health and biological integrity of the river and stream corridors and minimize adverse impacts.	Building & Development, Planning & Zoning
2.1.B. Develop and implement a watershed management plan for each watershed, establishing development guidelines and performance standards to protect water quality.	Building & Development
2.1.C. Establish appropriate regulations for Catoctin Mountain, Short Hill Mountain, and the Blue Ridge Mountains to limit diversions of water from the Catoctin and Goose Creek headwaters and prevent stream pollution.	Building & Development, Planning & Zoning
2.1.E. Work with the incorporated towns, Loudoun Water, and other organizations and agencies to establish overall water quality goals and specific standards for individual streams and river and stream corridors, consistent with County RSCR objectives and policies.	County Government
2.2.A. Amend zoning regulations and development standards to establish a minimum 100-foot stream buffer to protect rivers and streams when floodplains and adjacent steep slopes do not extend beyond either bank by 100 feet.	County Government, Building & Development

2.2.B. Amend zoning regulations and development standards to establish a 50-foot management buffer as part of the RSCR surrounding floodplains and adjacent steep slopes. Specific criteria for allowable reductions in the 50-foot management buffer should be included to ensure that reductions do not adversely impact the other elements of the RSCR. The RSCR 50-foot management buffer will not be added to the 100-foot minimum stream buffer.	County Government, Building & Development
2.2.C. Develop and use incentives to encourage property-owners to establish and maintain a 100-foot minimum riparian stream buffer.	County Government, Building & Development
2.3.A. Develop appropriate standards and regulations to protect natural streams from the harmful effects of increased stormwater volume, velocity, and pollutant loads resulting from development.	County Government, Building & Development
2.3.C. Establish incentives and/or a funding program for reforestation, SWM/BMP projects, and SWM/BMP retrofits.	County Government, Building & Development
2.3.F. Support and incentivize reforestation for degraded forested areas in upper stream reaches that do not include Major Floodplain and promote natural regeneration within the limits of the Major Floodplain to mitigate the loss of native canopy coverage as a result of construction.	County Government, Building & Development
2.3.G. Develop and maintain standards for activities that propose pollution sources such as the storing and dispensing of fossil fuels, chemical storage, and sale or transfer of potential contaminants.	County Government, Building & Development
2.4.D. Prepare and implement TMDL Action Plans, as necessary to meet TMDL requirements. The Action Plans, designed to improve the County's surface water quality may include working with other entities, such as the Loudoun Soil and Water Conservation District (LSWCD) and Virginia Cooperative Extension-Loudoun (VCE-Loudoun).	County Government, Building & Development
2.5.C. Develop and implement a watershed overlay district for all public water supply reservoir watersheds, establishing more stringent development guidelines and performance standards to protect water quality.	County Government, Building & Development

2.5.D. Develop and implement a Potomac River shoreline management plan and seek to coordinate this effort with adjacent jurisdictions (local, state, and regional organizations, advisory boards, and citizen groups). This plan should include:	County Government, Building & Development
<ul style="list-style-type: none"> i. The boundaries of the study area, ii. A comprehensive natural resources inventory, iii. Existing and proposed private/public water access entry points, iv. Policy recommendations for river corridor management and protection, v. A process for integrating the participating groups, and vi. A plan for acquiring and managing open space corridors along the Potomac River. 	
2.5.E. Establish appropriate standards and land uses in consultation with Loudoun Water and/or incorporated towns to protect drinking water supplies.	County Government, Building & Development
2.5.F. Develop a community-based Source Water Protection Plan in cooperation with Loudoun Water and other agencies and organizations.	County Government, Building & Development
2.6.A. Develop and implement a comprehensive groundwater protection strategy to ensure adequate and sustainable water supply.	County Government
2.6.B. Develop and implement a comprehensive pollution management program to monitor and protect groundwater resources.	County Government, Building & Development
2.6.F. Assess the recharge and consumption rates for groundwater in each watershed by analyzing data from groundwater level monitoring and stream flow measurements. If negative impacts are detected, the information will be presented to the Board of Supervisors for appropriate action.	County Government
2.6.G. Develop standards for uses that consume and/or require the usage of large quantities of water in those areas that could affect neighboring wells and aquifers.	County Government
2.6.I. Study best practices/guidelines to reduce impervious surfaces and minimize increases in post-development runoff peak rate, frequency, volume.	County Government

Soils and Geological Resources	
Action	Responsibility (Loudoun County Department or Agency)
3.1.E. Identify pollution sources and establish appropriate standards for reducing pollution in areas underlain by limestone.	County Government, Building & Development, Planning & Zoning
3.2.A. Develop a public education program that will focus on communicating advantages associated with private protection of Prime Agricultural Soils.	County Government, Building & Development
3.3.H. Review and amend zoning regulations and development standards to ensure consistency with the mountainside area policies.	County Government, Building & Development, Planning & Zoning
3.3.I. Establish performance standards for unavoidable development on questionable soils as defined by the International Building Code.	County Government, Building & Development, Planning & Zoning
Forests, Trees, and Vegetation	
Action	Responsibility (Loudoun County Department or Agency)
4.1.B. Incentivize and encourage the preservation of existing trees within required landscape buffer areas and for screening of uses.	County Government, Building & Development, Planning & Zoning
4.1.C. Require the removal of invasive plant species during the development process.	County Government, Building & Development, Planning & Zoning
4.1.D. Develop and adopt a Tree Preservation Ordinance.	County Government, Building & Development, Planning & Zoning

4.1.E. Inventory and map trees and native vegetative resources to be preserved or managed in accordance with County standards and create and maintain a database of these resources to include, but not be limited to, old growth forests, significant tree stands, specimen trees, heritage trees, and State or National Champion trees.	Building & Development and Mapping & Geographic Information
4.2.A. Prioritize the planting of native vegetation, specifically along those corridors that provide connections to other natural, environmental, and heritage resources.	County Government, Building & Development, Planning & Zoning
4.2.B. Develop Countywide goals and objectives for the creation, maintenance, and preservation of the County's tree canopy.	County Government, Building & Development, Planning & Zoning

Historic, Archaeological, and Scenic Resources

Action	Responsibility (Loudoun County Department or Agency)
5.1.B. Evaluate the <i>Heritage Preservation Plan</i> every five years and update if necessary.	Planning & Zoning, HDRC, Heritage Commission
5.1.C. Require an archaeological and historic resources survey for all development applications. This survey must include a plan for recordation of identified resources and measures for preservation, mitigation, and adaptive reuse. The County will maintain a repository for artifacts recovered from required surveys; such artifacts will be used for research and public education purposes.	County Government, HDRC, Heritage Commission
5.1.D. The County will update its cultural resource inventory through the land development process and County-sponsored historic surveys.	County Government, HDRC, Heritage Commission
5.1.E. Evaluate the historic or archaeological value of inventoried resources based on criteria set forth in the Secretary of the Interior's Standards for Archaeology and Historic Preservation, which include historic context and site integrity. The County will evaluate resources for consideration for state and National Registers. Identify, through survey and community outreach, locally important historic and archaeological resources that meet criteria for listing on the County Heritage Register as outlined in the <i>Heritage Preservation Plan</i> .	County Government, HDRC, Heritage Commission
5.1.F. Identify, delineate, and map historic cemeteries, burial grounds, and graves to ensure they are protected from destruction or neglect. Ensure that adequate buffers are provided around these sites to protect them during the development process.	Mapping & Geographic Information, HDRC, Heritage Commission

5.1.G. Identify African American and Native American cultural resources, document them in the County's database of heritage resources, and create policies and programs that protect, preserve, and interpret these resources for the benefit of County residents.	Planning & Zoning, HDRC, Heritage Commission
5.1.I. Conduct a staff assessment to determine historic significance prior to issuing a demolition permit for a structure that is 50 years old or older.	Planning & Zoning, HDRC, Heritage Commission
5.1.M. Prioritize the adaptive reuse of historic structures that are of local, regional, or national significance as the primary method of preserving the County's diverse collection of historic architecture within the framework of sustainable development.	Planning & Zoning, HDRC, Heritage Commission
5.1.N. Amend zoning regulations and development standards to ensure the viability of adaptive reuse, particularly in the County's villages where the ability to reuse historic structures is vital to the historic character and vitality of these communities.	Planning & Zoning, HDRC, Heritage Commission
5.1.O. Prepare and implement corridor management plans, including identifying and defining viewsheds for the County's Scenic Rivers in order to protect their natural and scenic quality.	Mapping & Geographic Information, Planning & Zoning, HDRC, Heritage Commission
Natural Heritage Resources	
Action	Responsibility (Loudoun County Department or Agency)
6.2.B. Identify essential wildlife corridors and encourage protection of these areas through conservation easements acquired by the County or others, participation in the Open Space Preservation Program, development design, and other means.	County Government

Complementary Elements	
Action	Responsibility (Loudoun County Department or Agency)
7.1.B. Evaluate and implement methods to reduce emissions of airborne pollutants including particulates, greenhouse gases, ozone precursors, and other gases known to adversely affect human and environmental health.	County Government, Planning & Zoning, Building & Development
7.2.D. Continue to enforce and update with the most current information, as appropriate, the Airport Impact Overlay District included as part of the Loudoun County Zoning Ordinance.	County Government
7.2.F. Consider replacing the existing noise contours for Washington Dulles International Airport to reflect the noise contours in the 2019 Washington Dulles International Noise Contour Map Update. [Implemented with CPAM-2021-0001, ZMAP-2021-0011, and ZOAM-2021-0002, Airport Impact Overlay District Update. However, the Ldn 65 or higher aircraft noise impact area is revised to exclude areas already approved for residential development through proffered rezoning.]	County Government
7.3.A. Update lighting standards. <i>(See Chapter 3 for more information)</i>	County Government, Building & Development
Sustainability	
Action	Responsibility (Loudoun County Department or Agency)
8.1.A. Update and implement the County Energy Strategy (CES) to account for rapid growth in population and high energy demand uses, technological changes allowing improved energy storage, changing renewable energy markets, and the impacts of climate change.	General Services, Transportation & Capital Infrastructure, Planning & Zoning
8.1.D. Use the data from benchmarking the energy use to set policy and regulations in the County.	General Services
8.1.E. Whenever feasible, build County-constructed facilities to LEED Silver, or equivalent, standards.	General Services, Building & Development
8.1.G. Continue to monitor the efforts of MWCOG.	County Government
8.1.I. Incorporate natural, environmental, and heritage resources and BMPs into County Energy Strategy.	General Services,

	Planning & Zoning
8.1.L. Develop a Sustainability Plan for the County that provides the framework to balance economic development, social well-being, and environmental health.	County Government, General Services, Planning & Zoning
8.2.B. Research and support opportunities for micro-grid energy and district energy systems.	General Services
8.2.D. Prioritize public investment in energy efficient, clean products, and infrastructure.	General Services
8.3.A. Create partnerships with universities and private sector companies to foster growth of a sustainable economy that supports workers and students in the advanced technology and science industries.	County Government LCPS, Local Sustainability Organizations, Public-Private Partnership
9.1.B. Establish incentives for sustainable development.	Planning & Zoning, Building & Development
9.5.A. Adopt solar zoning and permitting best practices for accessory use solar development.	Planning & Zoning, Building & Development
9.5.B. Become certified as a “solar-ready” community under the Department of Energy’s SolSmart program.	General Services

Chapter 4

Housing

Action	Responsibility (Loudoun County Department or Agency)
1.1.B. Amend zoning regulations to accommodate more innovative and flexible density, building height, lot size, lot line, parking, setback, and design standards through the implementation of a planned unit development (PUD) ordinance.	County Government, Planning & Zoning, Family Services
1.1.D. Develop zoning regulations and design standards that facilitate innovative, lower cost, compact residential and mixed-use development that emphasizes the physical form and the character of the built environment and seamlessly integrates uses.	County Government, Planning & Zoning, Family Services, Building & Development

1.1.E. Amend zoning regulations and design standards to permit accessory housing product types (e.g., carriage houses, accessory apartments, and cottages) in residential and mixed use zoning districts and incentivize the integration of universal design features in accessory units.	County Government, Planning & Zoning, Family Services, Building & Development
1.1.F. Amend zoning regulations to expand the number of districts where manufactured housing, accessory units, and alternative housing types are allowed (e.g., small lot, zero lot-line, micro-units, maximum unit sizes, and innovative housing types).	County Government, Planning & Zoning, Family Services, Building & Development
1.1.G. Develop regulations and standards by which affordable housing development can be approved as a by-right use.	County Government, Planning & Zoning, Family Services, Building & Development
1.2.A. Amend zoning regulations and design standards to incorporate density bonuses and other incentives into appropriate zoning districts to encourage the provision of housing to address the County's unmet housing needs in areas currently served by or planned for mass transit.	County Government, Family Services, Planning & Zoning
1.3.A. Identify alternatives in calculating the costs of development for the impact on capital facilities (such as a rating system) to reduce costs and to encourage diversity in unit types produced. Explore the use of square footage and/or number of bedrooms to assess capital facility costs associated with a broad range of unit types to encourage the development of needed unit types (for example, studio and one bedroom apartments, smaller homes).	County Government, Family Services, Planning & Zoning
1.4.A. Amend zoning regulations and design standards to incentivize the integration of universal design elements in residential units and in the design of neighborhoods.	County Government, Family Services, Planning & Zoning
1.5.B. Incentivize the provision of age-restricted housing units for residential or mixed-use development proposals in transit centers and other areas planned for an integrated mix of uses to support older adults' option to live in close proximity to transit, retail, service, and entertainment uses.	County Government, Family Services, Planning & Zoning
1.6.A. Provide incentives to encourage zoning map amendments or zoning concept plan amendments on previously entitled properties that increase the provision of a mix of smaller housing types and affordably priced housing.	County Government, Family Services, Planning & Zoning County Government, Family Services, Planning & Zoning

1.6.B. Research and implement effective incentives, such as appropriate density increases for the provision of housing focused on the County's unmet housing need proximate to major employment centers and public transit such as Silver Line Metrorail stations, as well as the offset of capital facilities contributions to reduce housing development costs to foster a continuum of housing affordability for workers in Loudoun.	County Government, Family Services, Planning & Zoning
1.7.A. Develop zoning regulations and design standards to implement form-based approaches for infill and redevelopment areas that facilitate the development of "missing middle" housing product types and affordable prices.	County Government, Family Services, Planning & Zoning
2.2.A. Create an inventory of housing stock using County assessment data that identifies the type of unit, its location within the County, and general characteristics of the units.	County Government, Family Services, Planning & Zoning
3.1.A. Develop an Unmet Housing Needs Strategic Plan, consistent with the adopted <i>Loudoun County 2019 Comprehensive Plan</i> , that specifically identifies strategies, actions, programs, and best practices to address the County's current and future unmet housing needs. Such plan should include, but is not limited to, down-payment assistance programs, utilization of housing trust funds, and home purchase programs, and should be developed prior to the approval of any zoning map amendments requesting higher densities planned in the Urban Policy Area outside the Metrorail Service Districts, Suburban Policy Area, and the Transition Policy Area. The plan would include estimates on unmet housing needs, establish development targets, and evaluate how housing programs address those needs every five years.	County Government, Family Services, Planning & Zoning
3.1.C. Develop zoning regulations and design standards that remove barriers and incentivize the development of housing affordable to households at or below 100 percent AMI in all residential and mixed-use development.	County Government, Family Services, Planning & Zoning
3.1.D. Reduce capital facilities proffer expectations as a means of incentivizing the provision of housing affordable to households earning less than 100 percent AMI in new transit-oriented development.	County Government, Family Services, Planning & Zoning County Government, Family Services, Planning & Zoning
3.1.E. Create an expedited permit process to fast-track applications for developers who commit to providing additional units affordable to households earning less than 100 percent AMI.	County Government, Family Services, Planning & Zoning
3.1.F. Provide incentives such as those included in the Affordable Dwelling Unit regulations of the Zoning Ordinance to support Low Income Housing Tax Credit projects to encourage zoning map amendments or zoning	County Government, Family Services, Planning & Zoning

concept plan amendments for properties subject to previous legislative zoning approvals when they increase the provision of housing affordable to households earning less than 100 percent AMI.	
3.1.G. Strengthen Affordable Dwelling Unit regulations in the Loudoun County Zoning Ordinance and the County Codified Ordinances, to the greatest extent that the Code of Virginia allows, to increase the development of housing that helps address the County's unmet housing needs in all residential and mixed-use development.	County Government, Family Services, Planning & Zoning
3.1.I. Develop effective incentives that enable development to meet unmet housing needs to include housing for households with incomes at or below 30 percent AMI and 50 percent AMI, which is the area of greatest need.	County Government, Family Services, Planning & Zoning
3.2.A. Identify and designate dedicated local funding sources to support the County's plan to provide a continuum of housing.	County Government, Family Services, Planning & Zoning
3.4.A. Expand and increase the funding for the Down Payment and Closing Cost Assistance and Public Employee Grant programs to help households earning up to 100% AMI purchase a home.	County Government, Family Services, Planning & Zoning
3.4.B. Create and implement home buyer readiness financial literacy classes to help educate first-time home buyers.	County Government, Family Services, Planning & Zoning
3.4.D. Work with employers located in the County to develop workforce housing financial assistance programs such as direct loans, gap financing, revolving loans, credits, and grants.	County Government, Family Services, Planning & Zoning
3.5.B. Develop a housing ambassador program to Loudoun's incorporated towns to raise awareness and provide technical assistance to assist them in establishing and maintaining programs that address their unmet housing needs.	County Government, Family Services, Planning & Zoning
3.5.C. Conduct regular focus groups with the building industry, the CEO Cabinet, and major employers.	County Government, Family Services, Planning & Zoning
3.5.D. Convene an Annual Housing Summit to check in with stakeholders on issues and successes.	County Government, Family Services, Planning & Zoning
3.5.F. Implement a robust community outreach plan to promote the importance of housing to Loudoun's quality of life and the economy.	County Government, Family Services, Planning & Zoning

Chapter 5

Economic Development

Action	Responsibility (Loudoun County Department or Agency)
1.5.A. Embed staffing resources in each cluster/overlay to attract or expand businesses using industry expertise, relationships, and earned reputation.	County Government, Economic Development, Planning & Zoning
1.5.D. Create mechanisms for the rural economy to maintain its status as a regional agricultural leader and local advantage.	County Government, Economic Development
1.5.G. Strategically use economic incentives as needed for attraction and retention.	County Government, Economic Development, Planning & Zoning
2.6.A. Establish “Technology Zones” for the encouragement of new and expanding technology businesses.	County Government, Economic Development, Planning & Zoning
2.6.C. Periodically update the County’s zoning regulations and design standards to keep pace with innovation in the marketplace.	County Government, Economic Development, Planning & Zoning
3.4.C. Develop programs to incentivize construction of attainable workforce housing.	County Government, Economic Development, Planning & Zoning
3.4.D. Consider using the Economic Development Authority for property acquisition to bank land for public-private partnerships on workforce housing projects.	County Government, Economic Development, Planning & Zoning
5.2.A. Establish “Tourism Zones” that would enable the County to provide tax incentives and regulatory, and would provide a mechanism to assist developers of authorized tourism projects to obtain gap financing and make payments thereon.	County Government, Economic Development

Chapter 6

Fiscal Management and Public Infrastructure

Action	Responsibility (Loudoun County Department or Agency)
1.1.B. Co-locate public safety and other public facilities whenever it will improve service efficiencies.	Board of Supervisors, Transportation & Capital Infrastructure
1.1.G. Establish an expansion plan for the Fire and Rescue Training Academy based on a needs assessment of the existing campus as the needs of LCFR and the County increase. Ensure the requirements of Fire and Rescue training remain a priority during the development of surrounding areas.	County Government, Transportation & Capital Infrastructure, Fire and Rescue
1.3.J. The County will acquire school sites in advance of LCSB's recognized short and long-term future needs to minimize school transportation costs and to structure future planned growth.	Transportation & Capital Infrastructure, Loudoun County School Board
1.4.B. Support the acquisition of land and development of facilities such as the Potomac Heritage National Scenic Trail.	Board of Supervisors
1.4.C. Work with the United States Department of the Interior, the Virginia Tech Conservation Management Institute, the Virginia Department of Historic Resources, NOVA Parks, and other local, regional, and state organizations and the incorporated Towns to define and recommend areas for open space preservation and development of a trail network that links the County's natural, historic, and recreational resources.	County Government
1.4.H. Identify opportunities, such as public/private partnerships and co-location, to work with the private sector to provide public facilities.	Public –Private partnerships
2.1.A. Create and maintain development regulations that require an adequate water supply, such as dry hydrants or tanks, for new residential subdivisions of more than five dwelling units when an alternative water source is not available on site.	County Government, Fire and Rescue
2.1.B. Encourage and offer incentives to voluntarily provide sprinklers in new residential construction.	County Government, Fire and Rescue

2.2.C. Establish a program that retrofits existing traffic signals, subject to VDOT approval, with signal preemption equipment to provide priority access to emergency vehicles responding to a call.	County Government, Fire and Rescue
2.2.E. Ensure that development regulations address the installation and maintenance of emergency apparatus access roads for fire and rescue resources.	County Government, Fire and Rescue
3.1.B. Establish programs and regulatory mechanisms to increase publicly accessible open space through easements, land dedications, and purchase; ensure that such programs and mechanisms are consistent with County facilities plans.	Parks, Recreation & Community Services
3.1.H. Seek through public purchase, proffer, donation, or third-party easement, the preservation of natural areas and the development of linear parks, recreation space, and trails.	Parks, Recreation & Community Services
3.1.I. Continue the Open Space Preservation Program, to the extent permitted by Virginia Code Section 15.2-2303.4, linking the loss of open space associated directly with low-density land use to the provision of open space or funds towards the purchase of open space that provides publicly accessible and usable open space. (See more information in Chapter 6)	Board of Supervisors
3.1.J. Institute a program whereby the County facilitates acquisition of conservation easements by others by providing assistance such as a revolving loan program to reduce or defer the landowner cost of establishing conservation easements. The program should emphasize protecting the priority open space areas that are identified in this Plan that are not otherwise protected.	Planning & Zoning, Building & Development
3.1.K. Encourage protection of the following priority open space areas through conservation easements acquired by the County or others, participation in the Open Space Preservation Program, development design, and other means.	Board of Supervisors, Planning Commission, Planning & Zoning
3.1.L. Amend the zoning ordinance and development regulations as needed to permit a percentage of the open space required on an individual site to be met through off-site permanent open space that creates a more usable, desirable, or environmentally significant open space (see 3.1.J, above) located in the same planning subarea identified in the latest Capital Needs Assessment.	Board of Supervisors, Planning Commission, Planning & Zoning
4.1.A. Pursue funding sources to rehabilitate homes that currently lack adequate sewer and water systems.	Board of Supervisors
4.2.B. Prohibit connection to water distribution and wastewater collection systems when such requires crossing land outside a defined water or sewer service area, except as allowed herein.	Board of Supervisors
4.4.C. Expand the use of Loudoun Water's reclaimed water network.	Board of Supervisors, Loudoun Water

4.4.G. Construct new central wastewater and water lines and facilities in a manner that causes the least environmental risk and visual disruption.	Board of Supervisors, Health Department
4.5.A. Prohibit extension of central water and wastewater service into the Rural Policy Area, except to address a public health threat to an existing rural community or to serve public facilities on contiguous parcels immediately adjacent to the western boundary of the Transition Policy Area.	Board of Supervisors
4.5.B. Institute a wellhead protection program in all areas not served by central system facilities to ensure adequate water quality.	County Government
4.5.F. Implement an inspection and maintenance program for conventional on-site sewage disposal systems and provide homeowner educational materials on this and related well and septic safety for residents in the Rural Policy Area, particularly in the Limestone Overlay District.	County Government
4.6.A. Implement water and wastewater treatment and disposal standards for alternative systems that protect water quality.	County Government
4.6.D. Require Loudoun Water to own and operate all public community water and wastewater systems with more than 15 connections.	General Services, Loudoun Water
5.1.C. Develop a hazardous waste education program and increase residential access to the safe disposal of hazardous waste to protect groundwater resources.	County Government
6.1.A. Establish zoning regulations and design standards that permit alternative electrical generation such as wind and solar generation by and for individual users.	Planning & Zoning
6.1.C. Work with electrical providers to identify potential high voltage distribution lines and substation locations that minimize impacts on key travel corridors, sensitive cultural and historic resources, and existing residential communities or to place high voltage distribution lines underground when approaching such areas; and where possible, use existing transmission corridors and substation sites to expand capacity.	Planning & Zoning, Building & Development
7.1.A. Review and update the County's <i>Strategic Land Use Plan for Telecommunication Facilities</i> to facilitate the expansion of fiber and broadband service throughout the County.	Planning & Zoning
7.1.B. Adopt zoning regulations and design standards requiring open access conduit to all development projects to facilitate future broadband extensions.	Planning & Zoning

7.1.C. Establish performance standards for wireless communication facilities to minimize the need for legislative action.	Planning & Zoning
8.1.B. Direct the majority of public investments into currently developed communities, Towns and non-residential areas of the County where development is planned according to the Comprehensive Plan and give priority to the redevelopment and enhancement of existing infrastructure, capital facilities, and services.	Board of Supervisors
8.1.C. Where permitted, continue to seek private sector support for improvements or provision of current and future public facilities and sites, including proposals of cash and in-kind assistance for public facilities in addition to the timely provision of dedicated sites.	Board of Supervisors
8.1.D. Seek authority from the state legislature to establish impact fees and a reasonable implementation process applicable in areas of the County where rezonings are not anticipated or where the provision of improvements and facilities through proffers associated with rezonings for new residential development is restricted by State legislation.	County Administration
8.2.C. Develop demographic, economic, and financial data that are used as inputs to demographic forecasts and for fiscal impact modeling.	Management & Budget, Planning & Zoning
8.2.D. Develop and regularly update the CIF – the dollar amount of the capital facilities impact measured by unit type or unit characteristics and geographic location that is calculated using County CFS and demographic inputs. The County uses the CIF to assess the capital facilities impacts of new residential development and provide a guideline to evaluate and consider residential rezoning applications and proposed proffers.	Management & Budget, Planning & Zoning
8.2.G. Where permitted, seek to ensure that an equitable and proportionate share of public capital facility and infrastructure development costs that are directly attributable to a particular development project will be financed by the users or beneficiaries.	Board of Supervisors, Planning Commission, Planning & Zoning
8.2.H. Evaluate, consistent with the Virginia Code Sec. 15.2-2283 and 15.2-2284 and other applicable law, the adequacy of existing and planned public facilities and services when assessing impacts of any legislative application for more intensive use or density. <i>(See Chapter 6 for more information)</i>	Board of Supervisors, Planning Commission, Planning & Zoning
8.3.A. Consider proposals of the timely dedication of land, cash, and in-kind assistance from a landowner through proffered conditions submitted in accord with Virginia Code Sections 15.2-2303 and 15.2-2297, as applicable, in the provision of public facilities identified in the CIP or CNA. <i>(See Chapter 6 for more information)</i>	Board of Supervisors, Planning Commission, Planning & Zoning
8.3.B. Ensure that an equitable and a proportionate share of public capital facility and infrastructure development costs that are directly attributable to a particular development project are financed by the users or beneficiaries.	Board of Supervisors, Office of the County Attorney, Planning Commission, Planning & Zoning

8.3.C. Apply all of the proffer policies and actions and guidelines set forth in this document subject to and in compliance with the limitations established by Virginia Code Section 15.2-2303.4 as applicable. In its consideration and acceptance of all proffers, the County will apply the standards of Virginia Code Sections 15.2-2297, 15.2-2303, and 15.2-2303.4, as applicable, to evaluate the reasonableness of proffered conditions.	Board of Supervisors, Office of the County Attorney, Planning Commission, Planning & Zoning
8.3.F. To assist the County in an equitable and uniform evaluation of developer proffers and other proposals, for proposed densities above the specified base density for each planning policy area, which otherwise conform with the policies of this Plan, the County anticipates developer assistance valued at 100 percent of capital facility costs associated with such increased densities.	Planning & Zoning
8.3.I. Consider developing capital standards for roads to incorporate into the CIF or providing credit against the anticipated capital facilities proffers for transportation proffers that exceed the anticipated transportation impact mitigation of the proposed development.	Management & Budget
8.3.J. Establish the boundaries for Small Area Plans, authorized under Code of Virginia Section 15.2-2303.4, encompassing the Urban Policy Area, Suburban Policy Area, Transition Policy Area, and Leesburg JLMA, and the three Silver Line Metrorail Stations within the County. The planned land use within these Small Area Plan boundaries will reflect the land uses developed in the <i>Loudoun County 2019 Comprehensive Plan</i> for each policy area until such time as the Board adopts more detailed plans.	Planning & Zoning

Chapter 7

Implementation Strategy

Action	Responsibility (Loudoun County Department or Agency)
Staff is to provide for regular updates on the various elements of the <i>Loudoun County 2019 Comprehensive Plan</i> which will allow the Board to direct a comprehensive review of the Plan at least every five years to ensure that the Plan is kept current. The order and sequence of the review of the chapters and policy area sections of the <i>Loudoun County 2019 General Plan</i> will be determined by the Board of Supervisors. Focus areas can be identified and prioritized by the Board annually during its strategic planning sessions.	Planning & Zoning, County Government
Conduct a comprehensive review of the County Zoning Ordinance and prepare a Zoning Ordinance consistent with the Plan's policies, strategies, and actions.	Planning & Zoning
Reconvene the Fiscal Impact Committee to evaluate standards relative to the new place type service demands and specifically address the demand for public infrastructure in the Urban Policy Area.	County Government

Update the Land Subdivision and Development Ordinance and Facility Standards Manual to align with the policies, strategies, and actions of this Plan.	County Government
Develop a strategy to facilitate the development of high-speed wired and wireless telecommunication networks, including broadband technology, in the RPA.	
Deployment of implementation strategies set forth in the <i>Loudoun County 2019 Countywide Transportation Plan</i> .	Planning & Zoning, Transportation & Capital Infrastructure

Initial Board-Directed Amendments to the Zoning Ordinance

Action	Responsibility (Loudoun County Department or Agency)
Provide a resolution of intent to amend the Zoning Ordinance to the Board to consider replacing the existing noise contours for Washington Dulles International Airport and consider adopting the noise contours in the 2019 Washington Dulles International Noise Contour Map Update. [Implemented with CPAM-2021-0001, ZMAP-2021-0011, and ZOAM-2021-0002, Airport Impact Overlay District Update]	
Develop performance standards for data centers to address design, landscaping, and compatibility that could eliminate the need for a special exception.	County Government, Planning & Zoning
Consider reducing the maximum allowable accessory dwelling unit square footage to the lesser of 1,200 square feet or 70 percent of the principle structure gross square footage and ground floor footprint for applicable zoning districts in the Suburban Policy Area, subject to performance standards.	County Government, Planning & Zoning
Develop performance standards to address design, landscaping, and compatibility for industrial uses in the Suburban Industrial and Mineral Extraction adjacent to residences and primary roads.	County Government, Planning & Zoning

Glossary

A

Accessory Residential Unit: A secondary house or apartment that shares the building lot of a larger, principal residential structure.

Active Adult Retirement Communities: Primarily residential communities offering housing types and neighborhoods tailored to the specific interests and desires of older adults. These communities offer an independent living environment with houses often designed to reduce maintenance requirements and cater to specific interests of the older adult home buying market. Restricted to adults above a certain age, these communities offer amenities and services tailored to this age group and cater to older adults seeking a living environment among others who share similar interests. Active adult dwelling units may also be found in age-targeted communities where they commingle with traditional family housing.

Adaptive Reuse: The repurposing of an existing structure in order to accommodate new uses while preserving the structure. This often involves improving existing buildings to allow for modern design and building program preferences.

Adverse Effect: Any negative consequence resulting from a change in the type or intensity of land use, which may include one or more of the following:

- impairment of the quality of natural, environmental, and heritage resources;
- injury or damage to property or to plant or animal life;
- harm or material discomfort to any person;
- impairment of the safety of any person;
- rendering any property or plant or animal life unfit for use by man;
- loss of enjoyment of normal use of property; or
- interference with the normal conduct of business.

Affordability Gap: The difference between the cost of housing and the amount households can afford to pay.

Affordable: When not used in the context of specific programs and policies (e.g., Affordable Dwelling Unit), a general descriptor for housing requiring no more than 30 percent of a household's income.

Affordable Dwelling Unit (ADU): A dwelling unit for rent or for sale that is locally restricted for occupancy by households whose income falls between 30 and 70 percent of the Area Median Income (AMI). Typically ADUs are offered at a below-market rate.

Agriculture: Any land use that produces livestock or plant materials to be used for food or fiber for human or animal consumption. Examples include activities that produce cattle,

sheep, hogs, horses or other livestock; activities that produce grains such as wheat, barley and corn; fruit and vegetable production and tree or timber production.

Agricultural Soils: Productive soils that include both Prime Agricultural Soils (Class I) and Secondary Cropland (Class II) that are essential for growing plants and crops, raising livestock, and supporting ecosystems.

Agricultural Supportive Business: Uses that provide either direct or indirect services to agricultural, silvicultural, horticultural, equine, and/or animal husbandry activities. These uses include farm machinery sales, rental, and repair services; veterinary services; blacksmithing; agricultural product storage and processing; feed and seed supply; and similar uses.

Agricultural and Forestal District: Districts that landowners voluntarily enter into, subject to Board of Supervisors approval, that limit the use and development of property for a specified term to protect agricultural and forest lands.

Agritourism: A commercial enterprise that links agricultural production and/or processing with tourism in order to attract visitors to a farm, ranch, or other agricultural business for the purposes of entertaining and/or educating the visitors and generating income for the farm, ranch, or business owner.

Airport Noise Impact Area: Areas that have been determined to be impacted by noise caused by airport operations (i.e., aircraft noise impact areas), as depicted on the Airport Noise Impact Area map (see Chapter 3 for the ANIA map and relevant policy guidance).

Apartment/Residential Condo: A building, or portion thereof, designed for occupancy by three or more households living independently of each other. (See also, *Multifamily Residential*)

Aquifer: A geologic formation or structure that transmits underground water in sufficient quantity to supply pumping wells or springs.

Archaeological Site: The physical remains of any area of human activity greater than fifty years of age for which a boundary can be established, including but not limited to domestic/habitation sites, industrial sites, burial sites, earthworks, mounds, quarries, canals and roads.

Archaeological Survey: The scientific archaeological investigation of a known or potential archaeological resource as defined by the Virginia Department of Historic Resources' Guidelines for Archaeological Investigations in Virginia. See also, *Historic Resources Survey*.

Area Median Income (AMI): The middle household income in a specific metropolitan area; half of households of a particular size have incomes higher and half have incomes lower. AMI is used to determine eligibility for housing programs.

Arterial Road: Generally, a publicly owned and maintained road, designed with restricted access and primarily intended to carry through traffic at 45 to 55 miles per hour.

B

Bedrock: Rock formation that underlies surface materials such as soil.

Best Management Practices (BMP): Structural, operational, or procedural practices that are generally accepted as the most effective and practical means for reducing the amount of non-point source (NPS) water pollution to a level compatible with established water quality goals.

Buffer: An undeveloped or relatively undeveloped land area that lies between two land uses and is intended to screen the view, limit noise exposure, or otherwise mitigate the impacts of one use on another. A buffer may include trees, plants, or structural measures to further shield one use from the other.

Built Environment: Human-made surroundings that provide the setting in which people live, work, learn, and play on a day-to-day basis, and how they are interrelated as a complete and connected system in relationship to human activity. The built environment includes uses such as buildings and structures, parks, utilities and communication infrastructure, roads, paths, transportation infrastructure, streetscapes, signage, man-made landscapes, and open space.

By-Right Uses: Uses or structures that are allowed under the regulations of a particular zoning district classification without the need for legislative approval by the Board of Supervisors.

C

Canopy: The upper branches of a stand of trees; the tallest trees in a forested area.

Capital Facility Proffer: An in-cash or in-kind (land or improvement) contribution, consistent with County policies and service needs, that is intended to mitigate the capital facility impacts of a development and is voluntarily agreed to by a property owner as a condition of a rezoning.

Capital Facility Standards: Standards developed to guide the development of new capital facilities such as schools, parks, libraries, roads, and other public facilities. They include the types and quantities of capital facilities needed, the typical square footage of each type of facility, the amount of acreage required (for building, parking, utilities, etc.), and the demographic or geographic factors by which a new facility is warranted.

Capital Improvement Program (CIP): The County's annual plan for future capital project expenditures. This plan spells out the funding for capital facilities, including schools, libraries, and parks, that the County plans to finance over a six-year period.

Capital Intensity Factor (CIF): The dollar amount of the capital facilities impact, measured by unit type or unit characteristics and according to a development project's geographic location, which is calculated using the County's capital facility standards and demographic inputs.

Capital Needs Assessment (CNA): Assessment that identifies the type and number of capital facilities that will be needed to serve the public over a ten-year planning period and maintain the County's desired levels of services.

Central System: The water and/or sewer (wastewater) utility network serving Loudoun Water's eastern service area, as shown in the Water/Sewer Service Area Map.

Champion Tree: Any tree deemed largest of its species and listed on either the Virginia Big Tree Registry (maintained jointly by the Virginia Forestry Association, Virginia Department of Forestry, and Virginia Tech College of Natural Resources) or the National Register of Big Trees (maintained by American Forests). A champion tree may be a National Champion, a State Champion, or both.

Civic Uses: Public or quasi-public uses in residential or business areas that are accessible to the public and primarily serve as gathering or meeting areas for the immediate community. Civic uses may be public buildings; defined space in residential, commercial, or mixed-use buildings; or outdoor space constructed to accommodate gatherings of the community. They can be the settings where celebrations are held, where social and economic exchanges take place, where friends run into each other, and where cultures mix. Such uses typically include churches, schools, libraries, community centers, amphitheaters, and property owner association meeting space or club houses. See also, **Community Uses** and **Cultural Uses**.

Cluster Development: A residential development pattern that features the grouping of units on smaller lots with the intention of retaining a significant area of the site as open space or farmland. See also, **Clustered Residential Subdivision**.

Clustered Residential Subdivision: A development or subdivision option permitted in certain zoning districts that features the grouping of building units on smaller lots within a portion or portions of the site, with the intention of retaining a significant area of the land as a contiguous tract of unbuilt open land. Clustering is both visual and spatial, with the dwellings scaled and sited to maintain coherent relationships to each other and the surrounding landscape. The open space may serve to preserve environmentally sensitive areas while catering to active or passive recreational, agricultural, forestal, or rural economy uses.

Collector Road: A road into which local roads funnel and that, in turn, carries traffic to an arterial road. Ideally a collector road would have few private entrances accessing it directly.

Commercial Core: An identifiable center or focal point of a community. Typically a commercial area that may include parks, public facilities, or civic uses and is located to enable convenient access to most of the community.

Commercial Use: Any wholesale, retail, or service business activity established to carry on trade for profit.

Community System: A shared water supply and/or sewer (wastewater) system operated and/or owned by Loudoun Water or a private entity as defined by Chapter 10.1 or 10.2 of Title 56 of the Code of Virginia that is designed to serve small scale development, including cluster developments, where permitted by the Zoning Ordinance. See also, **Shared Water and Sewer System**.

Community Plans: Specific, detailed land use plans that Loudoun County adopts for various areas of the County.

Community Uses: Gathering places for the surrounding community or general public, such as plazas, playgrounds, pocket parks, gardens, public art, and amphitheaters. See also, **Civic Uses** and **Open Space**.

Compatible: Describes an existing or committed land use or activity that can coexist with a neighboring use/activity or uses/activities, without generating one or more off-site **Adverse Effects**.

Comprehensive Plan: The general plan for the County and its supporting components, including the Countywide Transportation Plan. Every County in Virginia must have a Comprehensive Plan, which spells out policies for future development in order to ensure orderly growth and the protection of the public health and welfare. The Comprehensive Plan may consist of a number of components, such as community plans, strategic plans, service plans, and specific land use related resolutions of the Board of Supervisors.

Conference Center: A large building that is designed to hold conventions, conferences, or other large events where individuals and groups gather to promote and share common interests.

Conservation Design: A land development approach that conserves the environmental, natural, and heritage elements of a site while providing for development at full density on the remainder of the site.

Conservation Easement: A voluntary legal agreement between a property owner and a land trust or government agency that places permanent restrictions on a property, which may relinquish certain development rights and/or require the preservation of farmland, and/or natural, environmental, and heritage resources on a property in perpetuity. The easement is recorded in the land records and the property owner retains ownership of the property and all rights and privileges for its use, except for the uses restricted under the easement.

Contiguous: Touching, abutting, and/or adjoining at the border, or immediately across the street.

Continuum of Housing: A variety of housing types, sizes, and prices,—both for rental and homeownership —that meets the needs of Loudoun's current and future citizens.

County resources will be focused on unmet housing needs of households with incomes up to 100% AMI.

Contractor Services: A business establishment specializing in the installation and servicing of such items as air conditioners, electrical equipment, flooring, heating, painting, plumbing, roofing, tiling, and ventilation; the planting and maintenance of gardens, grounds and yards, such as landscape contractors and lawn maintenance services; and construction and demolition services.

Contractor with Outdoor Storage: A contractor services use that includes outdoor storage of materials, goods, and/or vehicles related to the service.

Contractor without Outdoor Storage: A contractor services use that does not include outdoor storage of materials, goods, and/or vehicles related to the service.

Cost-burdened Household: A household that spends 30 percent or more of their income on housing (gross rent or mortgage).

Cultural Landscape: 1. “The combined works of nature and of man [that] are illustrative of the evolution of human society and settlement over time, under the influence of physical constraints and/or opportunities presented by their natural environment and of successive social, economic, and cultural forces, both external and internal” (UNESCO/ICOMOS Expert Group, World Heritage Convention Operation Guidelines, February 1995) or 2. “A geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values” (National Park Service).

Cultural Uses: Uses that provide access to or interpretation of the history, customs, arts and social interactions of a particular nation, people, or other social group. May include such uses as monuments, museums and art galleries, visual and performing arts venues, historical sites, or cultural landscapes. See also, **Civic Uses**.

D

Data Centers: A facility composed of a large group of networked computer servers, typically used by organizations for the remote storage, processing, or transmission of large amounts of digital data.

Density: The amount of development permitted per acre of land. It may be expressed in terms of dwelling units per acre or as a percentage or portion of building **floor area ratio (FAR)**.

Department of Transportation and Capital Infrastructure (DTCI): County department that oversees roadway planning, local transportation projects and transit functions, as well as capital planning, funding, design and construction management.

Design Guideline: A set of recommendations towards good practice in design.

Design Standard: A set of rules to implement design items with generally accepted and uniform procedures, dimensions, or materials, which may be administered through a regulatory process.

Development: The act of building, or the existence of, structures for human habitation, business uses, or other human activity, including houses, stores, schools, offices and roads.

Diabase: A fine- to medium-grained dark-colored igneous rock, which is a good source for crushed stone for road and building construction.

Dillon Rule: The rule adopted by the Virginia General Assembly that limits the legislative powers of local government in Virginia to those powers that have been specifically and expressly granted to them by the General Assembly.

District Energy Systems: Networks of hot and cold water pipes, typically buried underground, that are used to efficiently heat and cool buildings using less energy than if the individual buildings were to each have their own boilers, chillers, or cooling towers.

Drainfield: Soil absorption trench fed by underground pipes for dispersion of the liquid portion of sewage from a *septic system*.

Duplex: A residential building that has separate but complete facilities to accommodate two households, either as adjacent or stacked units. See also, *Single-Family Attached Residential*.

E

Easement: An interest in land owned by another that entitles its holder to a specific and limited use.

Easement, Open Space (Scenic, Conservation): An easement that removes or limits the right to develop land. “Eased” is used as an adjective applied to land with such open space restrictions.

Eco-districts: A neighborhood committed to sustainability with empowered people, green buildings, and smart infrastructure. The establishment of eco-districts is a comprehensive strategy to accelerate sustainable development at the neighborhood scale by integrating building and infrastructure projects with community and individual action. Can be used as part of a public/private partnership.

Economic Development: Efforts that seek to improve the economic well-being and quality of life for a community by creating and/or retaining jobs and supporting or growing incomes and expanding the tax base.

Ecosystem: A complex network of biological communities and their interaction with their physical environment.

Enabling Legislation: Legislation passed by the Virginia General Assembly that authorizes a locality to carry out some particular program or that grants certain specific powers to those localities. Local governments may not enact ordinances without enabling legislation. See also, **Dillon Rule**.

Entertainment Commercial: Commercial uses that are devoted to entertainment including cinema, television, radio, games, theatre, and music.

Equine Facilities: Facilities for the purposes of accommodating, training, or competing equids, especially horses, to include barns, stables, or riding halls and may include commercial operations such as boarding stables, livery yards, or livery stables. Larger facilities may include complementary services such as riding schools, farriers, veterinarians, tack shops, or equipment repair.

Erosion: The wearing away and removal of soil or rock by natural means such as wind or water.

Exemplary Natural Communities: The most outstanding and viable occurrences of common natural community types, based on size, condition, and landscape context and all examples of rare natural community types, as defined by the Virginia Department of Conservation and Recreation, Division of Natural Heritage.

Extremely Low-Income Household: A household with an annual income at or below 30 percent of the Area Median Income (AMI).

E

Facilities Standards Manual: An adopted document that sets out design and construction standards for site development improvements implemented through subdivisions and site plans, to include infrastructure required for water/sewer service access (e.g. roads and streets), and environmental design (e.g. soils and geotechnical review, tree planting and conservation, erosion and sediment control).

Fiscal: Of or relating to public revenues, public expenditures, public debt, and public financial matters.

Fleet and Equipment Sales and Service: Any sales, leasing, parts, and service operation that specializes in new and used truck and trailer equipment.

Flex Space: A category of building that generally includes a compatible mix of warehouses, light manufacturing, and related accessory uses. These facilities are typically used for product production and service and the storage and distribution of goods.

Floodplain: A low, usually flat terrain on either side of a river or stream that is normally dry but submerged at times of high water, and where accumulations of silt and sand are deposited away from the main channel.

Floodplain, Major: The floodplain created by flooding from a stream that drains greater than 640 acres.

Floodplain, Minor: The floodplain created by flooding from a stream that drains less than 640 acres but greater than 100 acres.

Floor Area Ratio (FAR): The enclosed gross floor area of buildings on a given lot divided by the total area of the lot. See also, **Density**.

Forest: A plant community predominantly consisting of trees and other woody vegetation of at least 10 acres in which 50 percent of the tree canopy coverage exceeds 25 feet in height and one that currently has or will result in 85 percent crown closure within ten years. A forest is further defined as forming an ecosystem that provides food, water, and shelter for various plant and wildlife habitats.

G

General and Heavy Manufacturing and Assembly: Industrial uses involving the manufacture and/or assembly of goods or materials on a large scale.

Greenbelt: Any largely undeveloped area or an area of low-density development consisting of entirely or primarily heavily vegetated open space surrounding a developed area or separating one area from another to create a visual separation.

Greenfield Development: Development that occurs on undeveloped land.

Greyfield Development: Development on real estate that has been previously developed and used but has become obsolescent or substantially underutilized. Examples of greyfield sites may include abandoned commercial, industrial, or public properties or underutilized older commercial centers that no longer attract investment.

Groundwater: The supply of freshwater beneath the ground surface in a saturated zone that forms a natural reservoir for potable water. Groundwater is a major source of water supply for western Loudoun County.

Groundwater Recharge: Undeveloped or sparsely developed area where groundwater can be replenished by rainfall.

Growth Boundary: The limit of central water and sewer (wastewater) utility service marking the separation of distinctly different land uses and densities.

Growth Management: The process of guiding development in the direction that is most efficient, and fiscally and environmentally sound.

H

Habitat: The place or environment where animals or plants naturally or normally live and grow.

Heritage Resource: Those resources, both human and natural, created by activities from the past that remain to inform present and future societies of the past.

Heritage Trees: Any tree that has been individually recognized by the local governing body for its association with a historic event, person, structure, or landscape. The historic significance may be at the local, state, regional, or national level.

Historic District (County Designated): A zoning district overlaid on an existing zoning district that applies additional architectural and design controls to the regulations of the base district. A Historic Site District (HS) comprises a single historic property and its related structures, while a Historic and Cultural Conservation District (HCC) comprises a multiple properties related in some way to each other.

Historic District Review Committee (HDRC): A committee of citizens appointed by the Board of Supervisors and empowered to approve or deny the issuance of Certificates of Appropriateness for any construction, reconstruction, renovation or restoration activity in a County-designated Historic District.

Historic Landmarks: A site designated by national, state, or local officials as a historic landmark. The term is primarily used to refer to National Historic Landmarks.

Historic Property: Building, site, district, object, or structure evaluated as historically significant inclusive of their historic setting.

Historic Resources Survey: A survey locating and identifying properties within a specific geographic area and documenting them to an established standard as defined by the Virginia Department of Historic Resources' Guidelines for Conducting Historic Resources Survey in Virginia. The survey involves collecting and organizing data from field investigations and gathering data from historical research, interviews, and planning studies. See also, *Archaeological Survey*.

Historic Site: An architectural, engineering or archaeological area, structure, object, or landscape that has historic significance to the region, locality, community, or nation.

Homeowners Association (HOA)/Property Owners Association (POA): A private association consisting of homeowners or property owners organized for the purpose of overseeing the enforcement of covenants or deed restrictions that apply to a group of homes, lots, or buildings. Covenants and deed restrictions may govern such things as the maintenance and use of homes, buildings, private streets, and common areas, such as pools, playgrounds, landscaping, and parking lots.

Hotel: An establishment providing accommodations, meals, and other services for travelers and tourists.

Hotel, Full Service: Mid-priced, upscale, and/or luxury hotel providing restaurant, lounge facilities, exercise facilities, meeting space, room service, and bell service.

|

Impermeable or **Impervious:** Describes any material or surface that prevents the absorption of water into the ground.

Indigenous Vegetation: Existing plant communities or species that occur naturally to a specified region or area, and that are descendants of plants that existed prior to the land being developed or cultivated. Also referred to as native vegetation.

Industrial Uses: Nonresidential and noncommercial employment uses such as warehousing, mining, milling, and manufacturing. Industrial uses are characterized by varying degrees of outside storage or activity, types of equipment use, and potential compatibility issues with surrounding uses.

Infill Development: Establishment of a new use on a site that may be undeveloped or underutilized but is located in an area of established, stable development where roads, water, sewer, and general services are available or planned. Infill sites are often small (less than 25 acres), and their development should complement or complete a larger development area.

Infrastructure: Utilities such as water/sewer, electrical, gas, communication, internet and transportation, which provide services and support necessary to the function of the built environment.

Institutional Uses: Land uses developed to help serve a community's social, educational, health, cultural, and recreational needs, including government offices and facilities; public or private health facilities; recreational uses; educational uses such as schools, training centers, and universities; libraries; camps; or similar facilities.

Intensity: Physical measures of the scope and scale of land use, including building height, bulk, and coverage. The most common measurement of intensity is **Floor Area Ratio (FAR)**. See also, **Density**.

Interim Use: Land use that does not require substantial infrastructure and construction investment and that by design or investment can be expected to be removed and the site redeveloped based on future market trends or can easily be adapted and augmented with future land uses. Examples may include community gardens, playgrounds, park-and-ride lots, and farmer's markets.

Invasive Plant Species: Any plant species that is not native to the region and causes or is likely to cause economic, health-related, or environmental harm.

J-L

Joint Land Management Area (JLMA): The County area surrounding an incorporated town intended to accommodate future town growth.

Karst: Refers to terrain characterized by the solution of bedrock that allows underground drainage and generates distinctive land forms and features such as sinkholes, pinnacled rock, and caves. Much of the County's limestone geology area is considered karst.

Land Trust: A public and/or private organization with the authority to buy, accept donations, hold, and/or sell interests in real property for the purpose of land and/or building preservation.

Large Lot Residential: Single-family detached homes built on large lots that provide low density living opportunities.

Ldn: Day-Night Average Sound Level. The energy-average level of sound, in decibels, for 24 hours adjusted to include a 10 decibel penalty for noise exposures during night-time hours (10:00 pm to 6:00 am).

Leadership in Energy and Environmental Design (LEED): A green building certification program developed by the U.S. Green Building Council that includes a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes and neighborhoods aimed at being environmentally responsible and using resources efficiently.

Light Pollution: Unnatural brightening of the night sky caused by street lights and other man-made sources, which has a disruptive effect on natural cycles and inhibits the observation of stars and planets.

Light Production: Production uses that are likely to result in fewer adverse impacts on their surroundings than heavy industries. Often located in industrial parks, flex space, or in conjunction with large mixed-use development; such uses may include manufacture and distribution of scientific products and/or precision instruments. In mixed-use communities, outdoor storage will not be permitted, and buildings should be designed and scaled compatibly with non-industrial uses.

Limestone Geology: Geologic formation that is highly water soluble and is characterized by numerous underground caves and surface sink holes; it is a natural groundwater aquifer and good water supply source. Limestone geology consists of various small rocks cemented together with a carbonate matrix. In appearance, it is very similar to concrete. See also, **Karst**.

Live/Work Units: A single unit consisting of both a commercial/office and residential component, often occupied by the same tenant (e.g. studio, loft or one bedroom).

Local Road: A public, state-owned, and state-maintained road designed for direct access to individual lots.

Low Impact Development (LID): Land planning and engineering design approach to manage stormwater through sustainable systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration, or use of stormwater in order to protect water quality and associated aquatic habitat.

Low-Income Household: A household with an annual income between 50 and 80 percent of the Area Median Income (AMI).

M

Medical Center: An aggregation of health care facilities whose day-to-day operation is supplemented by the close proximity or collocation of other health care facilities or healthcare-related businesses.

Metrorail Service Districts: Tax districts adopted by the Board of Supervisors intended to help fund construction costs associated with Metrorail operations; also known as *Metrorail tax districts*.

Micro-Grid Energy Systems: Stand-alone electrical systems consisting of multiple generating sources and defined loads that can operate independently from the primary utility grid. They provide a reliable, efficient solution to unexpected power loss, effectively balancing spikes in energy demand, optimizing energy usage for more reliable power, reducing operating costs and carbon emissions.

Micro Unit: A one-room, self-contained living space designed to accommodate a sitting space, sleeping space, bathroom, and kitchenette. Residents may have access to a communal kitchen, bathroom, patio and gardens. Units are generally 50 to 350 square feet in size.

Millennial: A person reaching young adulthood in the early 21st century, born between 1981 and 1996.

Missing Middle: The mix of small scale single-family units, accessory dwelling units, and limited multifamily units with a lower perceived density, intended to increase diversity and affordability of housing types in a manner sensitive to the scale and context of existing neighborhood surroundings.

Mitigation (environmental): Methods used to alleviate or lessen the impact of development. Examples include planting of new forests to replace those that have been removed; creation of new wetlands to replace those destroyed by development. Mitigation is sometimes done in a different area than that previously occupied by the replaced forest, wetland, etc., but this practice is not encouraged.

Moderate-Income Household: A household with an annual income between 80 and 100 percent of the Area Median Income (AMI).

Moderately Steep Slopes: Surface formation with a vertical incline of 15 percent to 25 percent, a sufficient steepness to cause problems such as erosion or increased flooding when land is disturbed. See also **Steep Slopes**.

Months of Supply: A measure of how many months would be needed to sell all of the existing home sales inventory available at the current rate of demand, calculated by dividing current inventory by current sales. This is an indicator for supply in the home sales market.

Mountainside Areas: Areas associated with the County's mountain features, categorized based on weighted criteria as defined in the Loudoun County Interpretive Guide to the Use of Soils Maps, and defined by the following:

- Elevation: Above 700 feet mean sea level for the Short Hill and Blue Ridge Mountains and 550 feet for the Catoctin, Hogback, and Bull Run Mountains;
- Soils: Associated with mountainsides that affect groundwater recharge, slippage potential, and suitability for onsite sewage disposal systems;
- Slopes: Moderately steep slopes (15 to 25 percent) and steep slopes (greater than 25 percent); and
- Forests: The quality and extent of tree cover, woodlands, and forests.

Multifamily Residential: A classification of housing where separate housing units are contained within one building or several buildings within one complex. See also, **Apartment/Residential Condo**.

Municipal System: Water and/or sewer (wastewater) utility network owned or operated by an incorporated Town.

N

National Register of Historic Places: The official Federal list of districts, sites, buildings, structures, landscapes, and objects significant in American history, architecture, archaeology, engineering and/or culture. These places contribute to an understanding of the historical and cultural foundations of the United States.

Natural Heritage Resources: Those resources that include rare, threatened, and/or endangered plant and animal species; exemplary natural communities, habitats, and ecosystems; and other natural features of the County.

Noise-Sensitive Use: A use for which quiet is integral to its function and/or the safety of residents, customers, and other users, including housing, hotels, nursing homes, schools, churches, hospitals, day care centers, libraries, and other similar uses.

Non-Point Source (NPS) Water Pollution: Diffuse water pollution that results when stormwater and other land runoff picks up pollutants and deposits them into a stream or other water body. NPS pollution cannot be traced to a specific source and/or point of entry.

O

Office: Uses such as administrative, professional, bureaucratic, or clerical services. Examples include but are not limited to law practices, accounting firms, clinics, real estate services, and other similar businesses.

Old Growth Forest: Also referred to as Ancient Forest. A forest that is ecologically mature and has been subject to negligible disturbance. Ecological maturity is typically defined when tree species reach the later stages of their life cycle, reflecting in significant amounts of the upper stratum or overstory in the mature (old) growth phases.

100-foot Minimum Stream Buffer: Minimum stream buffer providing a minimum filtration area to ensure the maintenance of water quality and the integrity of the river and stream corridor. The buffer is measured from the ordinary high water mark landward on both sides of the stream when the 100-year floodplain and adjacent steep slopes do not extend beyond either bank by 100 feet.

On-Site or Individual Water and Wastewater Systems: A system that serves a single user; commonly well and septic systems.

Open Space: Any essentially unimproved parcel or area of land or water that is designated for public or private use or enjoyment. See also, **Community Uses**. There are three types of open space defined in this plan, as follows:

Open Space, Active Recreation: Areas dedicated to leisure-time activities, usually of a formal nature and often performed with others, requiring equipment and taking place at prescribed sites or fields. Examples include ballfields, tennis or basketball courts, swimming pools, tot lots, golf courses, dog parks, and other areas for recreational sports and games. See also, **Recreation, Active**

Open Space, Natural: Land left in a mostly undeveloped state. Examples include forests, meadows, hedgerows, and wetlands.

Open Space, Passive Recreation: Areas for activities that involve less energetic activities such as walking, sitting, picnicking, card games or table games. Examples include trails (hiking, biking, walking, or equestrian), picnic, community gardens, camping, hunting, or fishing areas. Passive recreation uses have fewer potential impacts on the site and on surrounding land uses. See also, **Recreation, Passive**

Open Space Preservation Program: A program that seeks to balance the loss of open space to new development with the provision of easements or funds towards the purchase of publicly accessible and useable open space, to the extent permitted by Code of Virginia Section 15.2-2303.4.

Outdoor Manufacturing: Manufacturing in an outside area that is not enclosed or covered in any way that would obstruct the natural air flow.

Outdoor Storage: The outside storage of goods, material, vehicles, mechanical equipment, and any other equipment associated with the principal use of a building.

Overlay Zoning District: A zoning district superimposed on another, often used to apply additional standards for the purpose of protecting particular natural or cultural features or avoiding or mitigating potential adverse effects.

P

Parks and Recreation: Resources and services provided for the purposes of leisure, entertainment, and recreational pursuits. Such resources and services are non-commercial public spaces and facilities like parks, nature preserves, open space areas, greenways, trails, and built structures for sport, recreation, or arts programs.

Performance Standards: A set of regulatory criteria or limits relating to certain characteristics that a particular use or process may not exceed.

Permeable: Describes materials that permit water to enter the ground by virtue of their porous nature or by large spaces in the material. See also, **Pervious**.

Perpetuity: A state of something that is continuing or enduring forever. In planning, a limitation on property that is not destructible by the persons who hold an interest in the property, is said to be held in perpetuity.

Pervious: Describes materials that permit water to enter the ground by virtue of their porous nature or by large spaces in the material. See also, **Permeable**.

Physiographic: Pertaining to physical geography.

Planning Commission: The body of citizens appointed by the Board of Supervisors and empowered to prepare the Comprehensive Plan and to provide guidance on proposed land use changes for conformance with the Comprehensive Plan and other applicable land development policies and regulations. Every locality in the Commonwealth of Virginia is required to create a local planning commission in accordance with Section 15.2-2210 of the Code of Virginia.

Pollution Management Program: Program to help prevent water quality degradation and restore the health of lakes, rivers, streams and estuaries by promoting and funding measures to reduce and prevent nonpoint source pollution. Such programs may include watershed planning efforts, stream and wetland restoration and protection, and education and outreach.

Prime Farmland (as defined by the U.S. Department of Agriculture): Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It can be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas.

Proffer: A voluntary commitment from a landowner or developer to mitigate or eliminate the impact of new development on neighboring properties and the County. Such commitments may include the construction of certain improvements, contributions intended to mitigate development impacts, or assurances to develop property subject to specified conditions. See also, *Capital Facility Proffer*.

Property Assessed Clean Energy Program (PACE): A mechanism for financing energy efficiency and renewable energy improvements on private property created by the U.S. Department of Energy. PACE programs allow a property owner to finance the up-front cost of energy or other eligible improvements on a property and then pay the costs back over time through a voluntary assessment. The unique characteristic of PACE assessments is that the assessment is attached to the property rather than an individual.

Public Facilities: Public works supplied, owned, managed, and/or maintained generally by a government organization or public authority. Examples include public roads, schools, water and sewer facilities, community centers, fire and rescue stations, public parks and recreation facilities, and libraries.

Public Utilities (public water and sewer): A central or municipal water supply and/or sewer (wastewater) system.

Pump-and-Haul: A sewage disposal method in which a sewage holding tank is pumped out on a regular basis and the raw sewage is transported by vehicle to an authorized treatment plant.

Purchasing Power: An estimate of the amount of money a household can affordably spend to purchase a home, measured as household income multiplied by three.

Q-R

Quadruplex: A residential building that has separate but complete facilities to accommodate four households as adjacent and/or stacked units. See also, *Single-Family Attached Residential*.

Quality Development: Unique and functional community design components that promote high quality of life, enrich areas, create distinctive visual character, and ensure a pedestrian-friendly environment.

Quality of Life: The standard of health, comfort, and happiness experienced by an individual or group.

Quarry: A place, typically a large, deep pit, from which stone or other materials are or have been extracted.

Questionable Soil: Where the classification, strength, or compressibility of the soil are in doubt or where a load-bearing value superior to that specified in the International Building Code is claimed.

Real Property: Land and any immobile buildings or structures attached to the land.

Recreation, Active: A type of open space featuring areas dedicated to leisure-time activities, usually of a formal nature and often performed with others, requiring equipment and taking place at prescribed sites or fields. Examples include ballfields, tennis or basketball courts, swimming pools, tot lots, golf courses, and other areas for recreational sports and games. See also, **Open Space, Active Recreation**.

Recreation, Passive: A type of open space featuring areas for activities that involve less energetic activities such as walking, sitting, picnicking, card games or table games. Examples include trails (hiking, biking, walking, or equestrian), picnic, camping, hunting, or fishing areas. Passive recreation uses have fewer potential impacts on the site and on surrounding land uses. See also, **Open Space, Passive Recreation**.

Redevelopment: The rehabilitation, removal and replacement, or adaptive reuse of existing structures or uses. This includes any development project that significantly modifies an existing developed site resulting in changes to its design, use, and/or intensity. Projects may involve razing existing structures and constructing completely new buildings and may require mitigation or remediation of the impacts of previous uses.

Reinvestment: Reestablishing the economic and social vitality of an area through a combination of targeted efforts and investments that may be coordinated with redevelopment, infill, and adaptive reuse projects.

Research and Development: Any use related to the invention, discovery, study, experimentation, evaluation, identification, verification, design preparation, or production of products, new technologies, techniques, or processes. Research and development functions would include repair, storage, sale, and resale of materials, goods, and products relating to the research and development use.

Retail and Service Commercial: Uses primarily engaging in service business activity and/or the commercial retail sale, rental, or leasing of new or used products to the general public. See also, **services**.

Rezoning: A change in zoning district applicable to a given parcel or group of parcels of land.

Ridgeline: A ground line located at the highest elevation of a drainage divide for the major watersheds mapped by the County or other prominent mountain ridges visible from the public right-of-way as identified during the land development process.

Right-to-farm Act: A State Act that offers protection to farmers against nuisance suits. Localities are prevented from enforcing nuisance ordinances that would disrupt normal farm practices.

Riparian: An area of land contiguous to a stream, river, lake or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent areas.

Riparian Forest: A strip of land along a river or stream where forest and vegetation help to protect water quality, filter pollutants, regulate water temperature, enhance aquatic and wildlife habitats, and provide aesthetic value to the river or stream. Also called a riparian forest buffer when part of a larger stream buffer.

River and Stream Corridor Resources (RSCRs): Certain water resources and associated land areas, specifically:

- Rivers and streams draining 100 acres or more.
- Floodplains (including major and minor).
- Adjacent steep slopes (slope 25 percent or greater, starting within 50 feet of streams and floodplains, extending no farther than 100 feet beyond the originating stream or floodplain).
- 50-foot Management Buffer surrounding the floodplains and adjacent steep slopes.
- Wetlands, forests, historic and cultural resources, and archaeological sites that fall within the area of one or more of the above elements.

Rural Character: A term broadly applied to the appearance and experience associated with natural and man-made environments, comprising any combination of agricultural, forestal, environmental, scenic, historic and/or cultural elements that define a rural setting or landscape.

Rural Economy: A collection of traditional and non-traditional rural business uses that are dependent on the rural land base for its agricultural productivity, scenic quality, and rural character to sustain business activities. Rural economy uses include but are not limited to agriculture; crop and livestock production; forestry; horticulture and specialty farm products; farm markets and wayside stands; the equine industry; orchards; vineyards; farm wineries; cideries and breweries; farm restaurants; hospitality services such as bed and breakfasts, country inns, banquet/event facilities, and rural resorts; and private camps and parks.

Rural/Heritage Tourism: A range of attractions and activities that take place in rural/heritage areas, including the range of **agritourism** uses, equestrian events, agricultural and cultural fairs and festivals, village historic sites, farm wineries, farm breweries, and rural hospitality uses.

S

Scenic Highway/Virginia Byway:

- **National Scenic Byway:** A road located within a protected corridor and having recreational, historic or scenic interest.
- **Virginia Byway:** A road or part of a road having high aesthetic or cultural value or leading to an area of significant historical, national or recreational interest. Designation by Virginia Department of Transportation on recommendation of

the Commission on Outdoor Recreation with approval of local Board of Supervisors. Designation does not imply any particular protection of the roadway from development or structural improvements.

Scenic River : A river or section or portion of a river that has been designated by an act of the Virginia General Assembly pursuant to Section 10.1-400 of the Code of Virginia and that possesses superior natural and scenic beauty, fish and wildlife, and historic, recreational, geologic, cultural and other assets.

Self-Sustaining Communities: Communities planned, built, or modified to be economically, environmentally, and socially healthy and resilient.

Septic System: Subsurface sewage disposal system that uses the natural absorption of soil to treat wastewater. The common use is to serve one dwelling, but could be designed to serve several homes. **Drainfield** refers to this soil absorption trench fed by pipes from the dwelling.

Services: Establishments primarily engaged in providing assistance, as opposed to products, to individuals, business, industry, government, and other enterprises, including hotels and other lodging places; personal, business, repair, and amusement services; health, legal, engineering, and other professional services; educational services; membership organizations; and other miscellaneous services.

Setback: The distance from a property line to a structure or use such as parking, governed by the Zoning Ordinance, covenants, easements, proffers, and/or conditions at the time of legislative approval.

Severely Cost-burdened Household: A household that spends 50 percent or more of their income on housing (gross rent or mortgage).

Shared Water and Sewer Systems: Water and/or sewage (wastewater) treatment systems that are designed to serve individual users or a number of residences such as a cluster located outside the central service area of eastern Loudoun. See also, **Community System**.

Silviculture: The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands.

Single-Family Attached Residential: A classification of housing featuring two or more attached similar dwelling units sharing common walls, ceilings, or floors and where each unit has its own external entrance. See also, **Duplex**, **Triplex**, **Quadruplex**, and **Townhouse**.

Single-Family Detached Residential: A classification of housing containing one dwelling unit designed for one family and located on a single lot.

Site Plan: A plan, to scale, showing proposed uses and structures for a parcel of land, prepared in accordance with the Zoning Ordinance and Facilities Standards Manual. It includes such information as location of lot lines, streets, buildings, parking areas, landscaping, utility lines and topographic information.

Small Area Plan: Element of the Comprehensive Plan establishing areas, as authorized under Code of Virginia Section 15.2-2303.4, that are exempt from the proffer legislation provisions established by Code of Virginia Section 15.2-2303.4.

Small Lot Single-Family Attached Residential: Single-family attached homes in various configurations including one-to-four residential units in buildings that resemble single-family detached homes, semi-detached units, and more conventional duplexes and townhouses with smaller floor areas to encourage density and housing diversity.

Small Lot Single-Family Detached Residential: Single-family detached homes built on lots that are smaller than typically allowed in single-family zoning districts served by central or municipal utilities to encourage density and housing diversity. Such lots generally range from 5,000 to 7,000 square feet in area with corresponding lot widths of 50 to 70 feet.

Special Activities: Larger scale destination uses or activities that include such uses as professional sports stadiums, conference facilities, event venues, and theme parks.

Special Needs Population: A population group whose members may require specialized services or accommodations, including low income residents (incomes below the 30 percent AMI), elderly residents requiring congregate care, disabled residents, and the homeless.

Special Taxing District: A geographical area wherein landowners are levied a special assessment in order to provide a desired or necessary amenity or facility mutually beneficial to the landowners of the district.

Specimen Tree: Any tree that has been individually recognized by the local governing body for its special status. A tree may receive this designation by virtue of its outstanding size and quality for its particular species, especially if it represents a locally significant native species. Trees associated with the character of a community, trees that are relatively rare in an area, whether native or not, may also be awarded this status. The category also includes other locally significant trees that are significant on account of their great age or are especially renowned for their aesthetic or community value. The function of a tree in a landscape may be sufficient to justify special status such as a landmark pair of trees that frame an entrance and/or serve as natural gateways to historic sites, towns, or villages.

Sports Arena/Training Facility: An enclosed area, often circular or oval-shaped, designed to showcase theatre, musical performances, or sporting events. It is composed of a large open space surrounded on most or all sides by seating for spectators, and may be covered by a roof.

Steep Slopes: Surface formation with a vertical incline greater than 25 percent, a sufficient steepness to cause problems such as erosion or increased flooding when land is disturbed. See also **Moderately Steep Slopes**.

Stormwater Runoff: The portion of the total precipitation that does not sink into the soil but instead flows across the ground or other surface and eventually reaches a watercourse.

Stream Buffer: A minimum area of land directly adjacent to and on either side of a river or stream. The primary purpose of the stream buffer is to provide adequate filtration of pollutants and improve water quality. Defined as part of the **River and Stream Corridor Resources**.

Stream Corridors: Alternate terminology for **River and Stream Corridor Resources**.

Subdivision: The division of a parcel of land into two or more new parcels. The process of subdividing is regulated by the Zoning Ordinance and the Land Subdivision and Development Ordinance.

Subordinate Lot: A lot created pursuant to the Principal/Subordinate Subdivision Option of the Zoning Ordinance, which enables a property to be further divided into one or more smaller lots as identified in the Zoning Ordinance.

Sustainable Site Design: A development approach intended to create and sustain a high quality of community values and environmental responsibility in design and construction of buildings, infrastructure, transport, and landscape. The construction methods employed should ensure that each step of the building process is focused on eliminating unnecessary site disruption (e.g., excessive grading, blasting, clearing) and resource degradation (e.g., stream siltation, groundwater contamination, air-quality loss). The strategies can harness features such as ventilating breezes, solar gain, and microclimates, and can mitigate unfavorable features such as cold, moist air drainage; desiccating winds; and increased stormwater runoff. The building process should be strategically charted in stages to avoid unnecessary site disruption, and to achieve an orderly construction sequence from site clearing to site finish. Such a strategy reduces costs and damage to the site. It requires close coordination between all sub-contractors.

T

Technical Assistance: Assistance provided by specialists in the form of sharing information and expertise, instruction, skills training, transmission of working knowledge, and consulting services and may also involve the transfer of technical data.

Technology Zone: Designated areas where local jurisdictions may grant tax incentives and provide certain regulatory flexibility to encourage new and expanding technology businesses.

Tourism Zone: Designated areas wherein local jurisdictions may grant tax incentives and provide certain regulatory flexibility for tourism-related development projects.

Townhouse: A classification of housing where a series of three or more attached similar dwelling units are located on separately-owned lots separated by common walls and where each unit has its own external entrance. See also, **Single-Family Attached Residential**.

Traffic Calming: Measures designed to reduce the speed of motor vehicles, alter driver behavior, and improve conditions for non-motorized street users and may include both

physical (e.g., raised crosswalk, traffic circle, speed bumps) and non-physical measures (community education and enforcement).

Transit: A shared mode of transportation that operates on a fixed route and fixed schedule and is available to all who pay the fare, including bus services, light rail, and heavy rail.

Transit Oriented Development (TOD): Mixed-use neighborhoods designed to encourage and leverage transit ridership to create vibrant, complete communities. TODs often feature a rail or bus station at their center, surrounded by relatively high-density development decreasing in density as distance from the core increases. TOD neighborhoods encourage cycling and walking to maximize transit usage, feature streets with high levels of connectivity and traffic calming, and limit the land area dedicated to vehicular parking.

Transit Station: Structures housing both passengers and transportation systems' operations and equipment.

Transit Stop: A location along the street or transit line that has simple facilities like signage and shelters.

Tree Stand: A plant community predominantly consisting of trees and other woody vegetation sufficiently uniform in species composition, age, arrangement and condition: an area to be distinguishable as a group from the forest or other growth in the adjoining area.

Triplex: A residential building that has separate but complete facilities to accommodate three households as adjacent and/or stacked units. See also, *Single-Family Attached Residential*.

U

Understory: Low trees and large shrubs located below the canopy in a wooded area.

Universal Design: The simple design of both products and the built environment to be useable by people of all ages and abilities, and which promotes the ability for people to age in place.

Unmet Housing Needs: The lack of housing options for households earning up to 100% of the Washington Metropolitan Area Median Income (AMI).

Unstable Soils: Soils that because of their composition and unique landscape position have a higher than normal potential for erosion, particularly during periods of high rainfall.

Use-Value Taxation: A program authorized by the state and implemented by localities at their option in which qualifying agricultural, forestal, and open space land is taxed at its use value rather than at its market value for development. Sometimes referred to as "land use taxation."

V-Z

Vacancy rate: The proportion of rental units that are available for rent or otherwise unoccupied. When used in the context of rental housing units, vacancy rate is an indicator of supply in the home rental market.

Very Low-Income Household: A household with an annual income between 30 and 50 percent of the Area Median Income (AMI).

Vision Zero: A strategy to eliminate all traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all.

Warehousing: A land use involving the storage of goods that will be sold or distributed later.

Watershed: All of the land area that drains water to a specific point such as a stream, river, lake, or bay. Watershed areas are defined by topography and vary in size from small local drainage areas to large river basins. Large watersheds are composed of multiple smaller watersheds. In Loudoun County, watersheds have been defined and mapped most often at one of two sizes for use in water resource and hydrologic studies. At the larger of the two sizes, the county is divided into 17 watersheds.

Wellhead Protection Plan: A plan identifying and protecting the land area where subsurface water flows to public drinking water supply wells in order to protect groundwater from potential contaminates.

Wetlands: Vegetated areas where plants are rooted in water or water-saturated soil, or that regularly tolerate flooding for extensive time periods. Includes but is not limited to swamps and marshes. Many wetlands do not appear wet at all times.

Zoning District: A classification of land as designated by the Zoning Ordinance and depicted on the Zoning Map that prescribes applicable land use requirements and building and development standards.

Zoning Ordinance: A local ordinance enabled by Section 15.2-2280 of the Code of Virginia that implements a locality's comprehensive plan by prescribing land use requirements and building and development standards.

Appendix A

GENERAL PLACE TYPE CONSIDERATIONS

The following prompts should be considered while devising and developing a project to assess whether a proposal is compatible with the place type and improves the site and its surroundings:

Safety

1. Protection against traffic and accidents.
 - a. Can people walk or bicycle safely and comfortably?
 - b. Are streets planned with a Vision Zero strategy that will help eliminate traffic fatalities and severe injuries, while increasing safe, healthy, equitable mobility for all?
2. Protection against harm by others.
 - a. How is the public space made safe day and night? Are there people and activities at all hours because the area has, for example, both residents and offices?
 - b. Are sidewalks and trails, parking areas and outdoor public spaces clearly visible, comfortable and near activity areas during the day and night?

Vibrant

3. Mobility.
 - a. How well do walkways and public spaces avoid physical elements that might limit walking, using a wheelchair, or pushing a stroller?
 - b. How easily navigated is the arrangement of sidewalks and trails, parking areas and outdoor public spaces?
4. Interaction.
 - a. What features invite visitors to rest and linger? Are seating options placed in or near interesting things like public art, a façade that invites one to spend time next to it, a bus stop, a park, or a plaza?
 - b. How well can people from adjoining developments walk or bike safely and comfortably to the development?
5. Options for sitting.
 - a. What are the obvious seating options such as benches or chairs? Is there only secondary seating such as a stair, seat wall, or the edge of a fountain?
 - b. What are the options for sitting that do not require patronage?
6. Options for talking and listening/hearing.
 - a. Is it possible to have a conversation here? What options are there to sit together and have a conversation?
7. Options for play, exercise, and activities.
 - a. Are there options to be active year round? Are there options to be active at multiple times of the day and year for all ages?

Purpose

8. Scale.
 - a. How well do public spaces and the buildings that surround them exhibit a human

- scale? How well does the space function for people in small gatherings and large events?
- b. How does the development exhibit high quality design through shape, materials, finish, relationship with surrounding buildings, and coordinated use of lighting, public art, street furniture, surfacing, planting, etc?
9. Context-sensitive design.
 - a. How well are existing environmental features protected and integrated into the design?
 - b. To what extent are pre-development views retained?
 - c. How well does the project protect ridgelines?
 - d. How are impacts on water quality addressed?
 - e. Is open space accessible to the public and does it connect to open space on adjacent properties?
 - f. Are most wetlands, lakes, streams, and other water amenities retained? Are significant natural amenities at least partially fronted by thoroughfares rather than hidden behind back yards?
10. Residential neighborhood characteristics.
 - a. Are there a variety of dwelling types?
 - b. Are there places to work in the form of office buildings or live-work units?
 - c. Are there shops sufficiently varied to supply the ordinary needs of a household such as a convenience store, a post office, a teller machine, or a gym?
 - d. Do thoroughfares within the neighborhood form a continuous network, providing for the dispersal of traffic? Are the thoroughfares connected to those of adjacent neighborhoods and communities?
 - e. Are thoroughfares relatively narrow and shaded by rows of trees that slow traffic and create an appropriate environment for pedestrians and bicyclists?
 - f. Are the large areas of open space between neighborhoods connected into continuous corridors?
 - g. Are culs-de-sac avoided except where absolutely necessary due to natural conditions?
 - h. Are there public places for people to congregate and areas to engage in recreational activities dispersed throughout the neighborhood?

Urban Policy Area Design Guidelines

Unless otherwise specified, the following guidelines apply only within the Urban Policy Area:

Building Orientation and Setbacks

Buildings in the UPA, particularly along urban-type streets and “main streets”, should have common design strategies that promote walkability, accessibility, and activity in the “outdoor room” or “outdoor hallway” between streets and buildings.

1. Locate buildings at the front property line or at the minimum required setback to create a strong pedestrian pathway framed by adequate spaces for sidewalks, plantings, street furnishings, and lighting along buildings. Where additional setback is necessary adjacent

to the street, that area can be used to create a plaza, pocket park, or other public gathering space that incorporates activity space, outdoor seating, landscape features, and/or water features.

2. Design grade level entrances providing direct access to building entrances from sidewalks and streets.
3. Make primary entrances to buildings visible from the street and sidewalk.
4. Create primary entrances for pedestrians that are easily identifiable and accessible, with a direct path to transit amenities.
5. Maintain at least one entrance from the public way at retail and restaurant establishments.
6. Incorporate transitions from the sidewalk to the front door such as landscaping, overhead cover (canopies, awnings or trellises) and/or porches at individual entrances to businesses and residences.
7. Comply with the Americans with Disabilities Act (ADA), Universal Design, and International WELL Building Institute guidelines at primary pedestrian entrances, so that alternate approaches for persons with mobility limitations, such as a ramps next to primary pedestrian entrances, are not necessary.
8. Incorporate passageways or alleys into mid-block developments, particularly on long blocks, that facilitate safe pedestrian movement through the depth of the block to the front of the next parallel block. Ensure that pedestrians do not have to walk the circumference of a block in order to access the middle of the next parallel block or alley or parking behind the block.
9. Activate the use of mid-block passageways or alleys so that they are visually appropriate, functional, well-lit, and safe spaces.



Building Design

Addressing architectural features of buildings is an important component of creating the ‘sense of place’ that Loudoun County desires for the UPA, particularly with respect to the denser and more intensely used areas.

1. Incorporate different façade treatments such as forms, textures, colors, materials, and architectural features that add visual distinctions throughout the UPA, while building

consistency in their application within individual developments to create a unique and identifiable character for each new development.

2. Add scale and interest to the building façade by articulated massing. Blank or long expansive walls with no detail or variation in form, color, texture, openings or material are undesirable, particularly in activity centers and along pedestrian pathways or linkages.
3. Use of architectural features, enhanced materials, fenestration, planting, lighting, and signage should contribute to a more pedestrian friendly streetscape.
4. Reinforce the existing façade rhythm along the street with architectural elements, landscaping, signage, street lighting, and street furnishings.
5. Include overhead architectural features where compatible with building design, such as awnings, canopies, trellises or cornice treatments that provide identifiable entries, shade, and reduce heat gain.
6. Contribute to visual interest, human activity along streets and neighborhood safety by providing pedestrian scaled windows and fenestrations at the street level that act as pathways to activity inside buildings and “eyes on the street”.
7. For ground floor retail, restaurants, and professional office uses within mixed-use environments, along main streets, and other activity centers, devote a minimum of 65 percent to 75 percent relative to the length of the façade to pedestrian entrances and pedestrian-level display windows.

Sidewalks, Streets Trees, and Plantings

Sidewalks, in conjunction with street design and building placement, support ease of pedestrian movement and link people from their homes to community amenities such as parks, public places, retail and commercial areas, transit stops, nodes, landmarks, and the Metrorail stations. Sidewalks also enrich the quality of the public realm by providing appropriate connections and street furnishings in the public right of way. They create the basis for the concept of the ‘outdoor rooms’ and ‘outdoor hallways’ that support human activity at planned centers and along linkages.

Planting street trees and other ground cover has proven to improve the human experience between buildings and streets. Along with creating inviting spaces, comfort for human activity, and positive impacts to the natural environment, street trees and ground level plantings contribute greatly to the visual appeal of building façades and outdoor spaces.

1. Create a continuous and predominantly straight sidewalk to support two-way pedestrian traffic with enough space for streetscape amenities such as street furnishings, street trees, ground cover plantings areas, street lighting, signage, and utilities.
2. Create streetscape amenities that act as a buffer between pedestrians and moving vehicles by the use of landscape and street furnishings (benches, newspaper racks, pedestrian information kiosks, bicycle racks, bus shelters, and pedestrian lighting, etc.).
3. Use street furnishings to create a consistent rhythm (i.e., consistent height of light standards or consistent shade pattern of trees) and encourage the activity and use of the sidewalk area between buildings and streets.
4. Incorporate closely planted shade-producing street trees to encourage pedestrian activity along streets and promote comfort in the outdoor activity spaces. They may be interspersed

with existing or proposed street trees. Select native trees and plantings with low maintenance requirements. Plant outdoor spaces with ground cover, low-growing vegetation or permeable materials that accommodate both pedestrian movement and car door swings where on street parking is designed and planned. Incorporate stormwater bioswales with native plantings into the streetscape to serve both visual interest and stormwater management function.

Street Furnishings and Lighting

Street furnishings and lighting should be designed to strengthen the pedestrian experience and encourage outdoor use and activity in activity centers and spaces between buildings and streets. These amenities should also serve to create neighborhood identity and visual coherence with the use of building and street lighting.

1. Provide usable space in the sidewalk areas that include street furnishings such as benches, trash cans, kiosks, street gardens, bike racks, outdoor sitting spaces, and public art.
2. Provide adequate lighting levels to safely light the pedestrian path.
3. Use adequate, uniform, human-scaled, and glare-free lighting to avoid uneven light distribution, harsh shadows, and light spillage.
4. Use poles, standards, fixtures, and lighting types that achieve “dark sky” compliant goals and objectives, such as lighting when necessary, reducing glare, use of energy efficient lighting systems, lighting enough to promote safety and security, and considers ecological impacts to the natural environment and humans.

On-street Parking

On-street parking provides numerous benefits in urban environments such as reducing the need for parking decks and parking lots, buffering pedestrians from moving vehicle traffic, vehicle traffic calming, and by providing parking near community amenities, businesses, and retail uses that shape the ‘outdoor rooms’.

1. Provide parallel or angled on-street parking wherever possible.
2. Eliminate street parking within pedestrian crossings.
3. Create traffic calming along streets designed for low speeds.

Parking Structures

To promote an active and diverse streetscape and to minimize the visual impact of parking, parking structures should be integrated with surrounding development.

1. Parking structures that front on streets should wrap the parking structure at the street level with an active use. Active uses may include retail, office, or residential uses and should be based on the allowed uses in each respective Place Type.
2. The height and mass of parking structures should be consistent with the design character of the area within which the structure is located (e.g., a five-story parking structure should not be situated in an area that consists primarily of two-story buildings).
3. Pedestrian entrances should be well-defined and attractive.

4. Façades that face public rights-of-way should incorporate massing, textures, colors, and other architectural techniques that are of similar style and quality as primary adjacent buildings.
5. Parking structures should be designed to conceal the view of all parked cars and internal light sources from adjacent public right-of-way or public open space for the full height of the structure.

Public Places

Public places are areas that serve as centers for human activity, which could be a destination, a space to pass through, or a linkage. These places should provide a focal point for gathering, communicate community or neighborhood identity, and help make for complete neighborhoods. These places could include plazas, promenades, courtyards, park spaces that are landscaped and/or hardscaped, and should include trees and ground cover vegetation to create inviting spaces for activity and gathering.

1. Orient buildings so that public places receive sunlight as well as high quality, safe, night lighting.
2. Balance sunlight accessibility with shade producing trees and overhead cover.
3. Provide a variety of on-site features to maximize use and enjoyment of public places, including but not limited to:
 - a) Water features / public art,
 - b) Recreational features,
 - c) Outdoor furnishings,
 - d) Vegetative ground cover, gardens and shade tree plantings/reforestation,
 - e) Use of stormwater management best management practices to create year-round open space amenities with walking paths and benches,
 - f) Open places for gathering large groups of people, and/or
 - g) Variety of ground cover materials such as permeable and impermeable surfaces and natural ground cover.

Suburban Policy Area Design Guidelines

Unless otherwise specified, the following guidelines apply only within the Suburban Policy Area:

Development Criteria:

1. Ensure that the use contributes to and complements the existing development pattern;
2. Consider innovative uses that contribute to the surrounding community;
3. Provide consistency with the desired form, character and land uses of the underlying Place Type;
4. Differences between the height, scale, bulk, setback from the street, or other physical features of the proposed development, and existing development in the immediate area;
5. Presence and quality of a spatial or physical transition between uses;
6. Availability of adequate roads, services and infrastructure; and

7. Relationship and incorporation of existing Natural, Environmental and Heritage resources.

Building Orientation and Setbacks

1. All development should include a site design that is compact and makes buildings the prominent feature of the site as viewed from adjoining/adjacent roads, especially along major thoroughfares. Site design and development will strive to minimize site disturbance and minimize removal of existing, viable vegetation.
2. It is desirable to have civic spaces, open spaces, green spaces, and vegetation to separate parking lots from buildings and areas for human activity. Civic spaces and green spaces are encouraged to have public art enhancements.



Building Design

1. Buildings within larger multi-building developments should exhibit a unity of design through the use of similar elements such as rooflines, exterior materials, facade treatments, window/fenestration arrangements, sign location, and architectural styles and details.
2. Freestanding stores, retail centers, commercial centers, and restaurants will be encouraged to provide usable outdoor civic or public spaces.
3. Required drainage and stormwater management facilities, such as holding basins, drainage swales, and culverts should be incorporated as features into the site design of the project, to the extent possible. Natural drainage features should be conserved to the greatest extent possible, minimizing impervious facilities to the extent technically feasible.
4. Building massing and walls must be varied to avoid long, flat facades and break down the scale of large buildings and commercial/retail centers. It is desirable that building facades should incorporate wall relief, recesses, off-sets, angular forms, or other features. Buildings cannot present a "blank side" to neighboring properties.
5. Pitched, mansard, and other distinctive roof forms are strongly encouraged where appropriate.
6. Rooftop mechanical equipment will be screened with materials that blend with the architecture and will be perceived as an integral part of the principal building. Ground mounted mechanical equipment will also be screened either by incorporating it in the building architecture or by landscaping.
7. Buildings will incorporate covered entrances to provide weather protection for shoppers and create a pedestrian-oriented environment.
8. Retail development should avoid the appearance of strip commercial development which is commonly characterized by the following features to be avoided: multiple entrances serving individual uses, minimal setbacks and landscaping, and multiple structures and signs without a unified design scheme.

Sidewalks, Streets Trees, and Plantings

1. Large parking areas will be landscaped with trees and shrubs throughout to reduce the visual impact, provide shade, and reduce the heat island effect or heat absorption of the parking area.
2. The street frontage of development will be landscaped with trees to help create a green edge on both sides of the street.
3. Existing environmental features such as natural topography, hedgerows, mature trees, and berms will be integrated into the landscape plan for non-residential centers, when feasible.
4. Non-residential buildings and parking areas will be sufficiently screened and buffered from adjoining residential areas by distance, transitional uses, landscaping, and/or natural vegetation to mitigate the effects of noise, lighting, and traffic on the surrounding residences.
5. Residential areas will be buffered from adjacent non-residential uses by trees, fences, and hedges.
6. Sidewalks will be provided to all development to accommodate benches, bikes, strollers, trees, and planters.

Street Furnishings and Lighting

1. Provide usable space and amenities when planning sidewalks, including street furnishings such as benches, trash cans, kiosks, street gardens, bike racks, outdoor sitting spaces, and public art.
2. Signs for development will be developed as an integral part of the overall design. A unified graphic design scheme is strongly encouraged that is in conformance with an appropriate regulatory framework.
3. Site and building lighting will reduce glare and spillage of light onto adjoining properties and streets. Fixtures should be attractive site elements that are compatible with the architecture of the development.
4. Both lighting and signs will be designed for pedestrians, bicyclists, and vehicles.

Parking, Circulation, and Loading

1. All development should strive to create inter-parcel connectivity for pedestrian and vehicular circulation to increase pedestrian activity and decrease vehicular traffic on roadways necessitated by broken inter-parcel connections.
2. Pedestrian traffic, internal to non-residential centers, should be provided with a safe travel route from the parking area to the building with a demarcated pathway and clear directional signage. Trees and other plantings should be provided along the walkway.
3. Parking areas will be visually screened from adjacent streets and residential areas by heavy landscaping, depressing the parking area, constructing earthen berms, and/or other means.
4. All loading and storage areas must comply with Zoning Ordinance regulations and must be screened from adjacent residential areas by earthen berms, masonry walls, permanent wooden fencing, or dense landscaping.

5. Parking structures should be integrated with surrounding development to promote an active and diverse streetscape and to minimize the visual impact of parking. Pedestrian entrances should be well-defined and attractive.
6. Parking structures that front streets should wrap the parking structure at the street level with an active use. Active uses may include retail, office, or residential uses and should be based on the allowed uses in each respective Place Type.
7. The height and mass of parking structures should be consistent with the design character of the area within which the structure is located (e.g., a five-story parking structure should not be situated in an area that consists primarily of two-story buildings).
8. Façades that face public rights-of-way should incorporate massing, textures, colors, and other architectural techniques that are of similar style and quality as primary adjacent buildings.
9. Parking structures should be designed to conceal the view of all parked cars and internal light sources from adjacent public right-of-way or public open space for the full height of the structure.
10. Surface parking should be located to the rear or side of buildings and away from the street or street intersections, while providing direct pedestrian access to the buildings.
11. Textures, patterns, and colors are encouraged in the design of surface parking to provide breaks in large areas of pavement and distinguish between areas for pedestrian and vehicular movement.
12. Large surface parking lots should be functionally divided into smaller, well-landscaped and shaded parking clusters.

Transition Policy Area Design Guidelines

Unless otherwise specified, the following guidelines apply only within the Transition Policy Area:

1. Integrate buildings and parking into the existing natural landscape and provide usable open space that is accessible to residents and the public, subject to the following:
 - a. Perimeter open space screening from roads and other communities may be the predominant component of the 50 percent open space requirement,
 - b. Distribute community greens, playgrounds, and gathering spaces within residential development,
 - c. Link open space to surrounding neighborhoods and public facilities with pedestrian and bicycle networks,
 - d. Link open space to natural, environmental, and heritage resources, unique site features, and open space in other communities,
 - e. Locate low intensity parks that emphasize undisturbed open space in highly visible areas or in conjunction with schools, churches, and neighborhood commercial centers where they can serve as a buffer for adjoining homes.
2. Ensure that open space within developments creates or enhances the following:
 - a. The 300-foot buffer and 200-foot transitional area along the Bull Run in the Upper and Lower Foley and Lower Bull Run subareas,

- b. The 300-foot buffer and 1,000-foot voluntary open space area along the Goose Creek, Goose Creek Reservoir, and Beaverdam Reservoir in the Lower Sycamore and Middle Goose subareas,
 - c. A contiguous network of green spaces to supplement the natural, environmental, and heritage resources connecting communities and natural resource areas, and
 - d. A public trail and park network to destinations throughout the area.
3. Locate development on areas of the site that afford the least disruption of views of the landscape.
4. Protect the historic context of nearby archaeological and historic sites and along scenic corridors.
5. Provide trails and sidewalks that connect to adjacent neighborhoods and other destinations within and outside the project.
6. Ensure that clusters of residential units proposed in TPA communities are appropriate in number of units to reflect a traditional hamlet scale with multiple clusters separated by open space areas and featuring:
 - a. A variety of lot sizes with no minimum lot size requirement and minimal setbacks,
 - b. A predominantly single-family residential development pattern,
 - c. A network of publicly accessible trails and pedestrian sidewalks linking communities and amenities, and
 - d. A network of tree-lined streets constructed at minimum required widths to merge into the open landscape and slow traffic.
7. Ensure that housing diversity and affordability are components of larger and higher density developments, such as Transition Compact Neighborhoods by including a mixture of housing types, and a range of building and lot sizes and configurations.
8. Include varying densities in neighborhoods, with higher densities generally in close proximity to community greens, civic uses, or small-scale retail uses.
9. Diversify housing size, unit types, lot sizes, and lot pattern along each street frontage and in the same blocks to reflect the design of traditional villages and towns.
10. Include pedestrian features, landscaping, short blocks, few dead ends or cul-de-sacs, and traffic calming features.
11. Locate buildings close to the street but require some discernable variations in building setbacks along residential streets.
12. Encourage designs where building facades have differentiated surfaces and design elements consistent with surrounding development that follows natural contours.
13. Address parking in Transition Compact Neighborhood and Transition Community Center place types through a combination of on-street and off-street choices designed and located to minimize their visual impact.
14. Develop employment uses at a scale that minimizes their intrusion into the rural and natural landscape and their impact on surrounding roads and communities by:
 - a. Screening all outdoor storage and equipment parking areas from view of adjoining properties and roads,
 - b. Minimizing the number of entrances from major collector or arterial roads;
 - c. Ensuring adequate road and infrastructure capacity,

- d. Avoiding large expanses of blank building surfaces by using articulation, fenestration and façade treatments, especially when the facades are visible from public roads, and
- e. Separating industrial uses from residences by locating less-intensive uses adjacent to residential uses or using natural or manmade barriers between the uses.

Rural Policy Area Design Guidelines

Unless otherwise specified, the following guidelines apply only within the Rural Policy Area Rural North and Rural South Place Types:

- 1. Development on ridgelines or hill tops should be avoided to retain the rural character of the landscape and protect viewsheds.
- 2. Site development should preserve existing land forms and minimize significant alterations to the topography while incorporating natural features, trees, hedgerows and other vegetation into the design to protect viewsheds and provide visual buffers between parcels.
- 3. Required drainage and stormwater management facilities, such as holding basins, drainage swales, and culverts should be incorporated as features into the site design of the project, to the extent possible. Natural drainage features should be conserved to the greatest extent possible, minimizing impervious facilities to the extent technically feasible.
- 4. Development should be sited within the landscape to minimize visibility from roadways and other properties while preserving suitable farmland.
- 5. Outdoor lighting should be limited to areas where activity occurs and use the minimum light intensity necessary to eliminate glare and light trespass.
- 6. Trail connections should be provided when feasible, to link private and public lands as part of a multi-use trail network.
- 7. Rural Cluster subdivisions are a land development design that compactly groups homes on small lots arranged in a traditional community pattern while retaining large tracts of land for open space, agricultural production, and/or rural economy uses to preserve natural features and the rural character. When developing Rural Cluster subdivisions in the RPA:
 - a. Use existing topography, hedgerows, mature woodlands, and other site features to influence the location of the clusters to maintain the rural and scenic quality of the landscape.
 - b. Provide a compact cluster of building lots and maximize open space.
 - c. Design roads and driveways to follow the natural contours of the land. Roads and driveways should be the minimum width necessary to provide safe travel ways.
 - d. Cluster development to retain large areas of agricultural soils for farming
 - e. Encourage the use of shared water and wastewater systems to serve cluster developments to protect water resources.
- 8. Site building and structures should blend with the natural landscape to reduce their perceived scale, mass, and height, thus reducing their impact on the landscape and surrounding viewsheds.

9. Buildings should incorporate architectural styles and design elements that emulate and relate to the historical and regional architecture of Loudoun which contributes to the visual quality and identity of the RPA.
10. Parking, mechanical units, and other site development features should be located to diminish their visual impact from public roadways and neighboring properties.

Rural Historic Villages Design Guidelines

Unless otherwise specified, the following guidelines apply only within the Rural Historic Villages:

1. New development should reinforce the existing pattern of streets/roads in the Rural Historic Villages.
2. The streetscape of Rural Historic Villages should incorporate sidewalks, crosswalks, lighting, landscaping and other street amenities which enhance the pedestrian experience and contribute to the visual quality of the village.
3. Sidewalk and trail networks within the Rural Historic Villages should be expanded to provide connections to surrounding trail networks in the RPA.
4. Incorporate and retain existing trees and other site vegetation, especially when these features form a visual edge defining the streetscape or space between properties.
5. New buildings will be oriented on their site to maintain the existing street pattern, street design, and relationship to other buildings to reinforce the historic development pattern of the village.
6. The scale, size, massing, and design of new buildings will adopt building forms and architectural styles related to the individual character of the village.
7. Where the footprint of a new building is larger than existing buildings, reduce the perceived mass by dividing the building into smaller pieces with varying wall planes and rooflines. Design new commercial development to conform with the storefront configuration of existing historic examples, when no local precedent exists look to other examples in the villages to inform new construction.
8. Locate parking, mechanical units, and other site features in locations which diminish their visual impact from the street.

Joint Land Management Area Design Guidelines

Unless otherwise specified, the following guidelines apply only within the JLMA. These guidelines will be reviewed concurrently and coordinated with Town guidelines or policies related to the JLMA area.

1. Support the preservation and protection of historic, cultural, and environmental resources in and around each Town.
2. Support development of distinct “gateways” into each community and protect rural view sheds leading into the towns. Gateway concepts will be developed with the Town and may include measures to protect existing trees, hedgerows, viewsheds, and vistas, design

guidelines for lot configuration to continue the rural lot pattern, new landscaping, entrance features, and other techniques.

3. Protect the natural or rural scenic views along roads leading into the Towns through measures such as revised State Road Improvement Standards, scenic or conservation easements, the creation of historic corridor overlay zoning, and rural design concepts.
4. Encourage a variety of housing types and commercial development within the JLMA that are consistent with applicable Town and County policies, are compatible with the existing communities, and extend in a contiguous, rational and convenient manner from the Towns.
5. Apply the SPA Design Guidelines when reviewing non-residential developments located within the Leesburg JLMA.
6. Encourage residential communities in the JLMA that propose to connect to municipal utilities to exhibit:
 - a. A variety of lot sizes and, where permitted, a variety of unit types,
 - b. A street network without culs-de-sac and P-loop streets with numerous connections to existing streets,
 - c. An interconnected block pattern with compact lots, shallow front and side-yard setbacks, and small block sizes,
 - d. Sidewalks along all streets, providing access to the town or neighborhood center, public buildings, parks, and other destinations,
 - e. A compatible mix of complementary residential and non-residential uses such as home-occupation businesses, churches, and schools,
 - f. Parks, squares, or greens that provide a combination of natural and passive open spaces throughout the development, and
 - g. A central public focal point consisting of any combination of a park (village green); a public facility such as a church or community center; natural features; or neighborhood commercial uses.

Section 4-1500**FOD - Floodplain Overlay District****4-1501**

Purpose and Intent. The purpose of these provisions is to conserve the natural state of watercourses and watersheds and to prevent: the loss of life and property, the creation of health and safety hazards, the disruption of commerce and governmental services, the extraordinary and unnecessary expenditure of public funds for flood protection and relief, and the impairment of the tax base by (1) regulating uses, activities, and development which, alone or in combination with other existing or future uses, activities, and development, will cause unacceptable increases in flood heights, velocities, and frequencies; (2) restricting or prohibiting certain uses, activities, and development from locating within areas subject to flooding; (3) requiring all those uses, activities, and developments that do occur in areas susceptible to flooding to be protected and/or flood-proofed against flooding and flood damage; and ; (4) preventing individuals from using land and erecting structures which are unsuited for intended purposes because of flood hazards. These provisions shall apply to all privately and publicly owned lands within the jurisdiction of the County of Loudoun and identified as being located within the Floodplain Overlay District (FOD). Only those uses set forth in Section 4-1505 and 4-1506 shall be permitted or special exception uses within the FOD, and land so encumbered may be used in a manner permitted in the underlying zoning district only if and to the extent such use is also permitted in the FOD.

The degree of flood protection sought by Section 4-1500 is considered reasonable for regulatory purposes and is based on acceptable engineering methods of study, but does not imply total flood protection. Larger floods may occur on rare occasions. Flood heights may be increased by man-made or natural causes, such as ice jams and bridge openings restricted by debris. Section 4-1500 does not imply that property outside the FOD or land uses permitted within the FOD will be free from flooding or flood damages. Section 4-1500 shall not create liability on the part of Loudoun County or any officer or employee thereof for any flood damages that result from reliance on Section 4-1500 or any administrative decision lawfully made thereunder.

4-1502

Authority. Authority for these provisions includes:

- (A) Flood Damage Reduction Act, Va. Code Sections 10.1-600 et seq.
- (B) Va. Code Sections 15.2-2200 through 15.2-2329 (Planning, Subdivision of Land and Zoning).
- (C) Soil Conservation Districts Law, Va. Code Sections 10.1-500 et seq.
- (D) Erosion and Sediment Control Law, Va. Code Section 62.1-44.15:51 et seq.
- (E) Potomac River Basin Compact, Va. Code Section 28.2-1001.
- (F) National Flood Insurance Act of 1968, 42 U.S.C. 4001 et seq., as amended by the National Flood Insurance Reform Act of 1994 and the Flood Insurance Reform Act of 2004.

Definitions. The words and phrases defined in this subsection shall have the following meanings when used in Section 4-1500.

- (A) **Alteration.** A development action which will change the cross section of the floodplain and will increase either the erosive velocity or height of floodwaters either on-site or off-site. Alterations include, but are not limited to, land disturbing activities.
- (B) **Base Flood.** The flood having a one percent (1%) chance of being equaled or exceeded in any given year. Also known as the 100-year flood.
- (C) **Base flood elevation.** The water surface elevations of the base flood. The water surface elevation of the base flood is calculated based on the datum specified on Loudoun County's Flood Insurance Rate Map.
- (D) **Basement.** That portion of a building having its floor below ground level on all sides.
- (E) **Conditional Letter of Map Revision (CLOMR).** A formal review and written comment from FEMA on a proposed project that would, upon construction, cause an increase in base flood elevation. Upon completion of the construction of such project, a Letter of Map Revision (LOMR) issued by FEMA, determining that the increase was warranted, shall be required.
- (F) **Cross section.** Shape and dimensions of a channel and valley of the floodplain perpendicular to the line of flow.
- (G) **Development.** Any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials.
- (H) **Elevated building.** A non-basement building built to have the lowest floor elevated above the ground level by means of solid foundation perimeter walls, pilings, or columns (posts and piers).
- (I) **Flood or Flooding.**
 - (1) A general or temporary condition of partial or complete inundation of normally dry land areas from:
 - (a) the overflow of inland waters; or,
 - (b) the unusual and rapid accumulation or runoff of surface waters from any source.
 - (c) mudflows which are proximately caused by flooding as defined in paragraph (1)(b) of this definition and are akin to a river of liquid and flowing mud on the surfaces of

normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.

- (2) The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature such as a flash flood, or by some similarly unusual and unforeseeable event which results in flooding as defined in paragraph 1(a) of this definition.
- (J) **Flood Insurance Rate Map (FIRM).** The official map of Loudoun County on which the Federal Emergency Management Agency (FEMA) has delineated areas in the floodplain subject to inundation of the base flood and the risk premium zones based on the technical data in the Flood Insurance Study. The FIRM that has been made available digitally is called the Digital Flood Insurance Rate Map (DFIRM).
- (K) **Flood Insurance Study (FIS).** A report by FEMA that examines, evaluates and determines flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudflow and/or flood-related erosion hazards.
- (L) **Floodplain.** Any land area susceptible to being inundated by water from the base flood and having a drainage area greater than one hundred (100) acres. For purposes of regulation under this Ordinance, a distinction is made between the Major Floodplain and Minor Floodplain. Major floodplain shall correspond to Zones AE and A as shown on the FIRM, as may be subsequently revised or amended by FEMA, and is considered to be the Special Flood Hazard Area by FEMA. All watersheds draining greater than 640 acres shall be considered Major Floodplain. Minor Floodplain shall correspond to watersheds of 640 acres or less that are not designated as Zone AE or A.
- (M) **Floodproofing.** Any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.
- (N) **Floodway.** The channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without any cumulative increase in the base flood elevation. Floodways are included within, and regulated as, FOD (Major Floodplain). Floodways are not shown on the FIRM but are included within the Special Flood Hazard Area designated on the FIRM, which is regulated as FOD (Major Floodplain).
- (O) **Freeboard.** A factor of safety expressed in feet above a flood level for purposes of floodplain management. “Freeboard” compensates for the many unknown factors that contribute to flood heights greater than the

height calculated for Base Flood, such as wave action, bridge openings, and the hydrological effect of urbanization in the watershed.

- (P) **Historic structure.** Any structure that is:
- (1) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;
 - (2) Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district;
 - (3) Individually listed on the Virginia Landmarks Register; or,
 - (4) Individually listed on the Loudoun County Register of Heritage Resources.
- (Q) **Lowest floor.** The lowest floor of the lowest enclosed area (including basement). An unfinished or flood-resistant enclosure, usable solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of Code of Federal Regulations 44CFR §60.3.
- (R) **Manufactured Home.** A structure constructed and subject to federal regulation, which is transportable in one or more sections; is built on a permanent chassis; is designed to be used as a single-family dwelling, with or without a permanent foundation, when connected to utilities. The term "manufactured home" also includes recreational vehicles placed on a site for greater than 180 consecutive days whether connected to utilities or not.
- (S) **New construction.** Structures for which the start of construction commenced on or after January 5, 1978. All such structures shall comply with the Loudoun County regulations in effect at the time of construction. Any improvement(s) to a structure shall comply with the Loudoun County regulations in effect at the time of construction of the improvement(s).
- (T) **Recreational Vehicle.** A vehicle which is
- (1) built on a single chassis;
 - (2) 400 square feet or less when measured at the largest horizontal projection;
 - (3) designed to be self-propelled or permanently towable by a light duty truck; and

- (4) designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational camping, travel, or seasonal use.
- (U) **Road, Crossing of the Floodplain or Road Crossing.** Any public road, private road or driveway traversing a floodplain generally perpendicular to the flow of the drainageway.
- (V) **Special Flood Hazard Area (SFHA).** The land in the floodplain subject to a one (1%) percent or greater chance of being flooded in any given year. This area corresponds to where the National Flood Insurance Program's (NFIP's) floodplain management regulations must be enforced and includes Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE, and V as shown on the FIRM.
- (W) **Start of construction.** Means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, substantial improvement or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of the construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.
- (X) **Stormwater Management Improvements.** Surface or subsurface drainage improvements, storm sewers, detention and retention ponds and other such improvements as required by the Facilities Standards Manual (FSM), the Loudoun County Stormwater Management Ordinance, Chapter 1096 of the Codified Ordinances of Loudoun County, or the Loudoun County Erosion and Sediment Control Ordinance and Plan, Chapter 1220 of the Codified Ordinances of Loudoun County.
- (Y) **Stream Corridor.** Includes the stream and extends in cross section from the channel's bankfull level towards the upland (perpendicular to the direction of streamflow) to a point on the landscape where channel-related surface and/or soil moisture no longer influence the plant community.
- (Z) **Stream Restoration.** Converting an unstable, altered, or degraded stream corridor, including adjacent riparian area and flood-prone areas, to its natural stable condition considering recent and future watershed conditions.

- (AA) **Structure.** An assembly of materials forming a construction for occupancy or use including, among others, buildings, stadiums, gospel and circus tents, platforms, stagings, observation towers, telecommunications towers, radio and TV broadcasting towers, water tanks, trestles, piers, open sheds, coal bins, shelters, walls, power line towers, pipelines, railroad tracks, manufactured homes, and gas or liquid storage tanks that are principally above ground.
- (BB) **Substantial damage.** Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed fifty percent (50%) of the market value of the structure before the damage occurred.
- (CC) **Substantial improvement.** Any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds fifty percent (50%) of the market value of the structure before the start of construction of the improvement. This term includes structures which have incurred flood related damages on two (2) occasions in which the cost of the repair on the average equaled or exceeded twenty-five percent (25%) of the market value of the structure at the time of each such flood event or substantial damage regardless of the actual repair work performed. The term does not, however, include either:
- (1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or
 - (2) Any altering, repair or rehabilitation of a historic structure, provided that the altering, repair or rehabilitation will not preclude the structure's continued designation as a historic structure. Historic structures undergoing altering, repair or rehabilitation that would constitute a substantial improvement as defined above, must comply with all requirements of Section 4-1500 that do not preclude the structure's continued designation as a historic structure. Documentation that a specific requirement of Section 4-1500 will cause removal of the structure from the National Register of Historic Places or the Virginia Landmarks Register must be obtained from the Secretary of the Interior or the State Historic Preservation Officer. Any exemption from the requirements of Section 4-1500 will be the minimum necessary to preserve the historic character and design of the structure.
- (DD) **Utility Lines in the Floodplain.** Storm sewers, sanitary sewers, water lines and similar lines running generally parallel and perpendicular to the flow of the drainageway; and other public utility lines traversing a floodplain generally perpendicular to the flow of the drainageway.
- (EE) **Violation.** The failure of a structure or other development to be fully compliant with this Section 4-1500. A structure or other development

without a FEMA approved Elevation Certificate, other certifications, or other evidence of compliance required in this Section 4-1500 shall be presumed to be in violation until such time as that documentation is provided.

- (FF) **Watercourse.** A lake, river, creek, stream, wash, channel or other topographic feature on or over which waters flow at least periodically. Watercourse includes specifically designated areas in which substantial damage resulting from flooding may occur.

4-1504

Administration.

- (A) **Designation of Floodplain Administrator.** The Zoning Administrator, or his/her designee, shall administer and implement these regulations and is referred to herein as the Floodplain Administrator.
- (B) **Duties and Responsibilities of the Floodplain Administrator.** The Floodplain Administrator shall:
- (1) Review all applications for development located within the FOD.
 - (2) Interpret FOD boundaries in accordance with Section 6-407 and provide available base flood elevation and flood hazard information.
 - (3) Review applications for development to determine whether proposed activities will be reasonably safe from flooding and meet the requirements of Section 4-1500.
 - (4) Review applications for reconstruction, rehabilitation, addition or other improvement of a structure to determine whether such proposed activities constitute substantial improvements.
 - (5) Review applications for development to determine whether all necessary permits have been obtained from the Federal, State or local agencies from which prior or concurrent approval is required; in particular, permits from state agencies for any construction, reconstruction, repair, or altering of a dam, reservoir, or waterway obstruction (including bridges, culverts, structures), any altering of a watercourse, or any change of the course, current, or cross section of a stream or body of water, including any change to the 100-year frequency floodplain of free-flowing non-tidal waters of the State.
 - (6) Verify that applicants proposing to alter a watercourse have notified affected adjacent towns, cities, county or state government, the Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management), and other appropriate agencies (Virginia Department of Environmental Quality, United States Army Corps of Engineers) and have submitted copies of such notifications to FEMA.

- (7) Inspect or cause to be inspected, buildings, structures, and other development for which permits have been issued to determine compliance with Section 4-1500 or to determine if non-compliance has occurred or violations have been committed.
- (8) Review submitted FEMA Elevation Certificate applications and require incomplete or deficient applications to be corrected.
- (9) Submit to FEMA, or require applicants to submit to FEMA, data and information necessary to maintain FIRMs, including Floodplain Studies and Floodplain Alterations approved in accordance with the FSM, within six (6) months after such data and information becomes available if the analyses indicate changes in base flood elevations.
- (10) Maintain and permanently retain records that are necessary for the administration of the FOD, including:
 - (a) Flood Insurance Studies, Flood Insurance Rate Maps (including historic studies and maps and current effective studies and maps), and Letters of Map Change; and
 - (b) Documentation supporting approval or denial of development permits, Elevation Certificates, documentation of the elevation (in relation to the datum on the FIRM) to which structures have been floodproofed, other required design certifications, variations pursuant to Section 4-1511, and records of enforcement actions taken to correct violations of these regulations.
- (11) Enforce the provisions of these regulations, investigate violations, issue notices of violations or stop work orders, and require permit holders to take corrective action.
- (12) Advise the Board of Supervisors regarding the intent of these regulations and, for each application for a variation pursuant to Section 4-1511, prepare a staff report and recommendation.
- (13) Administer the requirements related to proposed work on existing buildings:
 - (a) Make determinations as to whether buildings and structures that are located in FOD (Major Floodplain only) and that are damaged by any cause have been substantially damaged.
 - (b) Make reasonable efforts to notify owners of substantially damaged structures of the need to obtain a permit to repair, rehabilitate, or reconstruct such damaged structures; and prohibit the non-compliant repair of substantially damaged buildings except for temporary emergency protective

measures necessary to secure a property or stabilize a building or structure to prevent additional damage.

- (14) Undertake, as determined appropriate by the Floodplain Administrator due to the circumstances, other actions which may include but are not limited to: issuing press releases, public service announcements, and other public information materials related to development permit requests and repair of damaged structures; coordinating with other Federal, State, and local agencies to assist with substantial damage determinations; providing owners of damaged structures information related to the proper repair of damaged structures in FOD; and provide property owners with information necessary to file claims for Increased Cost of Compliance coverage under the National Flood Insurance Program (NFIP) flood insurance policies.
- (15) Notify FEMA when the corporate boundaries of the County have been modified and:
 - (a) Provide a map that clearly delineates the new corporate boundaries or the new area for which the authority to regulate pursuant to Section 4-1500 has either been assumed or relinquished through annexation or otherwise; and
 - (b) For any new area for which the authority to regulate pursuant to this Section 4-1500 has been assumed, prepare necessary amendments to the Zoning Map and appropriate requirements, and submit such amendments to the Board of Supervisors for adoption. A copy of the amended regulations shall be provided to Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management) and FEMA.
- (16) Upon the request of FEMA, complete and submit information regarding the number of buildings in the FOD (Major Floodplain only), number of approved permits for development in the FOD (Major Floodplain only), number of approved variations pursuant to Section 4-1511. Any variations that are approved shall be noted in the annual or biennial report submitted to FEMA's Federal Insurance Administrator.
- (17) Serve as a referral agent on all legislative land development applications.

- (C) **Delineation of the FOD.** The original basis for the delineation of the FOD shall be the floodplain as shown on the Flood Insurance Study (FIS) and the Flood Insurance Rate Map (FIRM) for the County of Loudoun prepared by FEMA, Federal Insurance Administration, dated February 17, 2017. The boundaries of the floodplain and FOD may change based on

information submitted in accordance with this Chapter, and/or subsequent revisions or amendments to the FIS and FIRM approved by FEMA.

4-1505

Permitted Uses. The following uses shall be permitted within the FOD provided such uses conform with Section 5-1000. Uses allowed in the underlying district shall be prohibited to the extent such uses are not permitted, or special exception uses in the FOD. Where any uses, structures or improvements will result in development within the FOD, an application for a Floodplain Alteration shall be submitted in accordance with Section 4-1508(B) and the FSM.

- (A) Permitted uses in FOD (Major Floodplain). Such uses shall not cause any increases in base flood elevation of the FOD (Major Floodplain) unless otherwise provided below.
- (1) Agriculture, horticulture, forestry, and fisheries, not requiring the erection of structures, except that incidental structures shall be permitted in accordance with this Section. An increase in base flood elevation may be permitted provided a CLOMR is obtained from FEMA prior to approval of the requisite Floodplain Alteration application for such use.
 - (2) Passive and Active Recreation Uses, except swimming pools, provided that the area of impervious surfaces within the FOD (Major Floodplain) does not exceed three percent (3%) of the area of FOD (Major Floodplain) located within the subject parcel and the boundary of the FOD (Major Floodplain) does not change.
 - (3) Stormwater management improvements as follows:
 - (a) Rooftop disconnection. Associated soil amendments shall be located outside of areas of existing tree cover and shall not require the clearing of existing tree cover.
 - (b) Sheet flow to conservation area.
 - (c) Sheet flow to vegetated filter and associated soil amendments located outside of areas of existing tree cover and not requiring the clearing of existing tree cover.
 - (d) Grass channel and associated soil amendments.
 - (e) Soil amendments located outside of areas of existing tree cover and not requiring the clearing of existing tree cover.
 - (f) Other stormwater management improvements provided that such improvements shall only serve permitted or approved special exception uses in the FOD, and shall only serve those portions of such uses that are located within the FOD.
 - (4) Utility lines in the floodplain and road crossings. An increase in base flood elevation on site may be permitted provided a CLOMR is

obtained from FEMA prior to approval of the requisite Floodplain Alteration application for such use. Road crossings shall be designed and constructed in accordance with the standards and regulations of the Virginia Department of Transportation (VDOT) and/or the FSM, whichever shall apply.

- (5) Public roads shown on the Comprehensive Plan or included in a Capital Improvement Program project. An increase in base flood elevation may be permitted provided a CLOMR is obtained from FEMA prior to approval of the requisite Floodplain Alteration application for such use.
- (6) Public roads, private roads, and driveways.
- (7) Repair, reconstruction or improvement of existing residences, so long as the footprint of the existing residence is not increased within the FOD and provided that such repair, reconstruction or improvement, whether located within or outside of the FOD, is not a substantial improvement. If such repair, reconstruction or improvement is a substantial improvement then conformance with Section 4-1509 shall be required.
- (8) Parking areas accessory to permitted or approved special exception uses in the FOD. All such parking areas shall be equipped with best management practices in accordance with Chapter 5 of the FSM and Chapter 1096 of the Codified Ordinances.
- (9) Incidental structures, not exceeding 840 square feet of floor area, associated with permitted or approved special exception uses in the FOD, and temporary structures associated with Special Events in the FOD. Incidental structures include storage sheds, maintenance sheds, backstops, bath houses and locker rooms. Provided, however, bulk storage of gasoline, chemicals, fuels or similar substances are prohibited in the FOD; and further provided that any new construction shall comply with applicable FEMA standards.
- (10) Temporary storage of material or equipment necessary in the construction of permitted or special exception uses in the FOD.
- (11) Alterations of the floodplain associated with any permitted or approved special exception uses in the FOD. Such alterations shall not relocate or alter the natural active channel except for road crossings permitted under Section 4-1505(A)(4) or Section 4-1505(A)(13), to protect existing habitable structures subject to periodic flooding, or for stream restoration permitted under Section 4-1505(A)(16). Applications for alterations of the floodplain shall be in accordance with Section 4-1508(B). To the extent that the boundaries of the FOD change as a result of an approved Floodplain Alteration, any areas no longer within the FOD may be used for any use in the underlying zoning district,

subject to the provisions of the applicable zoning district regulations and conditions of any approved special exception.

- (12) Restoration and rehabilitation of historic structures.
 - (13) Road crossings that result in an increase in the base flood elevation off-site provided that:
 - (a) A CLOMR is obtained from FEMA prior to approval of the requisite Floodplain Alteration application for such use.
 - (b) The road crossing shall be a feature shown on the Comprehensive Plan or included in a Capital Improvements Program project.
 - (c) The road crossing shall be designed and constructed in accordance with the standards and regulations of the Virginia Department of Transportation and/or the FSM, whichever shall apply.
 - (d) The resulting increase in the base flood elevation shall not affect existing buildings and structures.
 - (e) Affected off-site property owners may at any time mitigate impacts on their land as a result of an increase in the base flood elevation by:
 - (i) Submitting a Floodplain Alteration to reclaim that portion of their land subject to the increase in base flood elevation as a result of the road crossing, provided there is no increase in the base flood elevation; and/or
 - (ii) Requesting a modification of the building setback or parking setback requirements on specific lots or parcels of land affected by the increase in the base flood elevation by special exception approved by the Board of Supervisors, in accordance with Section 6-1300 and 4-1507 of the Zoning Ordinance.
- (14) Public water utility drinking water supply reservoirs, including, without limitation, reclaimed quarries.
 - (15) Maintenance of the design conditions of an approved Floodplain Alteration.
 - (16) Stream Restoration designed in accordance with the FSM and approved by the County. An increase in base flood elevation may be permitted provided a CLOMR is obtained from FEMA prior to approval of the requisite Floodplain Alteration application for such use.

- (17) Wetland Mitigation. An increase in base flood elevation may be permitted provided a CLOMR is obtained from FEMA prior to approval of the requisite Floodplain Alteration application for such use.
 - (18) Flood mitigation practices carried out in order to minimize and reduce flood risk in accordance with the Code of Federal Regulations, Title 44, Section 78.1, et seq.
 - (19) Special Events, pursuant to 5-500(C), without land disturbing activity.
- (B) Permitted uses in floodplains in FOD (Minor Floodplain), with or without an increase in base flood elevation:
- (1) Uses allowed under Section 4-1505(A), except that increases in the base flood elevation in the FOD (Minor Floodplain) shall be permitted.
 - (2) Alteration of the floodplain whether or not associated with a permitted or approved special exception use in the FOD. To the extent that the boundaries of the FOD change as a result of the Floodplain Alteration, any areas no longer within the FOD may be used for any use in the underlying zoning district, subject to the provisions of the applicable zoning district regulations and conditions of any approved special exception.
 - (3) Stormwater management improvements whether or not associated with permitted or approved special exception uses in the FOD.
 - (4) Ponds designed by the Natural Resources Conservation Service, a Licensed Professional Engineer, or a Class B Land Surveyor.
 - (5) Basketball or tennis courts, and swimming pools.
 - (6) Parking areas less than 5,000 square feet not otherwise permitted. Such parking areas shall not be subject to 100-year flooding greater than one (1) foot in depth, shall be equipped with best management practices in accordance with Chapter 5 of the FSM and Chapter 1096 of the Codified Ordinances, and shall not result in any change in existing grade.

4-1506

Special Exception Uses. The following uses and structures may be permitted in the FOD (Major Floodplain or Minor Floodplain) by the Board of Supervisors by special exception, subject to Section 6-1300 and Section 4-1507, provided that such uses conform with Section 5-1000 and such uses shall not cause any increase in the base flood elevation of the FOD (Major Floodplain) unless otherwise provided below. Uses allowed in the underlying district shall be prohibited to the extent such uses are not permitted or special exception uses in the FOD. Where any uses, structures or improvements will result in development within the FOD,

an application for a Floodplain Alteration shall be submitted in accordance with Section 4-1508(B) and the FSM.

- (A) Marinas, boat rentals, docks, piers, wharves, water ski jump facilities.
- (B) Special Events, pursuant to 5-500(C), with land disturbing activity.
- (C) Riding stables.
- (D) Structures required for the operation of a public utility not otherwise permitted by this Ordinance.
- (E) Incidental structures, greater than 840 square feet of floor area, associated with permitted or approved special exception uses in the FOD. Incidental structures include storage sheds, maintenance sheds, backstops, bath houses and locker rooms. Provided, however, bulk storage of gasoline, chemicals, fuels or similar substances are prohibited in the FOD; and further provided that any new construction shall comply with applicable FEMA standards.
- (F) Passive and Active Recreation Uses, except swimming pools, provided that the area of impervious surfaces within the FOD (Major Floodplain) does not exceed ten percent (10%) of the area of FOD (Major Floodplain) located within the subject parcel, that cause the boundary of the FOD (Major Floodplain) to change, and/or that cause an increase in base flood elevation. Such increase in base flood elevation may be permitted provided a CLOMR is obtained from FEMA prior to approval of the requisite Floodplain Alteration application for such use.

4-1507

Standards For A Special Exception. In considering applications for a special exception, the Board of Supervisors shall be satisfied that the following standards and those of Section 6-1300 have been met:

- (A) The proposed use will not increase the danger to life and property due to increased flood heights or velocities.
- (B) The proposed use will not increase the danger that materials may be swept downstream to the injury of others.
- (C) The proposed water supply and sanitation systems are designed to prevent disease, contamination, and unsanitary conditions.
- (D) The proposed use or structure shall be located and designed to limit its susceptibility to flood damage, and available alternative locations, not subject to flooding, for the proposed use shall be considered.
- (E) The proposed use is compatible with existing and planned development.
- (F) The proposed use is in harmony with the Comprehensive Plan.

- (G) The expected heights, velocity, duration, rate of rise and sediment transport of the flood waters expected at the site shall not cause significant damage.

4-1508 Floodplain Overlay District Development Procedures.

- (A) **Floodplain Information to be Submitted with Land Development Applications.** All new subdivision proposals and other proposed development greater than fifty (50) lots or five (5) acres, whichever is the lesser, on any parcel of land which includes FOD within its boundaries, shall include with such proposals base flood elevation data in accordance with Chapter 5 of the FSM. The submission of such base flood elevation data shall be considered a request for a cartographic interpretation pursuant to Section 6-407, to interpret the exact location of the boundaries of the FOD based on such data.
- (B) **Floodplain Alteration.** Any proposed development in the FOD shall require approval of a Declaration of No Impact to Floodplain or Floodplain Alteration in accordance with Chapter 5 of the FSM. Any required Floodplain Alteration shall conform with the following:
- (1) **Procedures for Floodplain Alterations.** Applications for Floodplain Alterations shall be in accordance with Chapters 5 and 8 of the FSM and conform with the following procedures:
- (a) An approved CLOMR from FEMA shall be provided prior to approval of a Floodplain Alteration that proposes any increase in the base flood elevation within the FOD (Major Floodplain).
- (b) Floodplain Alterations that would result in changes to the boundaries of the FOD shall be subject to the following:
- (i) The application for such Floodplain Alteration shall be considered a request for a cartographic interpretation pursuant to Section 6-407 to interpret the exact location of the boundaries of the FOD upon approval of the Floodplain Alteration.
- (ii) Prior to approval of a Floodplain Alteration that would result in any increase in the base flood elevation off-site or other changes to the boundaries of the FOD off-site, an instrument describing the change in the base flood elevation executed by each affected property owner shall be recorded among the land records of Loudoun County, Virginia.
- (2) **Engineering and Environmental Criteria for Floodplain Alterations.** All proposed alterations to the floodplain shall meet the following criteria:

- (a) Alterations to the floodplain shall not create erosive water velocity on-site or off-site (where erosive water velocity is based on analysis of the surface material and permissible velocities for specific cross sections affected by the proposed alteration,), and the mean velocity of stream flow at the downstream end of the site after alteration shall be no greater than the mean velocity of the stream flow under existing conditions.
 - (b) Alterations to the floodplain shall be in conformance with Chapter 1220 of the Codified Ordinances of Loudoun County and the Erosion and Sediment Control Law, Va. Code Section 62.1-44.15:51 et seq.
 - (c) The flood carrying capacity within the altered floodplain shall be maintained.
- (C) **Zoning Permit Required.** All development occurring within the FOD (Major Floodplain), including placement of manufactured homes, shall be undertaken only upon the approval of a zoning permit. The following provisions shall apply to all such zoning permits:
- (1) In addition to the requirements of Section 6-1001, the application for such zoning permit shall include the following:
 - (a) Copies of all necessary permits from Federal, State, or local agencies from which prior or concurrent approval is required.
 - (b) The base flood elevation.
 - (c) The elevation of the lowest floor (including basement).
 - (d) For a structure to be flood-proofed (non-residential only), the elevation to which the structure will be flood-proofed.
 - (e) Topographic information showing existing and proposed ground elevations.

4-1509 Floodplain Overlay District Development Standards:

- (A) **General Development Standards.** The following provisions shall apply to development located in the FOD (Major Floodplain):
- (1) Residential Construction. New construction or substantial improvement of any residential structure (including manufactured homes) shall have the lowest floor, including basement, elevated to or above (one (1) foot freeboard recommended) the base flood elevation.
 - (2) Non-Residential Construction. New construction or substantial improvement of any commercial, industrial, or non-residential building (including manufactured homes) shall have the lowest floor, including basement, elevated to or above the base flood

elevation. Non-residential buildings may be flood-proofed in lieu of being elevated provided that all areas of the building components lower than one (1) foot above the base flood elevation are water tight with walls impermeable to the passage of water, and use structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effect of buoyancy. A licensed professional engineer or architect shall certify that the standards of this subsection are satisfied. Such certification, including the base flood elevation to which such structures are floodproofed, shall be retained by Floodplain Administrator.

- (3) All new construction and substantial improvements (including manufactured homes) shall be in accordance with all applicable sections of this Ordinance, the FSM, and Chapter 1410 of the Codified Ordinances, and anchored to prevent flotation, collapse or lateral movement of the structure.
- (4) Newly placed manufactured homes and/or substantial improvements to manufactured homes shall meet all applicable State anchoring requirements for resisting wind forces and shall be anchored to prevent flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors.
- (5) All new construction and substantial improvements (including manufactured homes) shall be constructed with materials and utility equipment resistant to flood damage.
- (6) All new construction or substantial improvements (including manufactured homes) shall be constructed by methods and practices that minimize flood damage.
- (7) Electrical, heating, ventilation, plumbing, air conditioning equipment and other service facilities, including duct work, shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.
- (8) New and replacement public and individual water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system.
- (9) New and replacement public sewer systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters.
- (10) Individual sewage disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding.

- (11) Prior to the approval of a Floodplain Alteration for any proposed alteration or relocation of any channel or watercourse, all required permits shall be obtained from the U. S. Army Corps of Engineers, the Virginia Department of Environmental Quality, and the Virginia Marine Resources Commission (a joint permit application is available from any of these agencies). The applicant shall provide notification of such alteration or relocation to the Department of Conservation and Recreation (Division of Dam Safety and Floodplain Management) and FEMA. If such alteration or relocation results in a change to the floodplain in an adjacent town, city, county, or state, notification shall also be provided by the applicant to such jurisdiction.
- (12) The flood carrying capacity within an altered or relocated portion of any channel or watercourse shall be maintained. Under no circumstances shall any development adversely affect the water carrying capacity of any channel or watercourse.
- (B) **Space Below the Lowest Floor.** In FOD (Major Floodplain), fully enclosed areas, of new construction or substantially improved structures, which are below the base flood elevation shall meet the following minimum standards:
- (1) Such areas shall not be designed or used for human habitation. Such areas shall only be used for parking of vehicles, building access, or limited storage of maintenance equipment used in connection with the premises. Access to such areas shall be the minimum necessary to allow for parking of vehicles (garage door) or limited storage of maintenance equipment (standard exterior door), or entry to the living area (stairway or elevator).
 - (2) Such areas shall be constructed entirely of flood resistant materials below the base flood elevation.
 - (3) Such areas shall include measures to automatically equalize hydrostatic flood forces on walls by allowing for the entry and exit of floodwaters that are either certified by a licensed professional engineer or architect or that meet the following minimum design criteria:
 - (a) Provide a minimum of two (2) openings on different sides of each enclosed area. Foundation enclosures made of flexible skirting are not considered enclosed areas for regulatory purposes, and, therefore, do not require openings. Masonry or wood underpinning, regardless of structural status, are considered as enclosed areas and require such openings.
 - (b) The total net area of all openings must be at least one (1) square inch for each square foot of enclosed area subject to flooding.

- (c) If a building has more than one (1) enclosed area, each area must have openings to allow floodwaters to automatically enter and exit.
 - (d) The bottom of all required openings to such enclosed areas shall be no higher than one (1) foot above the adjacent grade.
 - (e) Openings shall only be equipped with screens, louvers, or other opening coverings or devices that permit the automatic flow of floodwaters in both directions.
- (C) **Standards for Recreational Vehicles.** The following provisions shall apply to recreational vehicles located within the FOD (Major Floodplain):
- (1) Any recreational vehicles placed on a site shall be fully licensed, on its wheels or jacking system, and attached to the site only by quick disconnect type utilities and security devices, and shall have no permanently attached additions; or
 - (2) Recreational vehicles placed on a site for 180 days or longer shall be deemed to be manufactured homes and shall meet all development standards of Section 4-1509(A) and 4-1509(B).
- (D) **Standards for Subdivision Proposals.** The following provisions shall be required for any subdivision of a parcel that includes FOD (Major Floodplain):
- (1) All subdivision proposals shall be consistent with the need to minimize flood damage.
 - (2) All subdivision proposals that have public utilities and facilities, such as sewer, gas, electrical and water systems, shall have such utilities and facilities located and constructed to minimize flood damage.
 - (3) All subdivision proposals shall have adequate drainage provided to reduce exposure to flood hazards.

4-1510 Density Calculations. For purposes of calculating the permitted floor area and number of residential units in the underlying zoning district, the land area in any portion of the FOD shall be included as part of the land area for such calculations.

4-1511 Variations.

- (A) **Authority.** Pursuant to Code of Federal Regulations 44CFR60.6, the Board of Supervisors may approve a variation of the standards of Sections 4-1509(A), (B), and (C) for any proposed development within the FOD (Major Floodplain) in the instances as set forth below. Requests for approval of a variation of the standards of Sections 4-1509(A), (B), and (C) shall be made in accordance with the procedures for a Minor Special Exception application as set forth in Section 6-1300, except that the issues

for consideration shall be as set forth in Section 4-1511(B). No variation shall be approved for any proposed development within the FOD (Major Floodplain) that will cause any increase in the base flood elevation of the FOD (Major Floodplain).

(1) New construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood elevation provided that such new construction or substantial improvement is protected by methods that minimize flood damages during the base flood and creates no additional threats to public safety.

(2) Repair or rehabilitation of historic structures provided that such repair or rehabilitation shall not preclude the structure's continued designation as a historic structure and the variation is the minimum necessary to preserve the historic character and design of the structure.

(B) **Application for a Variation of the Standards of Sections 4-1509(A), (B), and (C).** Any person owning property, or having a possessory or contract interest in property and the consent of the owner, may file an application for variation of the standards of Sections 4-1509(A), (B), and (C) in regard to such property with the Floodplain Administrator. The application shall contain the following information and such additional information as required by Section 6-403:

(1) The particular standards of Sections 4-1509(A), (B), and (C) that prevent the proposed construction on, or use of, the property.

(2) The existing zoning of the property, including any previously approved modifications, conditions, or proffers.

(3) The special conditions, circumstances or characteristics of the land, building or structure that prevent the use of the land in compliance with the standards of Sections 4-1509(A), (B), and (C).

(4) The particular hardship that would result if the specified standards of Sections 4-1509(A), (B), and (C) were to be applied to the property.

(5) The extent to which it would be necessary to vary the standards of Sections 4-1509(A), (B), and (C) in order to permit the proposed construction on, or use of, the property.

(6) An explanation of how the requested variation conforms to each of the applicable standards set out in Section 4-1511(D).

(C) **Issues for Consideration.** In considering an application for a variation of the standards of Sections 4-1509(A), (B), and (C), the following factors shall be given reasonable consideration:

- (1) The danger to life and property due to increased flood heights or velocities caused by encroachments.
 - (2) The danger that materials may be swept on to other lands or downstream to the injury of others.
 - (3) The proposed water supply and sanitation systems and the ability of these systems to prevent disease, contamination, and unsanitary conditions.
 - (4) The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owners.
 - (5) The importance of the services provided by the proposed facility to the community.
 - (6) The requirements of the facility for a waterfront location.
 - (7) The availability of alternative locations not subject to flooding for the proposed use.
 - (8) The compatibility of the proposed use with existing development and development anticipated in the foreseeable future.
 - (9) The relationship of the proposed use to the comprehensive plan and floodplain management program for the area.
 - (10) The safety of access by ordinary and emergency vehicles to the property in time of flood.
 - (11) The expected heights, velocity, duration, rate of rise, and sediment transport of the flood waters expected at the site.
 - (12) The historic nature of a structure.
 - (13) Such other factors which are relevant to the purposes of this ordinance.
- (D) **Decision on Application for Variation of the Standards of Sections 4-1509(A), (B), and (C).** No such variation of the standards of Sections 4-1509(A), (B), and (C) shall be approved by the Board of Supervisors unless all of the following findings are made:
- (1) The applicant has demonstrated good and sufficient cause.
 - (2) Failure to grant the variation of the standards of Sections 4-1509(A), (B), and (C) would result in exceptional hardship to the applicant.
 - (3) Granting of such variation of the standards of Sections 4-1509(A), (B), and (C) will not result in:

- (a) any increase in base flood elevation of the FOD (Major Floodplain);
 - (b) additional threats to public safety;
 - (c) extraordinary public expense;
 - (d) the creation of nuisances;
 - (e) fraud or victimization of the public; or
 - (f) conflicts with other local laws or ordinances.
- (4) The variation of the standards of Sections 4-1509(A), (B), and (C) is the minimum required to provide relief.
- (E) **Notice of Approval.** Upon approval of a variation of the standards of Sections 4-1509(A), (B), and (C), the Floodplain Administrator shall notify the applicant of such approval, in writing, and that development in accordance with the approved variation may increase the risks to life and property and may result in increased premium rates for flood insurance.

NORTHERN VIRGINIA HAZARD MITIGATION PLAN

2017



Arlington County
Fairfax County
Loudoun County
Prince William County
City of Alexandria
City of Fairfax
City of Falls Church
City of Manassas
City of Manassas Park
Town of Dumfries
Town of Haymarket
Town of Herndon
Town of Leesburg
Town of Lovettsville
Town of Middleburg
Town of Purcellville
Town of Occoquan
Town of Round Hill
Town of Vienna



Executive Summary	ES-1
Chapter 1: Introduction	1-1
I. Background.....	1-1
A. Disaster Mitigation Act of 2000	1-2
II. Overview of Hazard Mitigation Planning.....	1-3
III. Purpose of Plan	1-4
IV. Authority	1-4
V. Summary of Plan Contents	1-5
Chapter 2: Planning Process	2-1
I. Mitigation Advisory Committee	2-4
II. Public Involvement and Citizen Input	2-5
III. Incorporation of Existing Plans and Studies	2-7
Chapter 3: Regional Information	3-1
I. Northern Virginia Overview	3-1
A. Planning Region	3-1
1. County Profiles	3-3
City Profiles	3-5
3. Town Profiles.....	3-7
B. Geography, Hydrology, and Climate.....	3-10
1. Geography.....	3-10
2. Hydrology	3-12
3. Climate	3-13
C. Demographics, Population & Economic Growth	3-16
1. Projected Economic Growth	3-19
2. Population	3-21
3. Housing	3-23
D. Land Use, Development & Zoning.....	3-23
1. Land Use	3-23
2. Development Trends	3-27
3. Zoning	3-28
Chapter 4: Regional Hazard Identification and Risk Assessment (HIRA)	4-1
I. Introduction.....	4-1
II. Data Availability and Limitations.....	4-2
<i>Local Critical Facility and Building Data</i>	4-3
<i>HAZUS^{MH} Version 3.1</i>	4-23
<i>Data</i>	4-25
III. Hazard Identification	4-27
<i>Federally Declared Disasters</i>	4-29
<i>NCDC Storm Events Database</i>	4-30
<i>NCDC Normalizing Data</i>	4-32
<i>NCDC Damages</i>	4-33
<i>NCDC Annualizing Data</i>	4-33
<i>NCDC Data Compilation</i>	4-33
IV. Ranking and Analysis Methodologies	4-35
<i>HAZUS^{MH} Methodology</i>	4-35



<i>Supplemental Annualized Loss Estimate Methodology</i>	4-36
<i>Critical Facility and Building Risk</i>	4-36
<i>Ranking Methodology</i>	4-37
<i>Population Vulnerability and Density</i>	4-38
<i>Geographic Extent</i>	4-39
<i>Annualizing the Data for Analysis</i>	4-40
<i>Annualized Deaths and Injuries</i>	4-40
<i>Annualized Crop and Property Damage</i>	4-41
<i>Annualized Events</i>	4-41
<i>Overall Hazard Ranking</i>	4-42
<i>Comparison of Methodologies</i>	4-42
<i>Additional Risk Assessments Completed for the Northern Virginia Region</i>	4-42
<i>Limitations of Data</i>	4-43
V. Overall Hazard Results	4-44
<i>Comparison of 2010 and 20166 Results</i>	4-44
VI. Flood	4-50
A. Hazard Profile	4-50
B. Risk Assessment	4-69
VII. Winter Storm	4-84
A. Hazard Profile	4-85
B. Risk Assessment	4-88
VIII. High Wind/ Severe Storms	4-95
A. Hazard Profile	4-95
B. Risk Assessment	4-103
C. Hurricanes and Tropical Storms	4-106
D. Risk Assessment	4-117
IX. Tornadoes	4-124
A. Hazard Profile	4-124
B. Risk Assessment	4-131
X. Drought	4-135
A. Hazard Profile	4-135
B. Risk Assessment	4-140
XI. Earthquake	4-142
A. Hazard Profile	4-142
B. Risk Assessment	4-149
XII. Landslides	4-154
A. Hazard Profile	4-154
B. Risk Assessment	4-158
XIII. Wildfire	4-160
A. Hazard Profile	4-161
B. Risk Assessment	4-164
XIV. Sinkholes / Karst / Land Subsidence	4-172
A. Hazard Profile	4-172
B. Risk Assessment	4-177
XV. Dam Failure	4-180



A. Hazard Profile.....	4-180
B. Risk Assessment.....	4-183
XVI. Extreme Temperatures	4-185
A. Hazard Profile.....	4-185
B. Risk Assessment.....	4-191
Chapter 5: Capability Assessment	5-1
I. Introduction.....	5-1
II. Conducting the Capability Assessment	5-1
III. Capability Assessment Findings	5-2
A. Administrative and Technical Capability	5-2
B. Planning and Regulatory Capability	5-10
C. Fiscal Capability	5-18
Chapter 6: Mitigation Strategies	6-1
I. Planning Process for Setting Mitigation Goals.....	6-1
II. Considering Mitigation Alternatives.....	6-2
A. Identification and Analysis of Mitigation Techniques	6-2
B. Prioritizing Alternatives	6-4
III. Identifying Objectives and Strategies	6-6
A. Goals and Strategies	6-6
Chapter 7: Jurisdiction Executive Summaries	7-1
I. Alexandria.....	7-1
II. Arlington County	7-8
III. Fairfax County	7-16
IV. Loudoun County	7-27
V. Prince William County	7-37
VI. City of Fairfax.....	7-44
VII. City of Falls Church.....	7-52
VIII. City of Manassas.....	7-58
IX. City of Manassas Park	7-65
X. Town of Dumfries.....	7-72
XI. Town of Haymarket	7-76
XII. Town of Herndon	7-82
XIII. Town of Leesburg	7-85
XIV. Town of Lovettsville	7-95
XV. Town of Middleburg	7-102
XVI. Town of Occoquan	7-109
XVII. Town of Purcellville	7-114
XVIII.Town of Round Hill	7-120
XIX. Town of Vienna	7-126
Chapter 8: Plan Maintenance	8-1
I. Implementation	8-1
II. Monitoring, Evaluation and Enhancement	8-2
III. Continued Public Involvement	8-5



Appendix:

- Appendix A – Crosswalk
- Appendix B – Adoption Resolution
- Appendix C – Meeting Documentation
- Appendix D – HIRA Documentation
- Appendix E – 2010 Mitigation Actions Update
- Appendix F – Outreach Screenshots
- Appendix G – NFIP Survey



Executive Summary

Mitigation is commonly defined as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. Hazard mitigation focuses attention and resources on community policies and actions that will produce successive benefits over time. A mitigation plan states the aspirations and specific courses of action that a community intends to follow to reduce vulnerability and exposure to future hazard events. These plans are formulated through a systematic process centered on the participation of citizens, businesses, public officials, and other community stakeholders.

The area covered by this plan includes:

Participating Communities	
Counties	Towns
Arlington County	Town of Dumfries
Fairfax County	Town of Haymarket
Loudoun County	Town of Herndon
Prince William County	Town of Leesburg
Cities	Town of Lovettsville
City of Alexandria	Town of Middleburg
City of Fairfax	Town of Purcellville
City of Falls Church	Town of Occoquan
City of Manassas	Town of Round Hill
City of Manassas Park	Town of Vienna

The additional contents of this Plan are designed and organized to be as reader-friendly and functional as possible. While significant background information is included on the processes used and studies completed (e.g., risk assessment, capability assessment), this information is separated from the more meaningful planning outcomes or actions (e.g., mitigation strategy, mitigation action plans).

Chapter 2, Planning Process, provides a complete narrative description of the process used to prepare the Plan. This includes the identification of who was involved, who participated on the planning team, and how the public and other stakeholders were involved. It also includes a detailed summary for each of the key meetings held along with any associated outcomes.

Chapter 3, Regional Information, describes the general makeup of the Northern Virginia region, including prevalent geographic, demographic, and economic characteristics. In addition, transportation, housing, and land-use patterns are discussed. This baseline information provides a snapshot of the regional planning area and thereby assists county and municipal officials to recognize those social, environmental, and economic factors that ultimately play a role in determining community vulnerability to natural hazards.

The Regional Hazard Identification and Risk Assessment (HIRA) is presented in Chapter 4. This section serves to identify, analyze, and assess the Northern Virginia region's overall risk to



natural hazards. The risk assessment also attempts to define any hazard risks that may uniquely or exclusively affect the individual municipal jurisdictions.

The Risk Assessment builds on available historical data from past hazard occurrences, establishes detailed profiles for each hazard, and culminates in a hazard risk ranking based on conclusions about the frequency of occurrence, spatial extent, and potential impact of each hazard. FEMA's HAZUS^{MH} loss estimation methodology was also used in evaluating known hazard risks by their relative long-term cost in expected damages. In essence, the information generated through the risk assessment serves a critical function as communities seek to determine the most appropriate mitigation actions to pursue and implement — enabling communities to prioritize and focus their efforts on those hazards of greatest concern and those structures or planning areas facing the greatest risk(s). For the purposes of compliance with the Disaster Mitigation Act as further specified by Interim Final Rule 44 CFR Section 206.401(c)(2)(i), this Plan addresses in full only the following hazards: Flood, High Wind, Tornadoes, Winter Storms, Drought, Earthquakes, Landslides, Wildfire, Sinkholes, Dam Failure, and Extreme Temperatures. For the 2017 Plan update, extreme cold was removed from Winter Storms, and extreme heat was removed from Drought. Extreme Temperatures was examined as its own hazard.

The Capability Assessment, found in Chapter 5, provides a comprehensive examination of each participating jurisdiction's capacity to implement meaningful mitigation strategies and identifies existing opportunities to increase and enhance that capacity. Specific capabilities addressed in this section include planning and regulatory capability, staff and organizational (administrative) capability, technical capability, fiscal capability, and political capability. Information was obtained through a survey for local officials and an inventory and analysis of existing plans, ordinances, and relevant documents. The purpose of this assessment is to identify any existing gaps, weaknesses, or conflicts in programs or activities that may hinder mitigation efforts, and to identify those activities that should be built upon to establish a successful and sustainable regional hazard mitigation program.

The Regional Information, Risk Assessment, and Capability Assessment sections collectively serve as a basis for determining the goals for the Hazard Mitigation Plan; each contributing to the development, adoption, and implementation of a meaningful Mitigation Strategy that is based on accurate background information.

The Mitigation Strategy, found in Chapter 6, consists of broad regional goal and strategies. The regional mitigation actions were removed from the 2017 Plan and have been incorporated into the jurisdictional Mitigation Action Plans. The strategy provides the foundation for detailed jurisdictional Mitigation Action Plans, found in Chapter 7, that link specific mitigation actions for each jurisdiction to locally-assigned implementation mechanisms and target completion dates. Together, these sections are designed to make the Plan both strategic (through the identification of long-term goals), but also functional through the identification of short-term and immediate actions that will guide day-to-day decision-making and project implementation.

In addition to the identification and prioritization of possible mitigation projects, emphasis is placed on the use of program and policy alternatives to help make the communities of the



Northern Virginia region less vulnerable to the damaging forces of nature while improving the economic, social, and environmental health of the community. The concept of multi-objective planning was emphasized throughout the planning process, particularly in identifying ways to link hazard mitigation policies and programs with complimentary community goals related to housing, economic development, downtown revitalization, recreational opportunities, transportation improvements, environmental quality, land development, and public health and safety.

The Plan Maintenance Procedures, found in Chapter 8, include the measures that the Mitigation Advisory Committee and participating jurisdictions will take to ensure the Plan's continuous long-term implementation. The procedures also include the manner in which the Plan will be regularly evaluated and updated to remain a current and meaningful planning document.



Chapter 1: Introduction

Mitigation is commonly defined as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. Hazard mitigation focuses attention and resources on community policies and actions that will produce successive benefits over time. A mitigation plan states the aspirations and specific courses of action that a community intends to follow to reduce vulnerability and exposure to future hazard events. These plans are formulated through a systematic process centered on the participation of citizens, businesses, public officials, and other community stakeholders.

A local mitigation plan is the physical representation of a jurisdiction's commitment to reduce risks from natural hazards. Local officials can refer to the plan in their day-to-day activities and in decisions regarding regulations and ordinances, granting permits, and in funding capital improvements and other community initiatives. Additionally, these local plans will serve as the basis for States to prioritize future grant funding as it becomes available.

It is hoped that the Northern Virginia Hazard Mitigation Plan will be a useful tool for all community stakeholders by increasing public awareness about local hazards and risks, while at the same time providing information about options and resources available to reduce those risks. Teaching the public about potential hazards will help each of the area's jurisdictions protect itself against the effects of the hazards, and will enable informed decision making on where to live, purchase property, or locate businesses.

The areas covered by this plan include:

Table 1.1. Participating Communities	
Counties	Towns
Fairfax County	Town of Dumfries
Loudoun County	Town of Haymarket
Prince William County	Town of Herndon
Cities	
City of Alexandria	Town of Leesburg
City of Fairfax	Town of Lovettsville
City of Manassas	Town of Middleburg
City of Manassas Park	Town of Purcellville
	Town of Occoquan
	Town of Round Hill
	Town of Vienna

I. Background

Natural hazards, such as floods, tornadoes, and severe winter storms are a part of the world around us. Their occurrence is natural and inevitable, and there is little we can do to control their force and intensity.



The Northern Virginia region is vulnerable to a wide range of natural hazards, including flooding, tornadoes, hurricanes, and winter storms. These hazards threaten the safety of residents and have the potential to damage or destroy both public and private property, disrupt the local economy, and impact the overall quality of life of individuals who live, work, and play in the Northern Virginia region.

While we cannot eliminate natural hazards, there is much we can do to lessen their potential impacts upon our community and our citizens. The effective reduction of a hazard's impact can decrease the likelihood that such events will result in a disaster. The concept and practice of reducing risks to people and property from known hazards is generally referred to as hazard mitigation.

Hazard mitigation techniques include both structural measures, such as strengthening or protecting buildings and infrastructure from the destructive forces of potential hazards; and non-structural measures, such as the adoption of sound land-use policies or the creation of public awareness programs. Some of the most effective mitigation measures are implemented at the local government level where decisions on the regulation and control of development are made. A comprehensive mitigation strategy addresses hazard vulnerabilities that exist today and in the foreseeable future. Therefore it is essential that projected patterns of development are evaluated and considered in terms of how that growth will increase or decrease a community's overall hazard vulnerability. Land use is a particularly important topic in the Northern Virginia region, where many communities are facing rapid growth and redevelopment rates. Now is the time to effectively guide development away from identified hazard areas and environmentally sensitive locations, before unsound development patterns emerge and people and property are placed in harm's way.

One of the most effective tools a community can use to reduce hazard vulnerability is to develop, adopt, and update as needed, a local hazard mitigation plan. A hazard mitigation plan establishes the broad community vision and guiding principles for addressing hazard risk, including the development of specific mitigation actions designed to eliminate or reduce identified vulnerabilities. The Northern Virginia Hazard Mitigation Plan (hereinafter "Hazard Mitigation Plan" or "Plan") is a logical first step toward incorporating hazard mitigation principles and practices into the routine activities and functions of local government within the Northern Virginia region.

The mitigation actions noted in this Plan go beyond recommending structural solutions to reduce existing vulnerability. Local policies addressing community growth, incentives to protect natural resources, and public awareness and outreach campaigns are examples of other measures that can be used to reduce the future vulnerability of the Northern Virginia region to identified hazards. The Plan has been designed to be a living document, with implementation and evaluation procedures included to help achieve meaningful objectives and successful outcomes.

A. Disaster Mitigation Act of 2000

In an effort to reduce the Nation's mounting natural disaster losses, the U.S. Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) in order to amend the Robert T. Stafford Disaster Relief and Emergency Assistance Act. Section 322 of DMA 2000 emphasizes the need for State



and local government entities to closely coordinate on mitigation planning activities, and makes the development of a hazard mitigation plan a specific eligibility requirement for any local government applying for Federal mitigation grant funds. These funds include the Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation (PDM) program, both of which are administered by the Federal Emergency Management Agency (FEMA) under the Department of Homeland Security. Communities with an adopted and federally-approved hazard mitigation plan thereby become pre-positioned and more apt to receive available mitigation funds before and after the next disaster strikes.

The Plan has been prepared in coordination with FEMA Region III and the Virginia Division of Emergency Management (VDEM) to ensure that the Plan meets all applicable DMA 2000 and State requirements. A Local Mitigation Plan Crosswalk, found in Appendix A, provides a summary of Federal and State minimum standards and notes the location where each requirement is met within the Plan.

II. Overview of Hazard Mitigation Planning

Local hazard mitigation planning is the process of organizing community resources, identifying and assessing hazard risks, and determining how to best minimize or manage those risks. This process results in a hazard mitigation plan that identifies specific mitigation actions, each designed to achieve both short-term planning objectives and a long-term community vision. To ensure the functionality of each mitigation action, responsibility is assigned to a specific individual, department, or agency along with a schedule for its implementation. Plan maintenance procedures are established for the routine monitoring of implementation progress, as well as the evaluation and enhancement of the mitigation plan itself. These plan maintenance procedures ensure that the plan remains a current, dynamic, and effective planning document over time.

Mitigation planning offers many benefits, including:

- saving lives and property;
- saving money;
- speeding recovery following disasters;
- reducing future vulnerability through wise development and post-disaster recovery and reconstruction;
- expediting the receipt of pre-disaster and post-disaster grant funding; and
- demonstrating a firm commitment to improving community health and safety.

Typically, mitigation planning is described as having the potential to produce long-term and recurring benefits by breaking the repetitive cycle of disaster loss. A core assumption of hazard mitigation is that pre-disaster investments will significantly reduce the demand for post-disaster assistance by lessening the need for emergency response, repair, recovery, and reconstruction. Furthermore, mitigation practices will enable local residents, businesses, and industries to re-establish themselves in the wake of a disaster, getting the community economy back on track sooner and with less interruption.



The benefits of mitigation planning go beyond solely reducing hazard vulnerability. Measures such as the acquisition or regulation of land in known hazard areas can help achieve multiple community goals, such as preserving open space, maintaining environmental health, and enhancing recreational opportunities. Thus, it is vitally important that any local mitigation planning process be integrated with other concurrent local planning efforts, and any proposed mitigation strategies must take into account other existing community goals or initiatives that will help complement or hinder their future implementation.

III. Purpose of Plan

The purpose of the Plan is to:

- Protect life, safety, and property by reducing the potential for future damages and economic losses that result from **natural** hazards;
- Make communities safer places to live, work, and play;
- Qualify for grant funding in both the pre-disaster and post-disaster environment;
- Speed recovery and redevelopment following future disaster events;
- Demonstrate a firm local commitment to hazard mitigation principles; and
- Comply with State and Federal legislative requirements for local multi-jurisdictional hazard mitigation plans.

IV. Authority

Following conditional approval of the plan by both VDEM and FEMA, the plan will be brought forth to each participating jurisdiction to be formally adopted.

The Plan, developed in accordance with current State and Federal rules and regulations governing local hazard mitigation plans, will be adopted by the four counties, five cities, and 10 participating municipalities in accordance with the authority and police powers granted to counties, cities, and municipalities under §15.2-2223 through §15.2-2231 of the Virginia State Code. Copies of local adoption resolutions are provided in Appendix B (to be completed after adoption). The Plan shall be routinely monitored and revised to maintain compliance with the following provisions, rules, and legislation:

- Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as enacted by Section 104 of the Disaster Mitigation Act of 2000 (P.L. 106-390); and
- FEMA's Interim Final Rule published in the Federal Register on February 26, 2002, at 44 CFR Part 201.



V. Summary of Plan Contents

The additional contents of this Plan are designed and organized to be as reader-friendly and functional as possible. While significant background information is included on the processes used and studies completed (e.g., risk assessment, capability assessment), this information is separated from the more meaningful planning outcomes or actions (e.g., mitigation strategy, mitigation action plans).

Chapter 2, Planning Process, provides a complete narrative description of the process used to prepare the Plan. This includes the identification of who was involved, who participated on the planning team, and how the public and other stakeholders were involved. It also includes a detailed summary for each of the key meetings held along with any associated outcomes.

Chapter 3, Regional Information, describes the general makeup of the Northern Virginia region, including prevalent geographic, demographic, and economic characteristics. In addition, transportation, housing, and land-use patterns are discussed. This baseline information provides a snapshot of the regional planning area and thereby assists county and municipal officials to recognize those social, environmental, and economic factors that ultimately play a role in determining community vulnerability to natural hazards.

The Regional Hazard Identification and Risk Assessment (HIRA) is presented in Chapter 4. This section serves to identify, analyze, and assess the Northern Virginia region's overall risk to natural hazards. The risk assessment also attempts to define any hazard risks that may uniquely or exclusively affect the individual municipal jurisdictions.

The Risk Assessment builds on available historical data from past hazard occurrences, establishes detailed profiles for each hazard, and culminates in a hazard risk ranking based on conclusions about the frequency of occurrence, spatial extent, and potential impact of each hazard. FEMA's HAZUS^{MH} loss estimation methodology was also used in evaluating known hazard risks by their relative long-term cost in expected damages. In essence, the information generated through the risk assessment serves a critical function as communities seek to determine the most appropriate mitigation actions to pursue and implement — enabling communities to prioritize and focus their efforts on those hazards of greatest concern and those structures or planning areas facing the greatest risk(s). For the purposes of compliance with the Disaster Mitigation Act as further specified by Interim Final Rule 44 CFR Section 206.401(c)(2)(i), this Plan addresses in full only the following hazards: Flood, High Wind, Tornadoes, Winter Storms, Drought, Earthquakes, Landslides, Wildfire, Sinkholes, Dam Failure, and Extreme Temperatures. For the 2017 Plan update, extreme cold was removed from Winter Storms, and extreme heat was removed from Drought. Extreme Temperatures was examined as its own hazard.

The Capability Assessment, found in Chapter 5, provides a comprehensive examination of each participating jurisdiction's capacity to implement meaningful mitigation strategies and identifies existing opportunities to increase and enhance that capacity. Specific capabilities addressed in this section include planning and regulatory capability, staff and organizational (administrative) capability, technical capability, fiscal capability, and political capability. Information was



obtained through a survey for local officials and an inventory and analysis of existing plans, ordinances, and relevant documents. The purpose of this assessment is to identify any existing gaps, weaknesses, or conflicts in programs or activities that may hinder mitigation efforts, and to identify those activities that should be built upon to establish a successful and sustainable regional hazard mitigation program.

The Regional Information, Risk Assessment, and Capability Assessment sections collectively serve as a basis for determining the goals for the Hazard Mitigation Plan; each contributing to the development, adoption, and implementation of a meaningful Mitigation Strategy that is based on accurate background information.

The Mitigation Strategy, found in Chapter 6, consists of broad regional goal and strategies. The regional mitigation actions were removed from the 2017 Plan and have been incorporated into the jurisdictional Mitigation Action Plans. The strategy provides the foundation for detailed jurisdictional Mitigation Action Plans, found in Chapter 7, that link specific mitigation actions for each jurisdiction to locally-assigned implementation mechanisms and target completion dates. Together, these sections are designed to make the Plan both strategic (through the identification of long-term goals), but also functional through the identification of short-term and immediate actions that will guide day-to-day decision-making and project implementation.

In addition to the identification and prioritization of possible mitigation projects, emphasis is placed on the use of program and policy alternatives to help make the communities of the Northern Virginia region less vulnerable to the damaging forces of nature while improving the economic, social, and environmental health of the community. The concept of multi-objective planning was emphasized throughout the planning process, particularly in identifying ways to link hazard mitigation policies and programs with complimentary community goals related to housing, economic development, downtown revitalization, recreational opportunities, transportation improvements, environmental quality, land development, and public health and safety.

The Plan Maintenance Procedures, found in Chapter 8, include the measures that the Mitigation Advisory Committee and participating jurisdictions will take to ensure the Plan's continuous long-term implementation. The procedures also include the manner in which the Plan will be regularly evaluated and updated to remain a current and meaningful planning document.



Chapter 2: Planning Process

For the 2017 plan update, the Mitigation Advisory Committee (MAC) held monthly meetings during the plan update process. Meetings were held in person, but committee members were given the option to call in due to the large geographic area covered by the plan. The dates and the description of the activities at these meetings are found below. Meeting sign-in sheets and notes are located in Appendix C. As many of the participants called into meetings, the sign-in sheets do not accurately represent the attendees for each meeting. The call-in attendees were documented and a full list of attendees for each meeting is found in the meeting notes located in Appendix C.

Table 2.1. 2017 Meeting Schedule

Date	Meeting Purpose
December 1, 2015	Project Kickoff Meeting
January 12, 2016	Hazard Identification and Risk Assessment
February 9, 2016	Status Update
March 8, 2016	Outreach Plan Development
May 10, 2016	Hazard Identification and Risk Assessment and Regional Mitigation Strategy
May-July 2016	Jurisdictional Meetings
June 14, 2016	Outreach Plan Discussion and Project Update
July 12, 2016	Status Update
August 9, 2016	Status Update
September 13, 2016	Outreach Plan Discussion and Project Update
December 13, 2016	Status Update
January 10, 2017	Project Update
February 14, 2017	Project Update

Kickoff Meeting

The update of the 2010 Northern Virginia Hazard Mitigation plan began establishing a project plan. A kick-off meeting was held on December 1, 2015, with representatives from various counties and cities in the planning region in attendance. A list of participants for each committee meeting can be found in Appendix C. At the kickoff meeting, the planning process was discussed in detail, along with the proposed schedule of deliverables and meetings.

The project scope and responsibilities were also discussed at length at the kickoff meeting. At the November meeting of the Northern Virginia Emergency Managers, the Mitigation Advisory Committee Chairman was given the direction to perform the update to the 2010 plan with limited contractor support. Witt O'Brien's was selected to support the update to the 2010 plan by performing the Hazard Identification and Risk Assessment, and updating that section of the plan.

Additionally, the committee was asked to review the list of hazards in the 2006 plan and determine if the list should carry over as-is to the 2010 plan, or if changes were necessary.



Hazard Identification and Risk Assessment Meeting

A second meeting was held on January 12, 2016, to discuss the goals and vision of the plan's HIRA section. The HIRA process involved analyzing the region's greatest hazard threats and determining its most significant vulnerabilities with respect to natural hazards. Additionally, the committee was asked to review the list of hazards in the 2010 plan and determine if the list should carry over as-is to the 2017 plan, or if changes were necessary. The hazards were kept largely the same, but Extreme Temperatures was added as its own hazard, removing extreme cold from Winter Storm, and extreme heat from Drought. Risk was determined by looking at the total threat and vulnerability for all of the jurisdictions for each hazard identified by the MAC. The HIRA was performed in large part using GIS data from the participating jurisdictions, HAZUS^{MH} (a GIS-based FEMA loss estimation software), and State sources. At the HIRA results meeting in May 2016, the MAC reviewed the draft HIRA. Witt O'Brien's hosted the January meeting and was responsible for performing the HIRA. A full description of the HIRA methodology can be found in the HIRA section of this plan.

February 9, 2016 Meeting

The February 9, 2016 meeting provided MAC members an opportunity to provide an update on their progress in providing data for inclusion in the HIRA. It also provided an opportunity for the MAC to ask any questions about the update of the plan.

March 8, 2016 Meeting

The focus of the March 8, 2016 meeting was a discussion of the plan to conduct outreach on the plan and to gain the input of the public and key stakeholders. The MAC determined that we would conduct two rounds of outreach on the plan. The first round would give stakeholders an opportunity to comment on the HIRA and would be conducted in June. The second round of outreach was conducted in the summer of 2016 and gave stakeholders an opportunity to comment on the complete plan.

Committee members were also assigned the task of updating their jurisdiction Capability Assessment at the March meeting. The results of this are included in Chapter 5 of the plan. The MAC was also asked to begin reviewing their jurisdiction's Mitigation Action Plan. The April MAC meeting was cancelled.

Hazard Identification and Risk Assessment Results Meeting

Witt O'Brien's hosted the May 10, 2016 HIRA Results meeting. During the HIRA Results Meeting, Witt O'Brien's presented the results of the HIRA to the MAC. Prior to the May 10 meeting, the MAC was given an opportunity to review the HIRA and any concerns were discussed at the meeting.

The MAC was also given the assignment of updating their individual executive summary and mitigation action plan found in Chapter 7. The due date for this assignment was July 15, 2016.

In addition, the MAC reviewed the Regional Mitigation Strategy, Chapter 6 of the plan. The committee reaffirmed the regional strategy with only minor changes. The MAC chose to remove the regional mitigation actions from the plan. The regional mitigation actions found in the 2010



plan were incorporated into the jurisdictional mitigation action plans found in Chapter 7, where appropriate. A full description of these changes can be found in Appendix C.

May-July Jurisdictional Meetings

Following the HIRA Results meeting on May 10, each jurisdiction held a meeting to develop jurisdiction-specific mitigation actions. The content and attendees for these meetings varied greatly between jurisdictions, but the result was an updated jurisdictional action plan.

June 14, 2016 Meeting

The June 14 meeting provided committee members an opportunity to provide status updates on the work that they were doing on their action plans. The outreach period was also discussed.

July 12, 2016 Meeting

The July 12 meeting provided committee members an opportunity to provide status updates on the work that they were doing on their action plans. The outreach period was also discussed.

August 9, 2016 Meeting

The August 9 meeting provided committee members an opportunity to provide status updates on the work that they were doing on their action plans. The outreach period was also discussed.

September 13, 2016 Meeting

The September 13 meeting provided committee members an opportunity to provide status updates on the work that they were doing on their action plans. The outreach period and draft plan submission was also discussed.

October, 2016 Meeting

This meeting was cancelled as the draft plan was out for public review and comment.

November, 2016 Meeting

This meeting was cancelled as many jurisdictions were preparing for the 2016 Presidential election.

December 13, 2016 Meeting

This meeting was held to advise jurisdictions that the plan was reviewed by the state and was submitted to FEMA Region III for their review.

January 10, 2017 Meeting

This meeting was held to advise jurisdictions that the plan was reviewed by FEMA Region III and that FEMA returned their comments and required changes. The committee was asked to review the list of comments and to complete the National Flood Insurance Program survey.



February 14, 2017 Meeting

This meeting was held to advise jurisdictions that their NFIP surveys were due and that a few jurisdictions needed to complete the survey. When all surveys are completed the plan will go back to FEMA to obtain approved pending adoption status.

I. Mitigation Advisory Committee

The Northern Virginia Emergency Managers convened an advisory committee comprised of representatives from various participating jurisdictions. The Mitigation Advisory Committee was responsible for the update of the plan and management of Witt O'Brien's as they updated the HIRA.

The following members were a part of the MAC and were chosen by their respective jurisdictions to participate in the development of this plan:

Table 2.2. Committee Members	
Member	Jurisdiction
David Morrison	Arlington County
Cara Howard, Adam Kelly and Gregory Zebrowski	Fairfax County
Kevin Johnson	Loudoun County
Alexa Lenhart	Prince William County
Aaron Hope and Blake Stave, and Ray Whatley	City of Alexandria
Walter English	City of Fairfax
Tom Polera	City of Falls Church
Amelia Gagnon	City of Manassas
Robert Hoffower	City of Manassas Park
Amanda Christman	Town of Clifton
Tiawana Barnes	Town of Dumfries
Holly Montague and Brian Henshaw	Town of Haymarket
Stephen Thompson	Town of Herndon
Kirstyn Jovanovich	Town of Occoquan
Dan Janickey	Town of Vienna
Rita Frazier	Town of Quantico

Throughout the planning process the Town of Clifton and the Town of Quantico withdrew from the process. They are still included in the Regional Profile and the Hazard Identification



and Risk Assessment as they withdraw after these chapters were completed. The decision was made to include their information as they till fall within the Northern Virginia Region and will be covered by Fairfax and Prince William County.

II. Public Involvement and Citizen Input

An important component of this planning process is the opportunity for the general public to provide input. Individual citizen and community-based input provided the planning team with a greater understanding of local concerns and increased the likelihood of successfully implementing mitigation actions by developing community “buy-in” from those directly affected by the decisions of public officials. As citizens become more involved in decisions that affect their safety, they are more likely to gain a greater appreciation of the natural hazards present in their community and take the steps necessary to reduce their impact. Public awareness is a key component of any community’s overall mitigation strategy aimed at making a home, neighborhood, school, business, or city safer from the potential effects of natural hazards. This public outreach effort was also an opportunity for neighboring jurisdictions, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process. Local jurisdictions included Community Emergency Response Teams (CERTs), the American Red Cross, and Citizen Corp groups in planning meetings and presentations for this plan update. A complete list of public outreach initiatives can be found below; however, it should be noted that many jurisdictions chose to have public outreach meetings following conditional approval of this plan.

The following lists include an explanation of the public outreach efforts accomplished by each participating jurisdiction. This section is considered a work-in-progress and will be completed by formal adoption.

Arlington County

- The Plan has been posted for review and comment on the county’s website and social media.
- The Plan project has been presented to the county commission which addresses emergency management issues

Fairfax County (including the Towns of Herndon, and Vienna)

- The County and Towns posted the draft plan at www.fairfaxcounty.gov for public comment and review. Please see Appendix F for a screenshot example.
- The County also posted a link to the Plan on their Twitter and Facebook pages, advertising that public review and comments were welcome.
- Fairfax County additionally sent out a newsletter to a group of businesses and non-profits that are part of the Emergency Support Function-15 Council of Governments group, advertising that the Plan was being updated and it could be accessed on the county website.
- The Office of Emergency Management (OEM) also included the link to the Plan in a monthly newsletter that is distributed to all county agencies and partner agencies.



- OEM's Outreach Coordinator also included the Plan update information in a monthly newsletter which is distributed to groups such as Fairfax County Citizen Corp Groups.

Loudoun County (Including the Towns of Leesburg, Middleburg, Purcellville, and Round Hill)

- A link to the draft plan will be posted to the OEM website, which is www.loudoun.gov/oem, in October 2016.
- County Administrator will make an announcement during his "Administrator's Comments" portion of the Board of Supervisors Business Meeting, which is scheduled for Tuesday, October 4, 2016.
- OEM will coordinate with the Loudoun County Public Information Office to distribute messages on Twitter and Facebook announcing the project and directing residents to the website.

Prince William County (including the Towns of Dumfries, Haymarket, Occoquan, and Quantico)

- A link to the draft plan will be posted on the county website for review and comment by the public during the fall of 2016.
- The County posted information about the plan being available for review by the public on their county website and social media.

City of Alexandria

- The City will post a link to the draft plan on their Emergency Management website, and social media requesting that the public review and comment on the plan during the fall of 2016.

City of Fairfax

- The City posted a link to the draft plan on their Emergency Management website, and social media requesting that the public review and comment on the plan. A screenshot can be found in Appendix H.

City of Falls Church

- Upon receiving the final document the City will provide public outreach via the City website, Facebook, and eFocus (newsletter).

City of Manassas

- The City posted the Plan to the City website, and social media during the summer of 2016.

City of Manassas Park

- The City posted the plan on its website and social media. A screenshot of this website can be found in Appendix H.

In addition, neighboring jurisdictions and additional stakeholders were asked via email on June 14, 2016 to review the document and provide any feedback by June 26, 2016. The distribution list consisted of:



- Clarke County
- Fauquier County
- Stafford County
- DC HSEMA
- Prince George's County
- Montgomery County
- George Mason University
- Northern Virginia Community College
- Northern Virginia Chamber of Commerce
- Volunteer Fairfax
- American Red Cross
- Fairfax County Public Schools
- INOVA Health System (INOVA Fairfax)
- HCA Healthcare (Reston Hospital Center)
- MICRON Technology, Inc.

III. Incorporation of Existing Plans and Studies

The Plan incorporates information from a number of other previously produced plans, studies, articles, exhibits, graphics, and reports. The various plans and documents were used to identify hazards and risks, assess vulnerabilities, develop trends, and align mitigation strategies throughout the Northern Virginia Hazard Mitigation Plan. These documents and sources include:

- Commonwealth of Virginia Hazard Mitigation Plan, 2010
- Critical Infrastructure Protection in the National Capital Region, 2005
- National Capital Region Hazard Identification and Risk Assessment, 2007
- National Capital Region Strategic Hazard Identification and Evaluation for Leadership Decisions (NCR SHIELD), 2008
- National Climatic Data Center Storm Events Database
- National Weather Service / National Oceanic and Atmospheric Administration
- Commonwealth of Virginia Emergency Operations Plan
- *Science Magazine*
- National Flood Insurance Program
- HAZUS-MH™
- Federal Emergency Management Agency
- Intergovernmental Panel on Climate Change
- North Carolina Division of Emergency Management
- American Society of Civil Engineers
- National Drought Mitigation Center
- US Geological Survey
- Virginia Department of Forestry
- Esri
- US Census Bureau
- Virginia Department of Mines, Minerals, and Energy



- US Army Corps of Engineers National Inventory of Dams
- Loudoun County Building and Development



Chapter 3: Regional Information

I. Northern Virginia Overview

A. Planning Region

The Northern Virginia planning region includes Arlington, Fairfax, Loudoun, and Prince William counties, as well as the cities and towns located within these counties (19 jurisdictions). For this plan update, two additional towns in Loudoun County participated, Round Hill and Lovettsville. The communities participating in the 2017 hazard mitigation plan update are summarized in Table 3.1 and graphically in Figure 3.1.

Table 3.1. 2017 Planning Jurisdictions	
	Jurisdictions Included
	Arlington County Fairfax County City of Alexandria City of Fairfax City of Falls Church Town of Herndon Town of Vienna Loudoun County Town of Leesburg Town of Lovettsville Town of Purcellville Town of Round Hill Town of Middleburg Prince William County City of Manassas City of Manassas Park Town of Dumfries Town of Occoquan Town of Haymarket

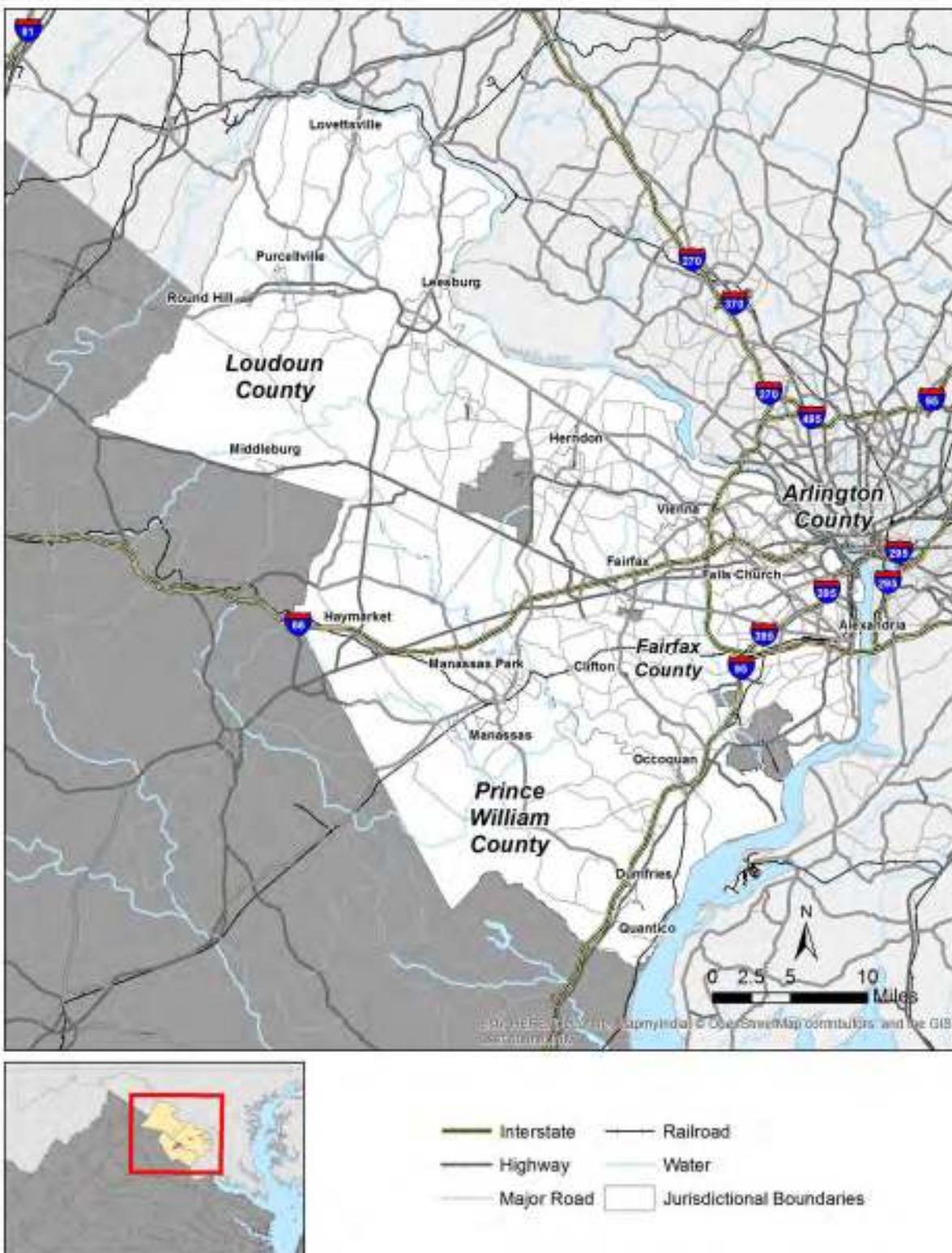


Figure 3.1. Northern Virginia 2017 Hazard Mitigation Plan Update Region



1. County Profiles

Arlington County

The area that encompasses present-day 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, and the county portion was officially renamed Arlington County in 1920. The 2014 census estimate for the county is 226,908, an approximately 9% increase since 2010.



Arlington is an urban county of about 26 square miles located directly across the Potomac River from Washington, D.C. 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 8,727 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. It should be noted that most of the Arlington river bank along the Potomac is Federal Land (National Park Service). During the 1960s and 1970s, Four Mile Run experienced significant flooding events as the watershed became more urbanized. In 1974, Congress authorized the United States Army Corps of Engineers (USACE) to design and construct a flood control channel that would contain the increased flows. Since its completion over twenty years ago, the channel has safely conveyed the high storm flows through Arlington County and the City of Alexandria. The channel will be undergoing a significant restoration project to last through the Fall of 2017. Additionally, winter storms pose significant threats, as evidenced during the 2015 – 2016 winter season.

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 2014 census population estimate for the county is 1,137,538, an approximately 5% increase since 2010.



Fairfax County comprises about 407 square miles located directly across the Potomac River from Washington, D.C. 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. Much of the commercial development in Fairfax County is centered around the Metrorail's



Silver line with stations in Reston and Tysons. Tysons alone has 26 million square feet of office space, 6 million square feet of retail space, and more than 100,000 people work there.

Due to its location on both the Virginia piedmont and the Atlantic coastal plain, the County experiences a variety of weather. 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 2015 – 2016 winter season.

Loudoun County

Loudoun County was established in 1757 and was formerly part of Fairfax County. It was named after John Campbell, Fourth Earl of Loudoun and past Governor of the Commonwealth of Virginia. It was the most populous Virginia county during the time of the American Revolution. Since 1757, the county seat has always been the Town of Leesburg. In 2014, Loudoun County was ranked by Forbes as America's second wealthiest county. The County has a total area of 521 square miles, of which one square mile is water. As of the 2014 Census estimate, it has a population density of 696 per square mile. The population was estimated to be approximately 363,050 in 2014 by the U.S. Census Bureau, a nearly 16% increase over the 2010 population of 312,311.



Geographically, Loudoun County is bounded to the North by the Potomac River, to the south are 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.

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 2015 – 2016 winter season.

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 1,364 per square mile. In 2014, the population was estimated at 446,094, an approximately 11% increase over the 2010 census.



Prince William County has been an incredibly fast growing community for decades. This is because of its central location to the Washington, D.C., metropolitan area. The population



growth rate poses a risk; as open land is developed flood management must be addressed with the increasing amounts of impervious surfaces. Its 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 2015 – 2016 winter season.

2. City Profiles

City of 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. In 2014 the population was estimated to be 150,575, an increase of nearly 8% since the 2010 Census.

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 2015 – 2016 winter and summer seasons have proven.



City of Fairfax

Named after Thomas Fairfax, Sixth Lord Fairfax of Cameron, what is now known as the City of Fairfax became an independent city in 1961. This occurred only after having been previously known as Earp's Corner, then Town of Providence, and eventually Town of Fairfax. In 2014 the population was estimated to be 24,483, an increase of 8% since 2010.



The city's location on the eastern edge of the Virginia Piedmont make it susceptible to natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2015 – 2016 winter season.

City of Falls Church

It is believed that the area was first settled by Europeans in 1699. The city takes its name from what was coined The Falls Church,





a building that was built in 1757. In 2014, the population was estimated to be 13,601, an increase of 10% since 2010.

The City of Falls Church comprises about 2.2 square miles located approximately 10 miles west of Washington, D.C. The City's proximity to the Washington metropolitan area and its ease of access by car and public transportation have allowed increasingly-varied residential and commercial development. In 2014, Falls Church was ranked by Forbes as America's wealthiest municipality. Falls Church is densely populated with more than 6,182 persons per square mile.

The City of 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 2015 – 2016 winter and summer seasons.

City of Manassas

The City of Manassas played an important role during the American Civil War. The First Battle of Bull Run (also called First Battle of Manassas) was fought in the vicinity in 1861. It was the first land battle of the Civil War. The Second Battle of Bull Run took place August 28-30, 1862. The Town of Manassas was incorporated in 1873 and became an independent city in 1975. In 2014 the population was estimated to be 42,081, an increase of 11% since 2010.



Manassas is subject to high wind events, winter weather, and flooding. Winter storms pose significant threats, as evidenced during the 2015 – 2016 winter season.

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. In 2014 the population was estimated to be 15,174, an increase of 10% since 2010.





3. Town Profiles

Town of Dumfries

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 is named after his birthplace, Dumfriesshire, Scotland. The population of the town was 4,961 as of the 2010 Census and was estimated by the Census Bureau to be 5,192 in 2014.



Town of Herndon



Incorporated in 1879, the area on which the town 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 23,292 as of the 2010 Census and was estimated by the Census Bureau to be 24,554 in 2014, an increase of 5%.

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 to the east of town.



European settlement began in the late 1730s. After its 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 242,616 as of the 2010 Census and was estimated by the Census Bureau to be 49,496 in 2014, an increase of 16%.

Town of Vienna

Originally called Ayr Hill, the 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 as a town in 1890. The population of the town was 15,687 as of the 2010 Census and was estimated by the Census Bureau to be 16,459 in 2014, an increase of 5%.



Town of Purcellville



Settled in the mid-1700s, the village was first known as Purcell's Store. The village renamed to 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 7,727 as of the 2010 Census and was estimated by the Census Bureau to be 8,929 in 2014, an increase of over 15%.

Town of Lovettsville

Originally known as the German Settlement, Lovettsville was officially established in 1820, incorporated in 1842. Its location at the intersection of the Berlin Turnpike and Lovettsville Road, and its proximity to an important Potomac River crossing allowed the town to grow and prosper well into the 20th Century. The population of the town was 1,613 as of the 2010 Census and was estimated by the Census Bureau to be 1,869 in 2014, an increase of 16%.

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 282 as of the 2010 Census and was estimated by the Census Bureau to be 295 in 2014.



Town of Middleburg

The population of the Town was 673 as of the 2010 Census and was estimated by the Census Bureau to be 781 in 2014. 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.

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. The population of the town was 539 as of the 2010 Census and was estimated by the Census Bureau to be 621 in 2014.



Town of Haymarket

Chartered in 1799 by the Virginia General Assembly, the Town of Haymarket was incorporated in 1882. The population of the town was 1,782 as of the 2010 Census and was estimated by the Census Bureau to be 1,973 in 2014, an increase of nearly 11%.





Since the 1900s it has been popular for fox hunting and steeple chasing and is also known for its wineries. The town covers 0.5 square miles of land and is located in Prince William County.

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 population of the town was 934 as of the 2010 Census and was estimated by the Census Bureau to be 1,013 in 2014.



Town of Quantico

Located in Prince William County and surrounded by the Marine Corps Base Quantico, the population of the town was 480 as of the 2010 Census and was estimated by the Census Bureau to be 531 in 2014.



B. Geography, Hydrology, and Climate

1. Geography

The Northern Virginia planning region is located at the north-east corner of the Commonwealth of Virginia, lies across the Potomac River from the Nation's Capital, Washington, DC, and is part of the Washington, DC-Maryland-Virginia-West Virginia Primary Metropolitan Statistical Area. Figure 3.1 above is an overview map for the Northern Virginia region including all counties, cities, and towns within the region.

Northern Virginia is made up of the counties of Arlington, Fairfax, Loudoun, and Prince William; the independent cities of Alexandria, Falls Church, Fairfax, Manassas, and Manassas Park; the towns of Clifton Herndon, and Vienna (Fairfax County), Leesburg, Purcellville, Lovettsville, Middleburg and Round Hill (Loudoun County), and Dumfries, Haymarket Occoquan, and Quantico (Prince William County). Figure 3.2 is a base map overview of the Northern Virginia region including all participating county, city, and town jurisdictions, as well as the identification of interstate highways, major roads, major water bodies, and lands outside the authority of participating jurisdictions such as Dulles Airport and U.S. government property.

Northern Virginia is home to numerous Federal government facilities such as the Pentagon, CIA, and U.S. Geological Survey. Historic and cultural resources include George Washington's historic home on the Potomac, Mount Vernon; Arlington National Cemetery; and the Udvar-Hazy Center of the Smithsonian Institution's National Air and Space Museum at Washington-Dulles International Airport.

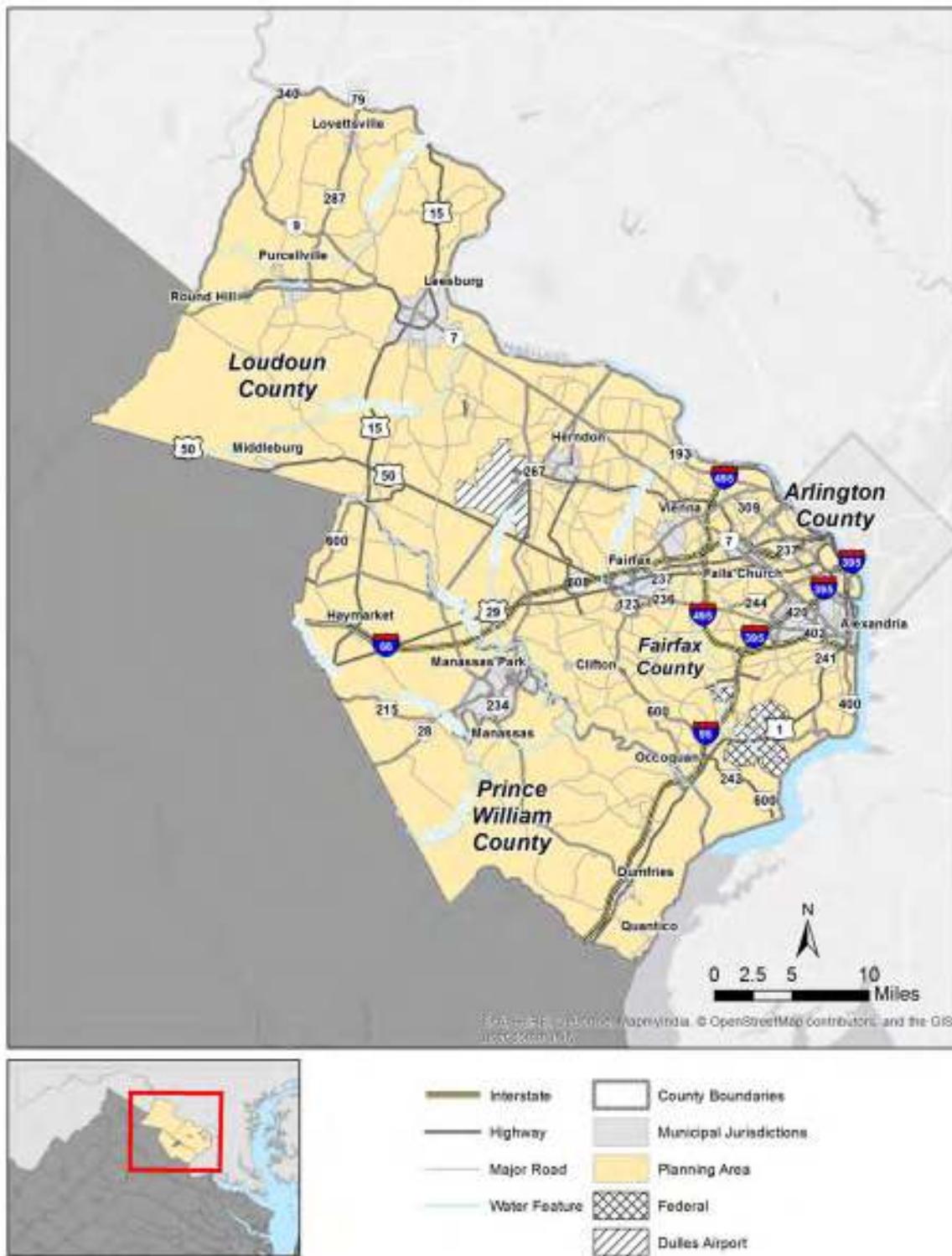


Figure 3.2. Major Features in Northern Virginia



2. Hydrology

The Northern Virginia Planning District is divided by three physiographic provinces of Virginia: the Coastal Plain, the Northern Piedmont, and the Blue Ridge (Figure 3.3). The Coastal Plain lies roughly east of Interstate 95/395 including the eastern portions of the City of Alexandria, and Fairfax and Prince William Counties. The Northern Piedmont province lies roughly between I-95 and US Highway 15 in central Loudoun and western Prince William counties. It is bounded by the Blue Ridge Mountains on the west with ridges, foothills, and hollows rolling down to the Potomac River to the east. Elevations range from more than 1,950 feet above sea level in the Blue Ridge Mountains in western Loudoun County to sea level in eastern Prince William County on the Potomac River. The total land area is 1,304 square miles.



Figure 3.3 Hydrologic Regions of Virginia

Source: U.S. Department of the Interior, U.S. Geological Survey, Fact Sheet 023-01

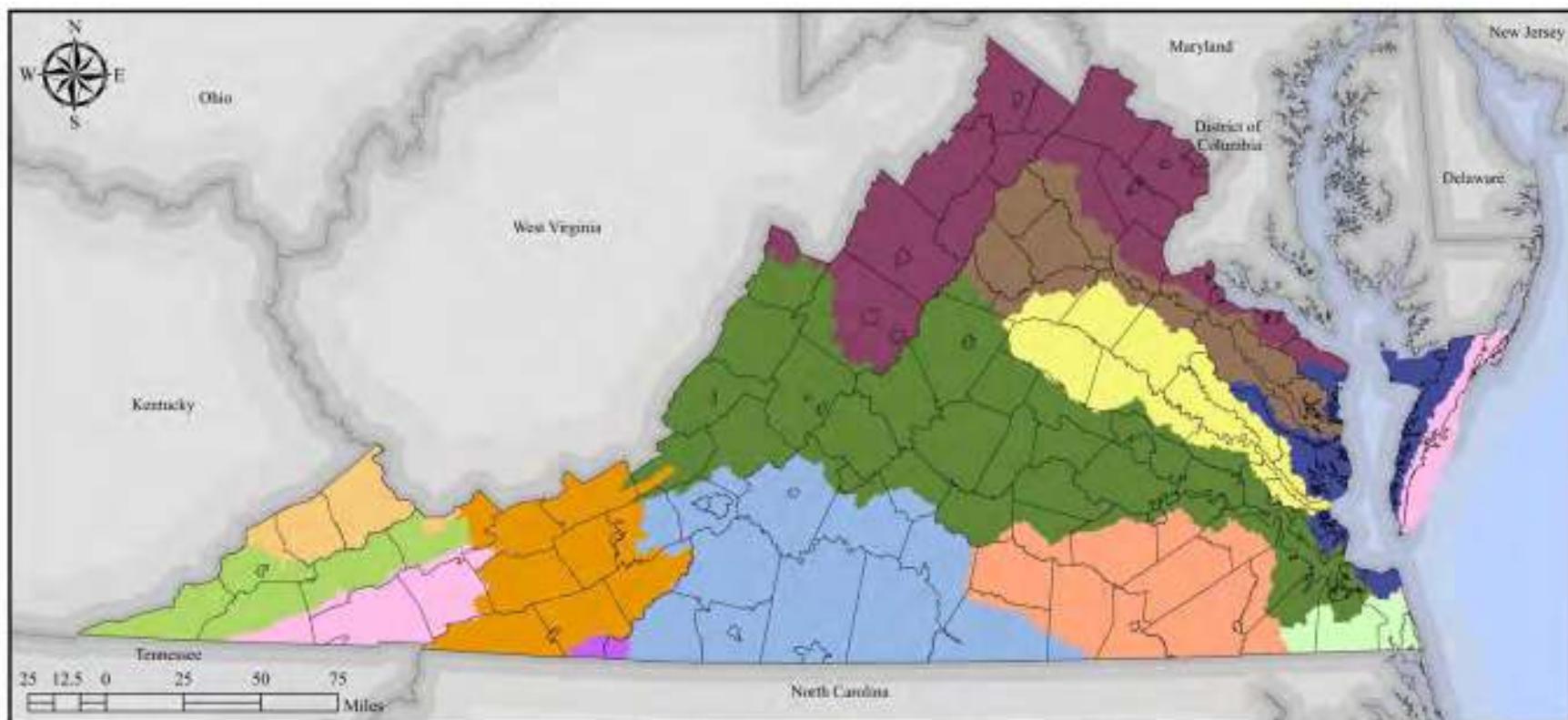
Northern Virginia lies entirely within the Potomac River watershed. After passing Harper's Ferry, WV, the Potomac forms the border between Maryland and Virginia, flowing in a southeasterly direction. Figure 3.4 provides a general overview of the watersheds in Virginia. The topography of the upper reaches of the basin is characterized by gently sloping hills and valleys. At Great Falls, the stream elevation rapidly descends from over 200 feet to sea level. Eastward of Great Falls, the Basin enters into the Coastal Plain physiographic province. Figure 3.5 illustrates the major physiographic features of Virginia.



3. Climate

The area has a moderate climate. Average temperatures are approximately 50 degrees, and range from January lows in the mid-20s to July highs in the high-80s. Annual rainfall averages above 40 inches the average snowfall in the region ranges from approximately 15 inches at Reagan National Airport to 22 inches at Dulles International Airport.

Climate change is both a present threat and a slow-onset disaster. It acts as an amplifier of existing hazards. Extreme weather events have become more frequent over the past 40 to 50 years and this trend is projected to continue.¹ Rising sea levels, coupled with potentially higher hurricane wind speeds, rainfall intensity, and storm surges are expected to have a significant impact on coastal communities, including those in northern Virginia. More intense heat waves may mean more heat-related illnesses, droughts, and wildfires. As climate science evolves and improves, future updates to this plan might consider including climate change as a parameter in the ranking or scoring of natural hazards.

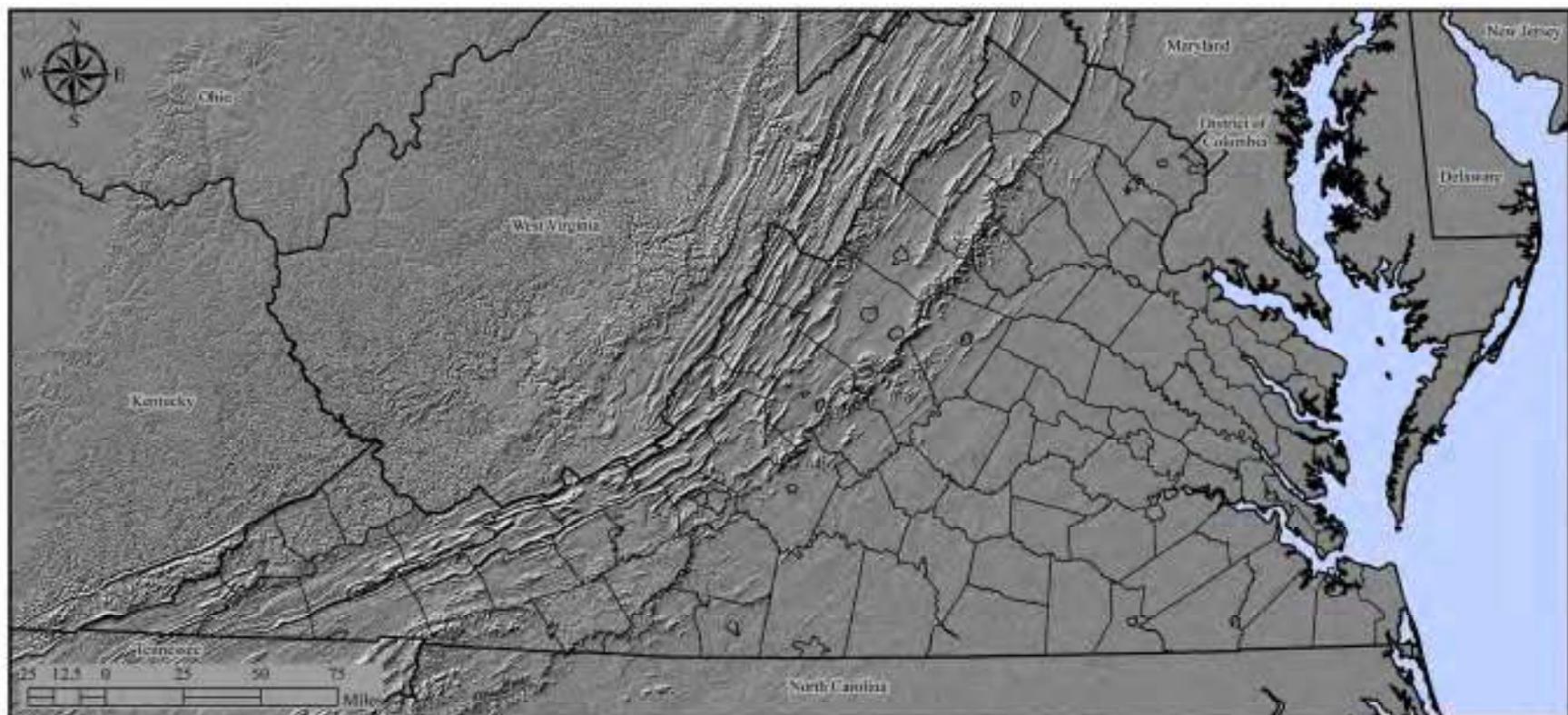


PROJECTION: 1st Lambert Conformal Conic
North American Datum 1983

DISCLAIMER: Majority of available hazard data is intended to be used at national or regional scales. The purpose of the data sets are to give general indication of areas that may be susceptible to hazards. In order to identify potential risk in the Commonwealth available data has been used beyond the original intent.

Commonwealth of Virginia Enhanced Hazard Mitigation Plan 2010
Section 3.2 Page 4

Figure 3.4. Watersheds of Virginia (Source: Commonwealth of Virginia Emergency Operations Plan HIRA Figure 3.2-2)



PROJECTION: *F.I. Lambert Conformal Conic
North American Datum 1983*

DISCLAIMER: Majority of available hazard data is intended to be used at national or regional scales.
The purpose of this data set is for general indication of areas that may be susceptible to hazards. An user is solely responsible for the Commonwealth's hazard data that has been used to conduct the analyses related

DATA SOURCES:

- USGS National Map Seamless Server
- Shuttle Radar Topography Mission
- VGIN Jurisdictional Boundaries
- ESRI State Boundaries

LEGEND:

- | |
|--|
| SRTM Hillshade
Mountains
Valleys |
|--|

HAZARD IDENTIFICATION:

The Shuttle Radar Topography Mission (SRTM) is a joint project between NASA and NGA (National Geospatial-Intelligence Agency) to map the world in three dimensions. SRTM data is being used to generate a digital topographic map of the Earth's land surface with data points spaced every 1 arc second for the United States of latitude and longitude (approximately 30 meters).

Commonwealth of Virginia Enhanced Hazard Mitigation Plan 2010
Section 3.2 Page 3

Figure 3.5. Shaded Relief of Virginia

(Source: Commonwealth of Virginia Emergency Operations Plan HIRA Figure 3.2-1.)

C. Demographics, Population & Economic Growth

The Washington metropolitan area is projected to experience substantial growth in population, employment, and output over the next 20 years. Proximity to the Nation's capital has been fueling population growth in Northern Virginia for more than 60 years. Since the mid-1930s, when large numbers of Federal workers moved to Washington, D.C., during the New Deal and began spilling out into adjoining suburbs, people have been moving into Northern Virginia at an accelerated rate.

Today, Northern Virginia is home to over 2 million people. As seen in Table 3.2, demographers are projecting on average, nearly 30,000 newcomers per year through the end of this decade, and approximately 28,000 per year the decade after. The latest population numbers from the Metropolitan Washington Council of Governments were grouped as shown in the table below. Numbers were not available for each city and county individually. By 2020, the population will approach 2.5 million.

The population of Northern Virginia is incredibly diverse and transient. According to the Census Bureau Report from November 3, 2015, there are 168 languages spoken at home. 26% of the metro area population age 5 and over speak a language other than English at home. Individual jurisdictions have even higher totals, for example, Fairfax County Public Schools data shows that 34% of the Fairfax-Falls Church Area population speaks a language other than English at home. The population in the Washington, D.C. area is also very transient, and there are large numbers of visitors to the region. These population characteristics present unique challenges for the Northern Virginia jurisdictions as outreach efforts are not possible in all of the languages spoken in Northern Virginia homes. These characteristics also present challenges in terms of residents' familiarity with the local alerting systems.

Table 3.2 Projected Population Growth in Northern Virginia, 2010-2040

Jurisdiction	2010	2025	2040	Percent Change
Alexandria	140,012	171,292	191,405	26.9%
Arlington County	207,627	247,357	282,998	26.6%
City of Fairfax, Fairfax County and Falls Church	1,116,549	1,255,627	1,406,187	20.6%
Loudoun County	312,310	452,242	484,498	35.5%
Prince William County, Manassas and Manassas Park	454,094	557,549	617,427	26.5%
Northern Virginia	2,230,592	2,684,067	2,982,515	25.2%

Source: Metropolitan Washington Council of Governments, Cooperative Forecasts

The locus of population growth, inexorably pushing outward, is now sweeping across the broad expanse of the outer rim of the Northern Virginia region. This is where the pressure to absorb



new metropolitan growth is most intense, Loudoun County in particular is predicted to see substantial population growth. There is substantial population growth across the region, with large population increases in every jurisdiction through redevelopment.

At the beginning of the 1960s, Northern Virginia was a suburban bedroom community of predominantly middle-class families with children, not dissimilar demographically from hundreds of other places. By the end of the century, it had evolved into a complex blend of urban and suburban influences, an intricate demographic composite formed by the economic growth, transformation, and prosperity of the Washington metropolitan economy, by a rising tide of immigration, aging of the baby boom generation, and other powerful agents of social and demographic change.

A second salient feature of Northern Virginia's demography is the degree of urbanization etched in locality profiles. In many ways, American suburbs have become more urban, as traffic congestion, overcrowding, immigrants, and more diverse homes and lifestyles work their way into suburbia. But urban pressures and forms, while present everywhere, have not impacted suburbia equally. The pressures are more intense, as a general rule, in neighborhoods settled by the first wave of post-war suburbanization, as they age and become part of an expanding urban core.

In Northern Virginia, impacts of urbanization can be observed in the contrasting demographic profiles of close-in and outer-fringe localities. The differences can be traced, primarily, to variations in the affordability, age, and composition of local housing inventories. As types of housing are unevenly distributed across regional and local landscapes, so too is the flow of different population streams as they seek a home in a location and at a price range suitable to their lifestyle, thereby stamping sections of the region with a distinctive demographic coloration. Listed below are some of the major demographic differences found in the close-in and outer-ring suburbs of Northern Virginia.

Northern Virginia Suburbs closest to Washington, D.C.:

(Primarily in Alexandria, Arlington County, and some inside-the-beltway Fairfax neighborhoods)

- are communities that have changed during the past three decades from conventional family-centered suburbs into new-urban enclaves that, demographically, have become similar to downtown Manhattan, San Francisco, and other U.S. cities
- have become “first-stop” immigrant gateways
- are approaching minority-majority status
- are distinctive and stand out nationally for their high percentage of non-family households, single-person households, childless households, renters, and multi-unit apartment and hi-rise housing (of 50 or more units)
- have among the smallest percentage of school age children, and among the largest percentage of young adults (20 to 35 year old), found anywhere in the U.S.
- have high population turnover, people continually moving in and out, with about half of the population replaced every five years
- exhibit evidence of a widening gap between have and have-nots with large numbers at the high end of the income ladder; and large numbers, mainly immigrants and minorities, at



the low with very few in the middle.

Outer-ring suburbs of Northern Virginia:

(Primarily in Prince William and Loudoun Counties and parts of Fairfax County)

- are communities that are more traditionally suburban in character
- dominated by families with school-age children, and homeowners who are living in detached single-family houses and townhouses
- have large average household sizes
- have growing foreign-born populations but with socio-economic backgrounds different from those pouring into the inner core. Outer suburban immigrants, generally, have lived in the U.S. longer, are better educated, are more affluent, and are more likely to live in homes they own
- many homes with affluent, and well educated people; with some pockets of lower income communities but less prevalent than the jurisdictions closer to Washington, D.C.

The Region at a Glance

The population of Northern Virginia is incredibly diverse and transient adding to the region's vulnerability. According to the Census Bureau Report from November 3, 2015, there are 168 languages spoken at home. 26% of the metro area population age 5 and over speak a language other than English at home. Individual jurisdictions have even higher totals, for example, Fairfax County Public Schools data shows that 34% of the Fairfax-Falls Church Area population speaks a language other than English at home. The population in the Washington, D.C. area is also very transient, and there are large numbers of visitors to the region. These population characteristics present unique challenges for the Northern Virginia jurisdictions as outreach efforts are not possible in all of the languages spoken in Northern Virginia homes. These characteristics also present challenges in terms of residents' familiarity with the local alerting systems.

The Northern Virginia MAC and participating jurisdictions were mindful of these challenges when creating new strategies. Some actions that were examined to address this vulnerability include:

- Expand code requirements to require redundant mechanical systems, especially in communities targeted at retirees.
- Design and build new schools to serve as community shelters.
- Assess if an under-assessed Hispanic service and farm labor force is at risk due to limited communication pathways.
- Determine whether school systems that rapidly expanded during the past 20 years have adequate natural hazard monitoring systems (tornado, winter storm, severe storm); are plans in place and exercised to ensure appropriate school closures or sheltering-in-place.
- Consider new multi-household housing units, especially for elderly, to have on-site generators for power redundancy.
- Work with Cooperative Extensive Service/USDA agencies and Loudoun and Prince William Soil and Water Conservation Districts to determine if agricultural land owners have special hazard mitigation challenges regarding power outages and livestock feeding, access, etc.



- Determine most effective emergency management and hazard mitigation notification communication networks to reach military and immigrant communities who are not familiar with the area.
- Verify that targeted elderly populations can be reached through redundant communication networks.
- Work with advocates for elderly populations to consider education and outreach for seniors to facilitate personal disaster preparedness plans.
- Develop and distribute homeowner hazard mitigation tool kits to property owners that focus on easy mitigation actions homeowners can take.
- Provide multi-language hazard mitigation tool kits through community churches and other organizations.
- Work with landlords to distribute multi-cultural hazard mitigation information to renters, as appropriate, regarding renter's insurance, what to do in an emergency, etc.

1. Projected Economic Growth

While still relatively strong, the recent downturn has had significant impact on the area's economy. The performance of the Washington metropolitan area economy is lagging behind the national economy and that of similar metropolitan areas, a five-year trend dating back to 2010. The Department of Labor Statistics reported an unemployment rate of 3.9% for the region in December 2015, as compared to 5.1% in December 2013. Even with the slumping economy, the region's unemployment rate remains considerably lower than the national rate of 4.8%. George Mason University's Center for Regional Analysis projects the Washington Metropolitan Area economy (Gross Regional Product) to grow from \$433.24 billion in 2010 to \$683.7 billion in 2030.

A few quick facts underscore the strength, performance, and unique structure of its economy, of which Northern Virginia is an important sub-component. Greater Washington:

- is home to the Federal government, the largest purchaser of goods and services in the world. The total value of Federal procurement outlays received by businesses in the National Capital region during fiscal year 2014 was \$71.2 billion, up from \$29.3 billion in 2000. The 2014 figure is a decrease from the peak in federal procurement in 2010, when \$82.4 billion was received by businesses in the NCR.
- 5th largest increase in jobs among the 15 largest job markets in the United States, with 68,500 additional jobs between December 2014 and December 2015
- has one of the lowest unemployment rates in the country (3.9% in December 2015).
- A total of 297 Fortune 500 companies operate in the Washington, D.C. area
- 11 of the 19 Fortune 500 Companies categorized as federal contractors are headquartered in the Washington Area
- While many of the Fortune 500 companies located in the Washington area, 43 are located here for reasons other than access to the federal market. Data processing and analysis is the Washington area's biggest industry strength.
- is a top U.S. tourist destination, serving as host to 19 million domestic and international visitors in 2013 according to Destination DC



- is home to a growing list of industries and advanced technologies on the vanguard of innovation. Many IT services and computer support firms have facilities here including NETAPP, Level-3 Communications, CenturyLink, IBM, CISCO, Oracle, Microsoft, 3M, and Google.
- The biggest industries in Northern Virginia are Professional, Scientific and Technical services and Government.

Northern Virginia is a strong sub-regional component of the larger Washington economy, as are suburban Maryland and the District of Columbia. Major employers for manufacturing and non-manufacturing jobs in the Northern Virginia region are shown in Table 3.3.

Table 3.3. Major Employers in Northern Virginia. Source: Virginia Employment Commission

Manufacturing		
<i>Company</i>	<i>Product/Service</i>	<i>Estimated Employment</i>
BAE Systems	Aerospace electronic systems	100 - 299
Lockheed Martin Corporation	Electronic components	5,000 - 9,999
Non-Manufacturing		
Booz, Allen & Hamilton	Management & technology consulting	10,000+
Computer Sciences Corporation	Information technology services	10,000+
Department of Defense	National security	10,000+
Department of Homeland Security	National Security	10,000+
Federal Home Loan Mortgage Corp.	Financial services	2,500 - 4,999
George Mason University	Higher education	2,500 - 4,999
INOVA Health System	Health care	10,000+
Northrop Grumman	Professional, scientific, and technical services	5,000 - 9,999
Science Applications International Corp. (SAIC)	Information technology services	5,000 - 9,999
Wal-Mart Stores, Inc.	Discount retail	2,500 - 4,999
Washington Metro Area Transit Authority	Transit system	1,500 - 2,499



2. Population

According to the U.S. Census Bureau, the population of the Northern Virginia region in 2014 was approximately 2.4 million. The average number of persons per square mile was 1,735, making the region one of the most densely populated in the United States. Table 3.4 shows the total population and population density per square mile, by jurisdiction. As can be seen in the table, the City of Alexandria is the densest jurisdiction while Loudoun County is the least dense. However, when the land comprising Arlington National Cemetery and Reagan National Airport are considered, Arlington County is even denser than Alexandria. Figure 3.6 illustrates the distribution of population density, using 2014 estimates, across the region according to census tracts.

Table 3.4. Population Statistics in the Northern Virginia Region, by Jurisdiction

Source: U.S. Census Bureau

Jurisdiction	2005 Population Estimate	2005 Population Density (Square Mile)	2010 Population	2010 Population Density (Square Mile)	2014 Census Population Estimate	2014 Population Density (Square Mile)
Arlington County	197,806	7,573	207,627	7,993	226,908	8,737
Fairfax County	1,036,578	2,550	1,081,726	2,767	1,137,538	2,909
Loudoun County	257,240	494	312,311	515	363,050	599
Prince William County	354,039	1,016	402,002	1,195	446,094	1,326
City of Alexandria	138,004	8,955	139,966	9,314	150,575	10,018
City of Fairfax	23,059	3,626	22,565	3,616	24,483	3,923
City of Falls Church	10,648	5,324	12,332	6,170	13,601	6,835
City of Manassas	37,423	3,742	37,821	3,828	442,081	4,259
City of Manassas Park	12,561	5,106	14,273	5,633	15,174	5,998
Northern Virginia Total	2,067,358	1,545	2,230,623	1,599	2,419,504	1,735

Development Trends, described in the following section, summarize population change for the region. The Risk Assessment Methodology section summarizes the population parameters used in ranking the hazards presented in this report.

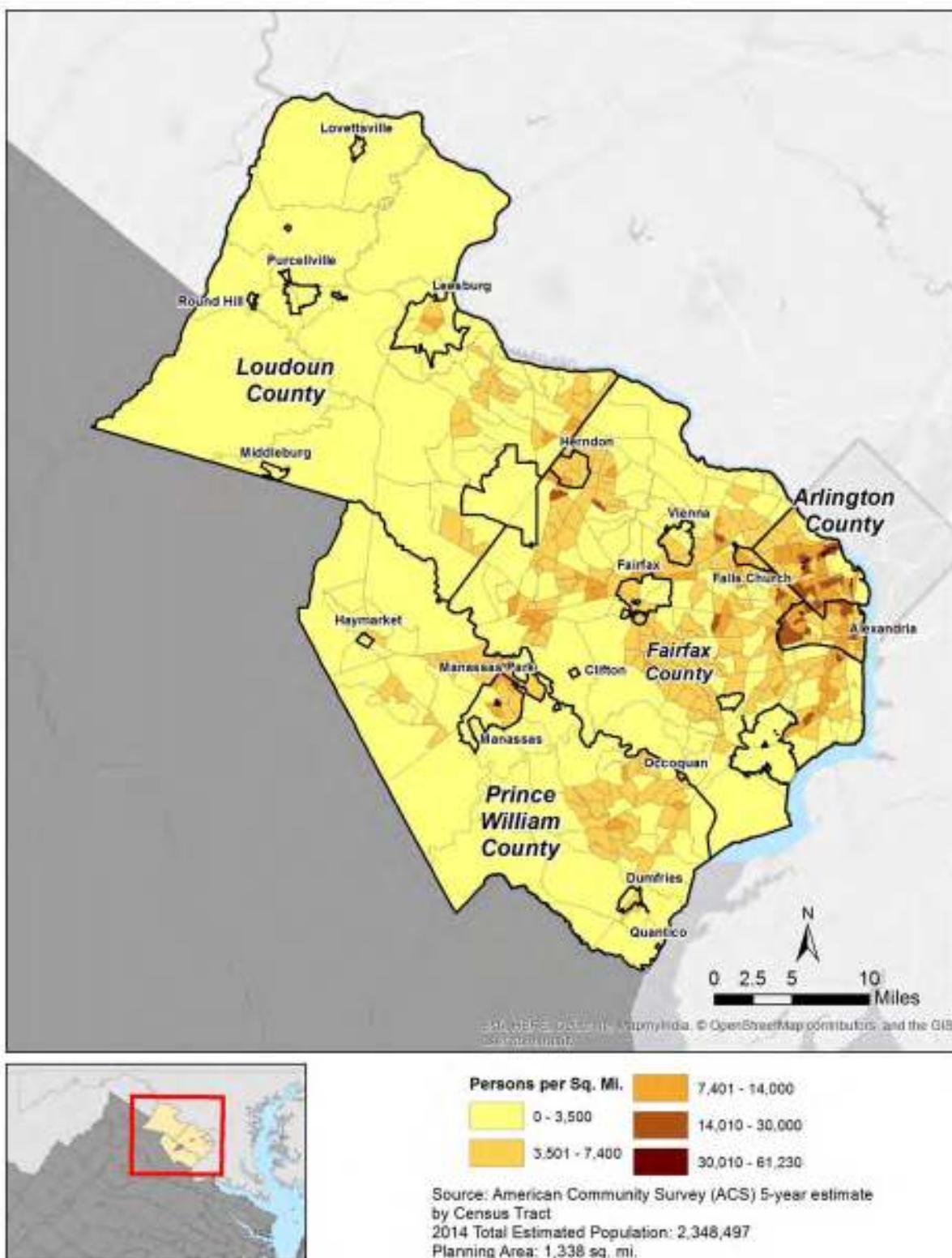


Figure 3.6 Population Density (2014).



3. Housing

A general market inventory of housing in Northern Virginia shows that there is a continual demand for affordable housing, with low vacancy rates throughout the region. Housing demand is being propelled by job growth.

As tracked by George Mason University, the median sales price of housing in December 2014 was \$408,000 an increase of 4.3% since December 2013. Incomes have not been keeping pace with rising housing prices. The Urban Institute estimates that 69% of Washington area households are paying less than 30% of their income in housing costs in 2011. Additionally, in 2011, the Urban Institute estimates that nearly half of all renters in the region are paying more than 30% of their salary on housing. Housing construction has continued to be strong in the outer-ring suburban jurisdictions.

http://cra.gmu.edu/pdfs/Washington_Metro_Housing_Market_Update.pdf

D. Land Use, Development, & Zoning

1. Land Use

FEMA requires that State and local mitigation plans evaluate land use and development trends so that mitigation options can be considered in future land-use decisions. Changes in urban and agricultural land cover may help to highlight areas within the State that should be considered in long-term comprehensive plans.

To identify these areas, land cover change was assessed using the National Land Cover Dataset. This dataset is produced by the Multi-Resolution Land Characteristics Consortium (MRLC), a collection of Federal agencies that pool resources to map land cover across the Nation. Using satellite imagery, the MRLC produced datasets for 2001 and 2011 that include land cover classes for various types of urban, agricultural, forested, and other natural areas. These two datasets were compared in order to map land cover changes during that 10 year period.

The majority of change in Northern Virginia has occurred in forested lands and urban areas shown in Table 3.5. From 2001 through 2011, forest land cover has decreased and urban area has increased across the region. With the exception of several towns, which saw no change, every jurisdiction saw an increase in urban area and a decrease in forested land. Loudoun County, however, has witnessed the most urban growth, increasing by 11,945 acres. Agricultural land cover has also shown significant decrease in both Loudoun and Prince William Counties as population growth moves out. Figures 3.7 and 3.8 show the distribution of land cover for Northern Virginia.

**Table 3.5. National Land Cover Changes 2001 to 2011.**

Jurisdiction	Urban Change (Acres)	Forest Change (Acres)	Agricultural Change (Acres)	Wetland Change (Acres)
Arlington County	65.8	-65.4	0	-1.1
Fairfax County	4,965	-4,212	-751	-116
Town of Herndon	33	-30	-3.6	0
Town of Vienna	6.4	-6.4	0	0
Town of Clifton	0	0	0	0
Loudoun County	11,945	-6,361	-6,158	-220
Town of Leesburg	918	-307	-585	-14
Town of Lovettsville	84	-7.8	-74.9	-1.1
Town of Purcellville	404	-127	-287	0
Town of Middleburg	0	0	0	0
Town of Round Hill	0	0	0	0
Prince William	12,440	-9,771	-2,813	-960
Town of Dumfries	42.5	-37.1	0	-7.3
Town of Haymarket	15.8	-10.5	-2.9	-2.4
Town of Occoquan	0	0	0	0
Town of Quantico	1.8	0	0	-1.8
Alexandria	87	-59	0	-18
Fairfax City	60	-53	-6	0
Falls Church	8	-8	0	0
Manassas	123	-111	-11	-8.2
Manassas Park	182	-126	-24	0
Total	31,381	-21,293	-10,715	-1,350

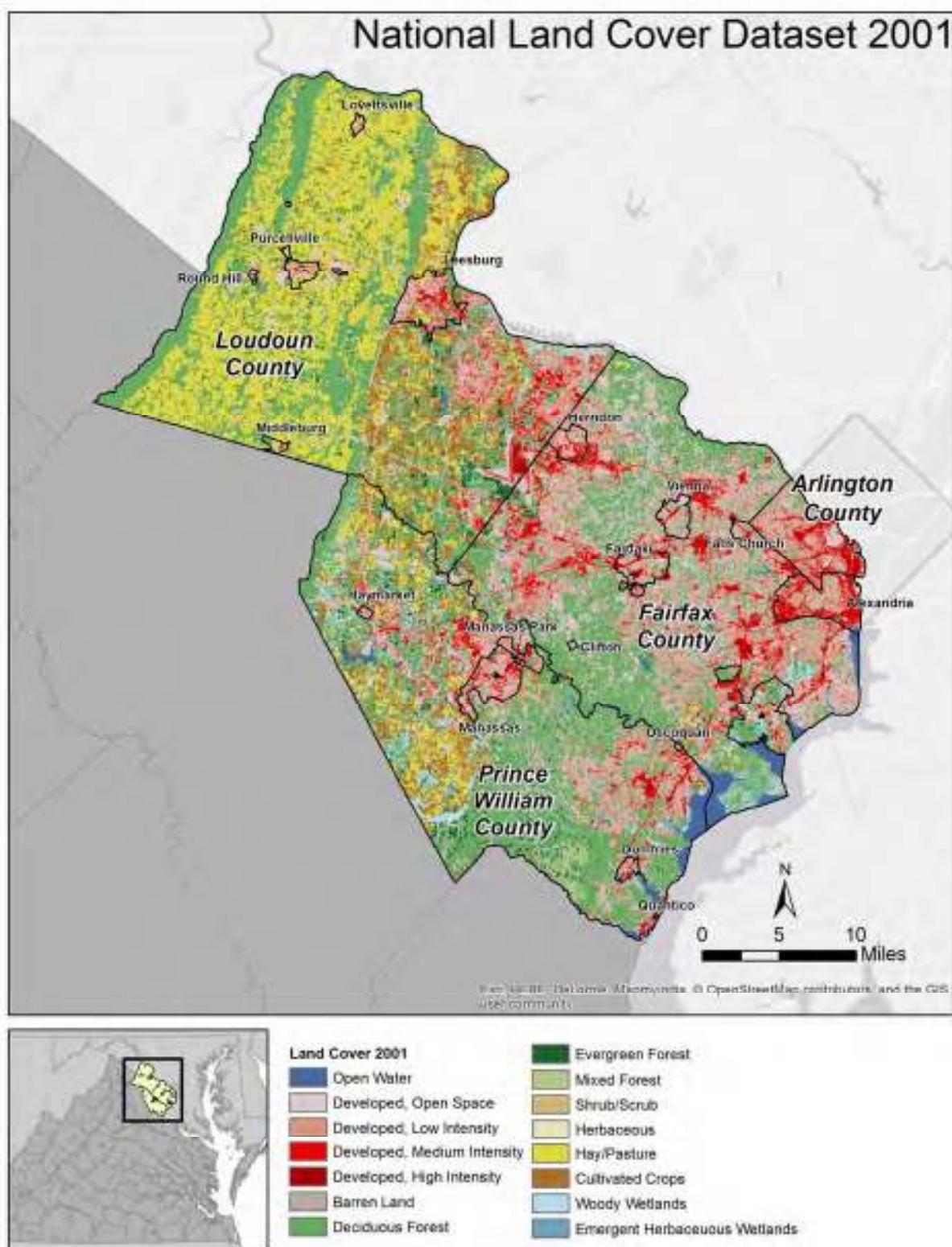


Figure 3.7. 2001 Land Cover categories.

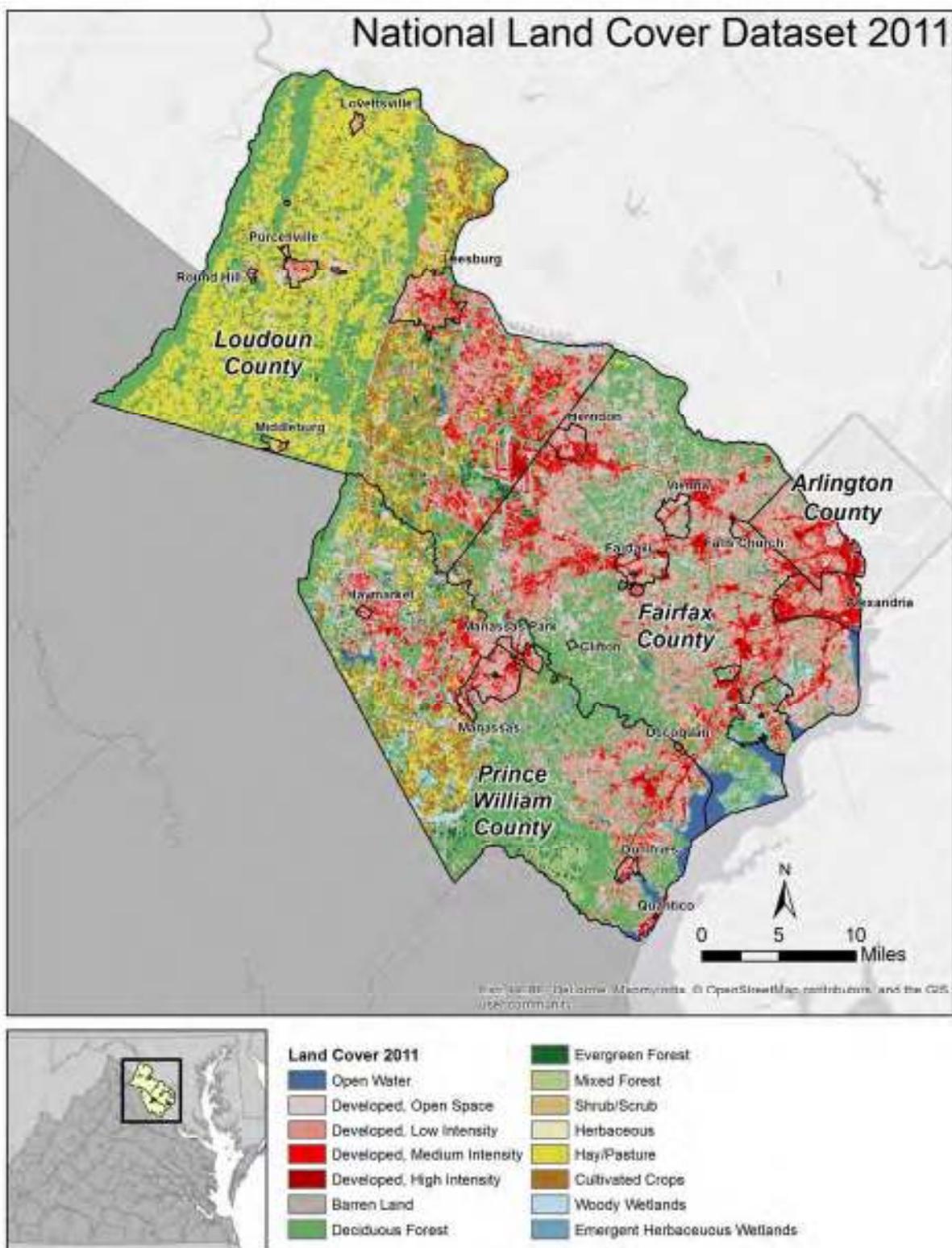


Figure 3.8. 2011 Land Cover categories.



2. Development Trends

A general analysis of land uses, development trends, and zoning within the planning area is an important factor in formulating mitigation options that influence future land use and development decisions. In many cases, local development policies greatly influence the degree of future vulnerability in communities across the region. The vulnerability of future buildings, infrastructure, and critical facilities is a great concern to community leaders across the Northern Virginia region and, as discussed in the Capability Assessment section, many of the day-to-day activities in local governments in the region are designed to deal with these challenges.

One of the most critical indicators to review in considering local development trends is population growth. The rate of population change in the Northern Virginia region from 2010 to 2014 was 8.58 percent, which is more than double the average growth rate for the State of Virginia during this same time period (4.07 percent). Table 3.6 shows the breakdown of population growth rates, by jurisdiction. As can be seen in the table, Fairfax County has the highest population in the region (1,137,538 people) while Loudoun County experienced the highest growth rate based upon percent change (16.25%). The region as a whole has experienced an 8.58% growth in the past nine years and accounts for over a quarter of the Commonwealth's total population.

Total population and population density have been used in the risk assessment ranking methodology. Refer to the Risk Assessment and Methodology section for more details on these ranking parameters.

Table 3.6. Northern Virginia Population Change (2010 – 2014).

Jurisdiction*	2010 Census	Estimated 2014	Percent Change
Arlington County	207,627	226,908	9.2%
Fairfax County	1,081,726	1,137,538	5.15%
Town of Herndon	23,292	24,554	5.42%
Town of Vienna	15,687	16,459	4.92%
Town of Clifton	282	295	4.61%
Loudoun County	312,311	363,050	16.25%
Town of Leesburg	42,616	49,496	16.14%
Town of Lovettsville	1,613	1,869	15.87
Town of Purcellville	7,727	8,929	15.56%
Town of Middleburg	673	781	16.05%
Town of Round Hill	539	621	15.21%
Prince William County	402,002	446,094	10.97

**Table 3.6. Northern Virginia Population Change (2010 – 2014).**

Jurisdiction*	2010 Census	Estimated 2014	Percent Change
Town of Dumfries	4,961	5,192	4.66%
Town of Haymarket	1,782	1,973	10.72%
Town of Occoquan	934	1,013	8.46%
Town of Quantico	480	531	10.63%
City of Alexandria	139,966	150,575	7.58%
City of Fairfax	22,565	24,483	8.50%
City of Falls Church	12,332	13,601	10.29
City of Manassas	37,821	42,081	11.26%
City of Manassas Park	14,273	15,174	6.31%
Northern Virginia Total	2,331,209	2,531,217	8.58%
VIRGINIA TOTAL	7,079,030	7,882,590	11.35%

*Town estimates are accounted for in County Totals.

3. Zoning

Zoning is also a critical indicator to review in considering local development trends. Zoning Geographic Information Systems (GIS) data was provided by the majority of the jurisdictions participating in the plan update. The following section summarizes the results of this data. In some cases, zoning generalizations were made in order to compare the jurisdictions to each other. In all of the jurisdictions, residential zoning is by far the largest classification, often followed by commercial.

Fairfax County has 46 zoning classifications that can be grouped into several large categories; residential zoning occupies approximately 79.8% of the total area of the county followed by planned units (10.9%). Commercial and Industrial make up 3% of the county land area.

Loudoun County's zoning categories were grouped to allow them to be compared to the other jurisdictions. Loudoun County is made up of 86% residential, 4% commercial, 4% industrial, and 6% mixed use zoning.

Prince William County has 7 zoning categories. Agricultural zoning occupies approximately 46.68% of the land within the county. 22.09% of the county is within the borders, but does not belong to the County (including towns, independent cities, and federally owned property). Residential makes up 13.63% of the land area, Mixed use is 12%, industrial is 3.23%, business is 2.13%, and office makes up 0.23% of the land area.

Arlington County has 30 zoning classifications. Over 47% of the land area zones are considered One-Family Dwelling Districts. In order to compare to the other jurisdictions, the classifications



were grouped into commercial, industrial, residential, and other. This resulted in 60% residential, 31% other, 8% commercial, and less than 1% is industrial based on land area.

The City of Alexandria has 32 zoning classifications. In order to compare to the other jurisdictions, the classifications were grouped into commercial, industrial, residential, and other. This resulted in 57% residential, 25% commercial, 15% other, and less than 3% industrial based on land area.

The City of Falls Church has 13 zoning classifications; low density residential represents the largest category with 51% of the land area of the city. In order to compare to the other jurisdictions, the classifications were grouped into commercial, industrial, residential, and other. This resulted in 79% residential, 14% commercial, 5% industry, and less than 2% other (or transitional) based on land area.

The City of Fairfax has 16 existing land use classifications; “Residential-Single Detached” represents the largest category with 45.6% of the land area of the city not including right of ways (or 39% of the total 4061.89 acres of the City). The second largest land use category is “Open Space – Recreation & Historic” which represents 12% of the land uses (10.3% of total area). Public right of way makes up 14.4% of the total area of the City. In order to compare to the other jurisdictions, the classifications were grouped into residential, commercial, industrial, institutional, and other. This resulted in 55.1% residential, 16.8% commercial, 8.5% institutional, 3.8% industrial and approximately 15.7% other based on land area not including the public right of way.

The City of Fairfax also provided Future Land Use categories. Based on this information, the city has 14 future land use classifications; “Residential – Low” is the largest category with 33.6% of the land area of the city not including public right of way. The second largest category, “Business – Commercial”, represents 12%. In order to compare to the other jurisdictions (and existing land uses of the city), the classifications were grouped similarly to the summarized existing land uses. This resulted in 54.2% residential, 13.3% commercial, 7.5% institutional, 6.2% mixed use, 3.0% industrial and 15.7% other based on land area not including right of way. “Mixed Use” is not a category used in the existing land use analysis. The category, which makes up 6% of the future land uses, is a mix of all other existing land uses (64% commercial, 27% residential, 4% industrial, 2% institutional, 3% other).

The City of Manassas has 17 Zoning Districts, as of April 2015, 54% of the land area is residential, 34% is industrial, 9% is commercial, and 3% is mixed-use/downtown.

4. Transportation

Northern Virginia and the Washington, D.C., metropolitan area is served by an extensive transportation network. There are 12 interstates and 42 highways in the Northern Virginia region. Transportation within the Northern Virginia region is primarily dependent upon a network of major highways (VA Rt. 7, I-66, US50, US29/211, I-95/395, and US1) that radiate out from the urban core (Washington, D.C., Arlington, and Alexandria); one major circumferential highway (I-495/95, the Capital Beltway); and other primary cross-county roads



such as the Fairfax County Parkway and the Prince William Parkway. Figure 3.1 above provides the major overview of the highways and interstates in the planning region.

The Washington Area's Metro Rail System primarily serves the inner localities with 11 stations in Arlington County, four stations in the City of Alexandria, and 10 stations in Fairfax County. There is a major expansion underway on the Metro Rail system, with the "Silver Line" extending service along I-267 into Fairfax and Loudoun Counties. Five of the stations in Fairfax County opened in June of 2014, and construction is underway to extend service to Dulles Airport and farther into Loudoun County. The Virginia Railway Express (VRE) commuter rail system serves communities to the west, cutting through central Fairfax County to the cities of Manassas and Manassas Park, and to the south in eastern Prince William County continuing to the City of Fredericksburg. Several bus systems (Metrobus, Alexandria's DASH, Arlington's ART, Falls Church's George, Fairfax County's Connector, Fairfax City's CUE, and Prince William's PRTC/Omniride) provide service throughout the region.

Commercial air service includes the Ronald Reagan Washington National Airport and Washington Dulles International Airport. Figure 3.2 shows the location of the airports in the planning region.

Nevertheless, these transportation systems are being strained by the growing population, housing, and employment patterns. In 2015, the travel time index for the Washington, D.C. area was 1.34. Travel time index is a comparison of travel time during the peak period to travel time with free flow. In other words, a trip will take 34% longer during rush hour than with no traffic. In 2014, the region experienced 5.4 hours of "rush hour" per day. This is a new measure and cannot be compared to previous years. According to the Census Bureau and Texas Transportation Institute, the average commute in the Washington, D.C. area is 34.5 minutes, up from 31.7 minutes in 2000. Workers are leaving home earlier and coming home later to make up the time that it takes to get where they need to go.

The Texas Transportation Institute 2014 Urban Mobility Report shows the Metropolitan Washington region ranks as follows:

- Number 1 in average hours lost sitting in traffic (82 hours).
- Number 1 in congestion cost per commuter (\$1,834).
- Number 1 in excess fuel consumed per commuter due to congestion (35 gallons/year).
- Number 6 in total excess gallons of fuel consumed due to congestion (88 million gallons)
- Number 5 total regional congestion cost (\$4.56 billion/year).
- Number 4 in total delay due to congestion (204 million hours/year)

Transportation systems are key in providing effective emergency response, but can also influence the impact of natural disasters. This can be a particularly crucial issue in Northern Virginia due to the high levels of traffic congestion. In addition to more immediate needs, businesses and employees suffer economic consequences when roads are closed due to natural disasters.

Day to day traffic reports frequently report accidents or simply high volume levels that may bring a particular highway to a standstill. The attack on the Pentagon on September 11, 2001,



Hurricane Isabel in 2004, and normal winter storms bring the regional highway system to a stop and taxes the transit system to the limits.

Northern Virginia, the Commonwealth of Virginia, and the metropolitan area as a whole are actively addressing transportation through significant updates in regional plans; expansion of transit to areas such as Tysons Corner, Reston, and Dulles Airport; and introduction of operational measures such as HOT (high occupancy toll) lanes (charging tolls on high occupancy vehicle lanes) to address congestion. In fact, HOT lanes have been added to I-95, I-395, and I-495.

¹ Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.



Chapter 4: Regional Hazard Identification and Risk Assessment (HIRA)

Requirement §201.6(c)(2): *(The plan shall include) ...a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include:*

- (i) A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.*
- (ii) A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:*
 - a. The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;*
 - b. An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate;*
 - c. Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*
- (iii) For multi-jurisdictional plans, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*

I. Introduction

The 2016 update to the Northern Virginia Hazard Mitigation Plan includes the following participating jurisdictions:

Counties
Arlington County
Fairfax County
Loudoun County
Prince William County

Cities
City of Alexandria
City of Fairfax
City of Falls Church
City of Manassas
City of Manassas Park

Towns
Town of Clifton
Town of Dumfries
Town of Haymarket
Town of Herndon
Town of Leesburg
Town of Lovettsville
Town of Middleburg
Town of Purcellville
Town of Occoquan
Town of Quantico
Town of Round Hill
Town of Vienna



Although some anecdotal information may be included regarding the towns located within these counties, these areas may not be fully included in this assessment due to the lack of data available. Where available, location-specific data is incorporated into the 2016 update. Where it was not available, it is assumed that adjacent county or municipal data includes or otherwise accounts for the town. For the purpose of simplicity, the study area will be referred to as the Northern Virginia planning area throughout the remainder of this chapter.

Efforts to involve county, city, and town departments and community organizations that might have a role in the implementation of mitigation actions or policies included invitations to attend meetings and assist with the development process, e-mails of minutes and updates, and opportunities for input and comment on all draft deliverables. Additional information on how this chapter was developed is available in the Planning Process Chapter.

The purpose of this section of the plan is to:

- 1) Identify the natural hazards that could affect the Northern Virginia planning area;
- 2) Assess the extent to which the area is vulnerable to the effects of these hazards; and
- 3) Prioritize the potential risks to the planning area.

The first step, identifying hazards, assessed and ranked all the potential natural hazards in terms of probability of occurrence and potential impacts. It also identified those hazards with the highest likelihood of significantly impacting the community. This section was completed based on a detailed review of the planning area hazard history. The 2010 update evaluated and reviewed the 2006 ranking and it was determined by the steering committee to expand the ranking and better align it with the Commonwealth of Virginia's methodologies. For the 2016 update, it was determined to continue the same methodology and hazards, with one minor change – rather than include extreme temperatures with other hazards, extreme temperatures is included in the 2016 update as an independent hazard.

Prior to the beginning of work to update the HIRA, the planning committee determined that the 2016 plan update would focus on natural hazards, and that no man-made or technological hazards would be included in this update, even in a redacted appendix.

The hazards determined to be of the highest risk were analyzed further to determine the magnitude of potential events, and to characterize the location, type, and extent of potential impacts. This included an assessment of what types of development are at risk, including critical facilities and community infrastructure. Finally, a prioritization of the risk to the planning area was compiled, to serve as an overall guide for the communities when planning development, implementing policy, and identifying potential mitigation measures.

II. Data Availability and Limitations

This study includes data collected from a variety of resources including local, state, and national datasets. Whenever possible and practical, data has been incorporated into GIS products to aid in analysis and to develop area-wide maps for depicting historical hazard events, hazard areas, and vulnerable infrastructure. Critical facility data has been collected from the FEMA loss-estimating



module, Hazards U.S. (HAZUS^{MH}), and has been supplemented, to the extent possible, by local data. The local data provided is summarized below in the Building Inventory & Local Critical Facility Data section. In accordance with FEMA mitigation planning guidance, the results of this study are based on the best available data. In most cases, detailed data regarding the structural characteristics of facilities does not exist in a usable format at the local level.

Local Critical Facility and Building Data

Building inventories were provided by the jurisdictions participating in this plan. In most cases, the building inventory captures only the location and estimated value of structures. Characteristics such as structure and construction type, (i.e., residential wood frame home) are not always recorded. This data was utilized to determine the risk to buildings based on the extent of known hazard areas that can be spatially defined through GIS technology. Hazards without known recurrence probabilities or mapped hazard extents are not deemed unique enough to make definitive risk and vulnerability assessments for potentially at-risk buildings or facilities that differentiate them from other areas of the region. The hazard-specific sections provide the analysis, if relevant, for the critical facilities, historic structures, and buildings at risk. Table 4.1 summarizes estimated building inventories per jurisdiction, estimated from both local inventories and HAZUS^{MH}.

Table 4.1. Local Building Inventory per Jurisdiction, from Local Inventories and HAZUS^{MH}

Jurisdiction	Estimated Number of Buildings per HAZUS ^{MH}	Jurisdiction Estimated Number of Critical and Historic Assets
Arlington County	40,847	380
Fairfax County	328,867	448
<i>Town of Clifton</i>	<i>included</i>	58
<i>Town of Herndon</i>	<i>included</i>	37
<i>Town of Vienna</i>	<i>included</i>	19
Loudoun County	99,182	176
<i>Town of Leesburg</i>	<i>included</i>	171
<i>Town of Lovettsville</i>	<i>included</i>	7
<i>Town of Purcellville</i>	<i>included</i>	7
<i>Town of Middleburg</i>	<i>included</i>	6
<i>Town of Round Hill</i>	<i>included</i>	5
Prince William County	128,867	171
<i>Town of Dumfries</i>	<i>included</i>	NA
<i>Town of Haymarket</i>	<i>included</i>	8
<i>Town of Occoquan</i>	<i>included</i>	11
<i>Town of Quantico</i>	<i>included</i>	NA
City of Alexandria	41,158	21
City of Fairfax	7,986	16
City of Falls Church	4,602	9
City of Manassas	8,024	85

**Table 4.1. Local Building Inventory per Jurisdiction, from Local Inventories and HAZUS^{MH}**

Jurisdiction	Estimated Number of Buildings per HAZUS ^{MH}	Jurisdiction Estimated Number of Critical and Historic Assets
City of Manassas Park	4,152	19

Local historic asset, critical facility, and infrastructure data were provided in some form by most jurisdictions. However, a comprehensive inventory consistent across jurisdictions does not exist because there is no universally accepted definition of what constitutes critical facilities and infrastructure, nor is one associated with FEMA and DMA 2000 planning requirements. For purposes of this plan, critical facilities and infrastructure are identified as “*those facilities or systems that are owned/operated/maintained by the jurisdiction whose incapacity or destruction would present an immediate threat to life, public health, and safety, or have a debilitating effect on the economic security of the region.*” This includes the following facilities and systems based on their high relative importance for the delivery of vital services, the protection of special populations, and other important functions in the Northern Virginia region:

- Emergency Operations Centers (EOCs);
- Hospitals and medical care facilities;
- Police stations;
- Fire stations;
- Schools (particularly those designated as shelters);
- Hazardous material facilities;
- Potable water facilities;
- Wastewater facilities;
- Energy facilities (electric, oil, and natural gas); and
- Communication facilities.

Because of their significance to many of the participating jurisdictions, historic assets were also included in this critical asset inventory for many jurisdictions.

In preparing the inventory of critical facilities for the Northern Virginia region, each participating jurisdiction was asked to submit best available GIS data for their primary critical facilities to be used in combination with HAZUS^{MH} inventory data. This resulted in the identification of hundreds of critical facilities for the Northern Virginia region. It is understood that this listing is incomplete due to data limitations associated with both the local GIS and HAZUS^{MH} inventories, but that further enhancements to the data will be made over time and incorporated during future plan updates. When analysis for critical facilities was performed, both the local and HAZUS^{MH} summary results are presented in the hazard specific sections, with clear notations as to which data set was utilized for that particular portion of the assessment.

During the 2016 update, each of the localities was provided a data matrix to assist them in compiling local data. The Data Matrix found in Appendix D contains the populated data matrices for localities that provided data during the data collection phase of this update. Figures 4.1



through 4.19 show the provided critical facility and historic asset locations within each of the participating jurisdictions.

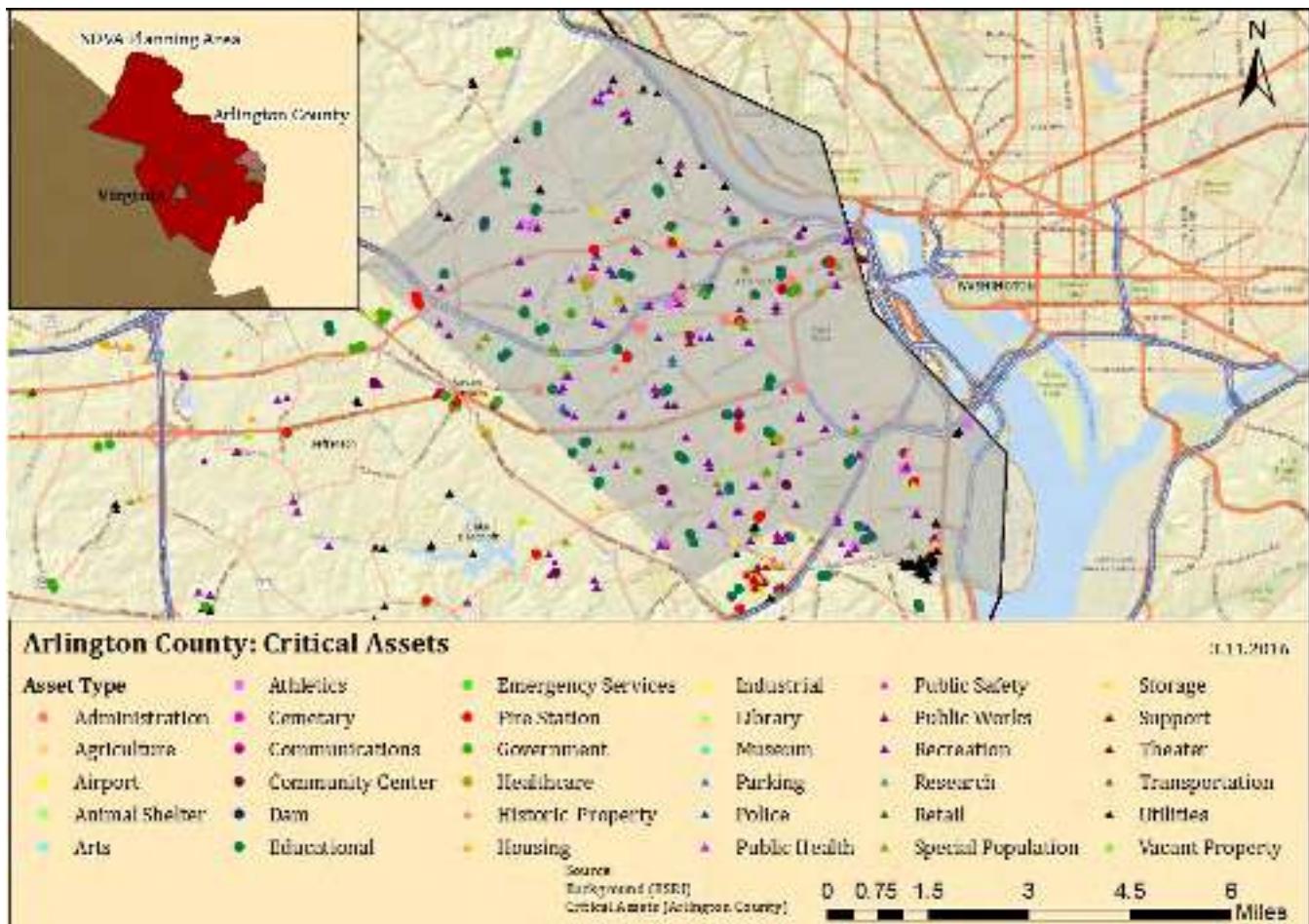


Figure 4.1. Arlington County local critical assets and historic structures.

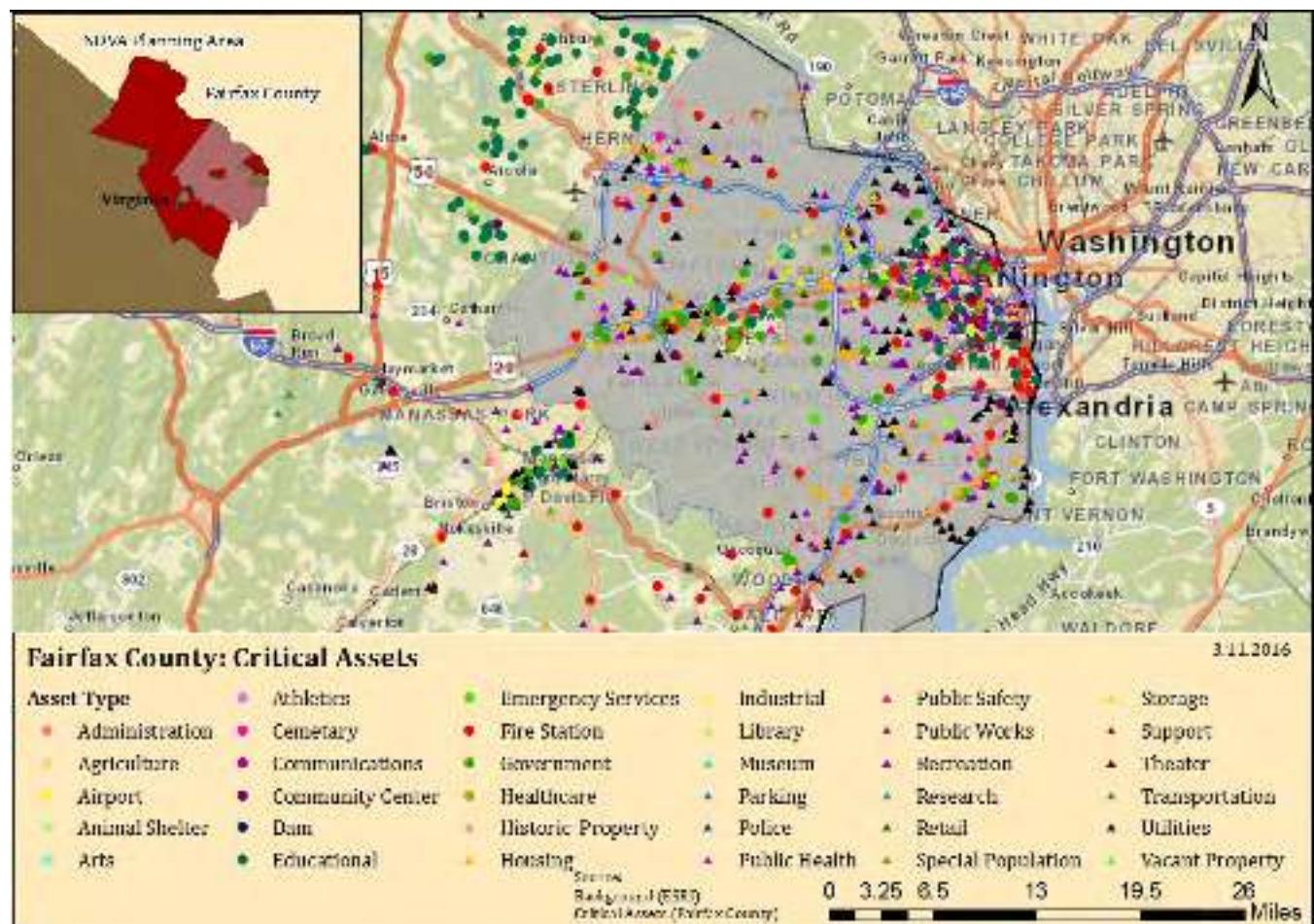


Figure 4.2. Fairfax County local critical assets and historic structures.

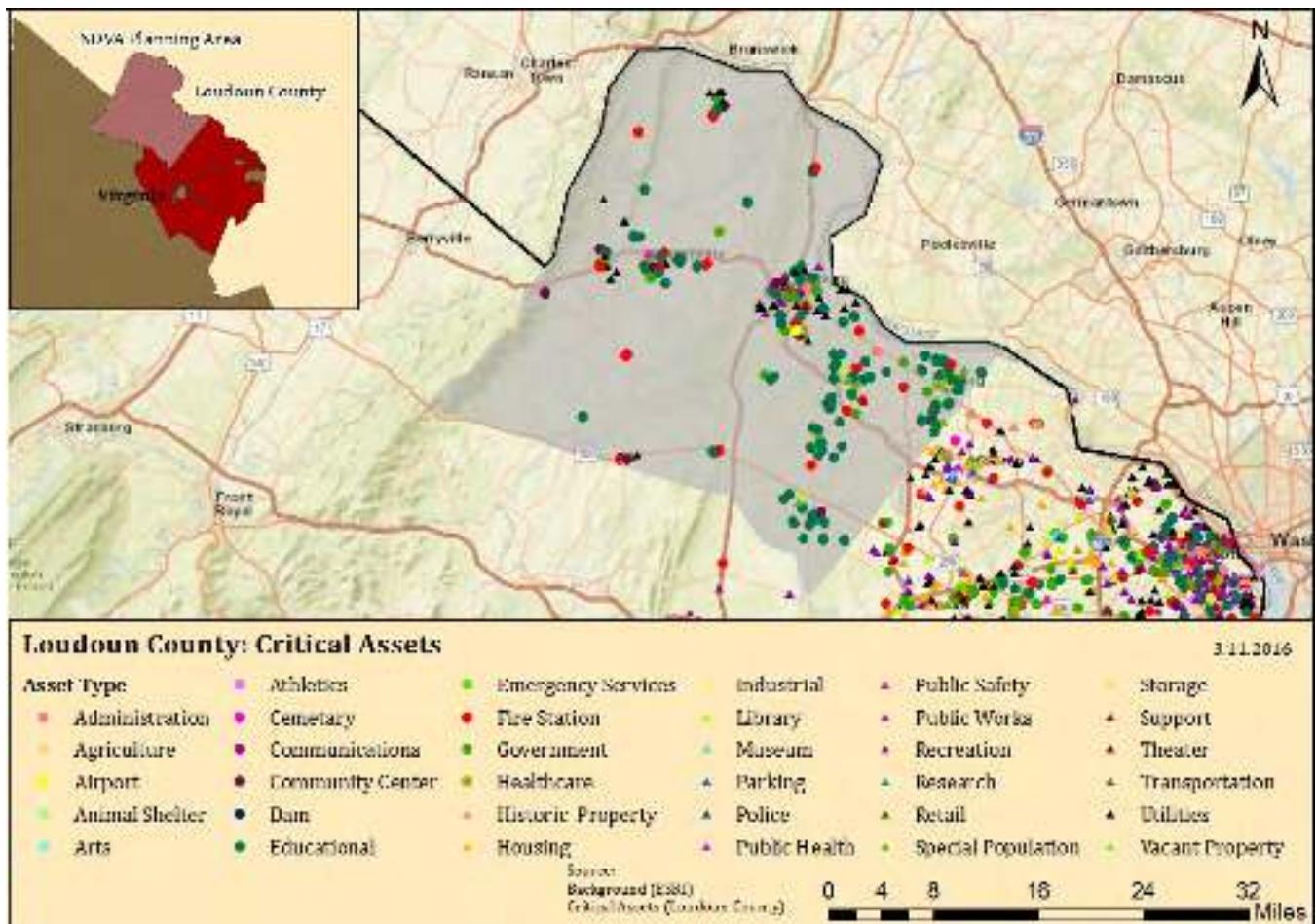


Figure 4.3. Loudoun County local critical assets and historic structures.

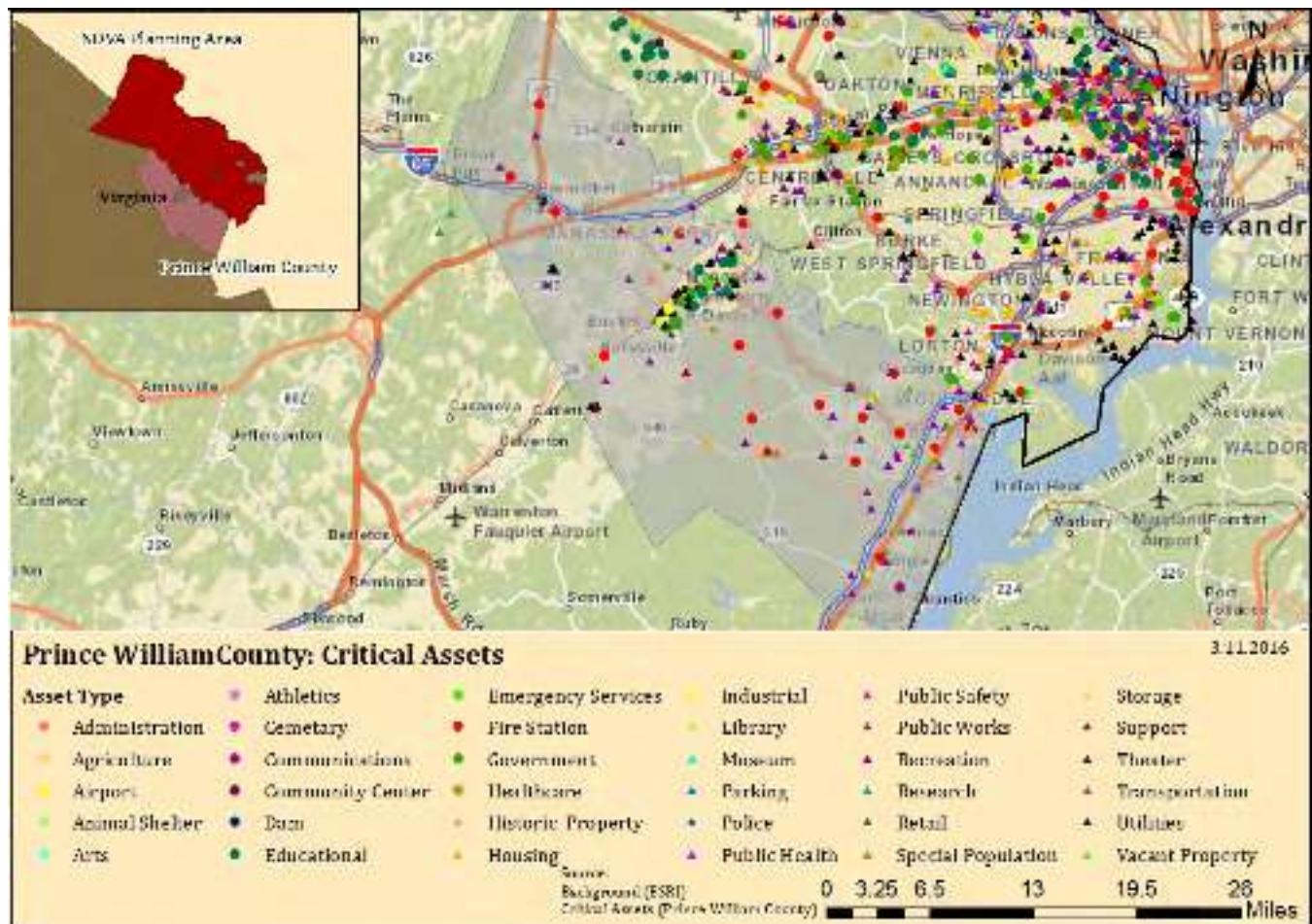


Figure 4.4. Prince William County local critical assets and historic structures.

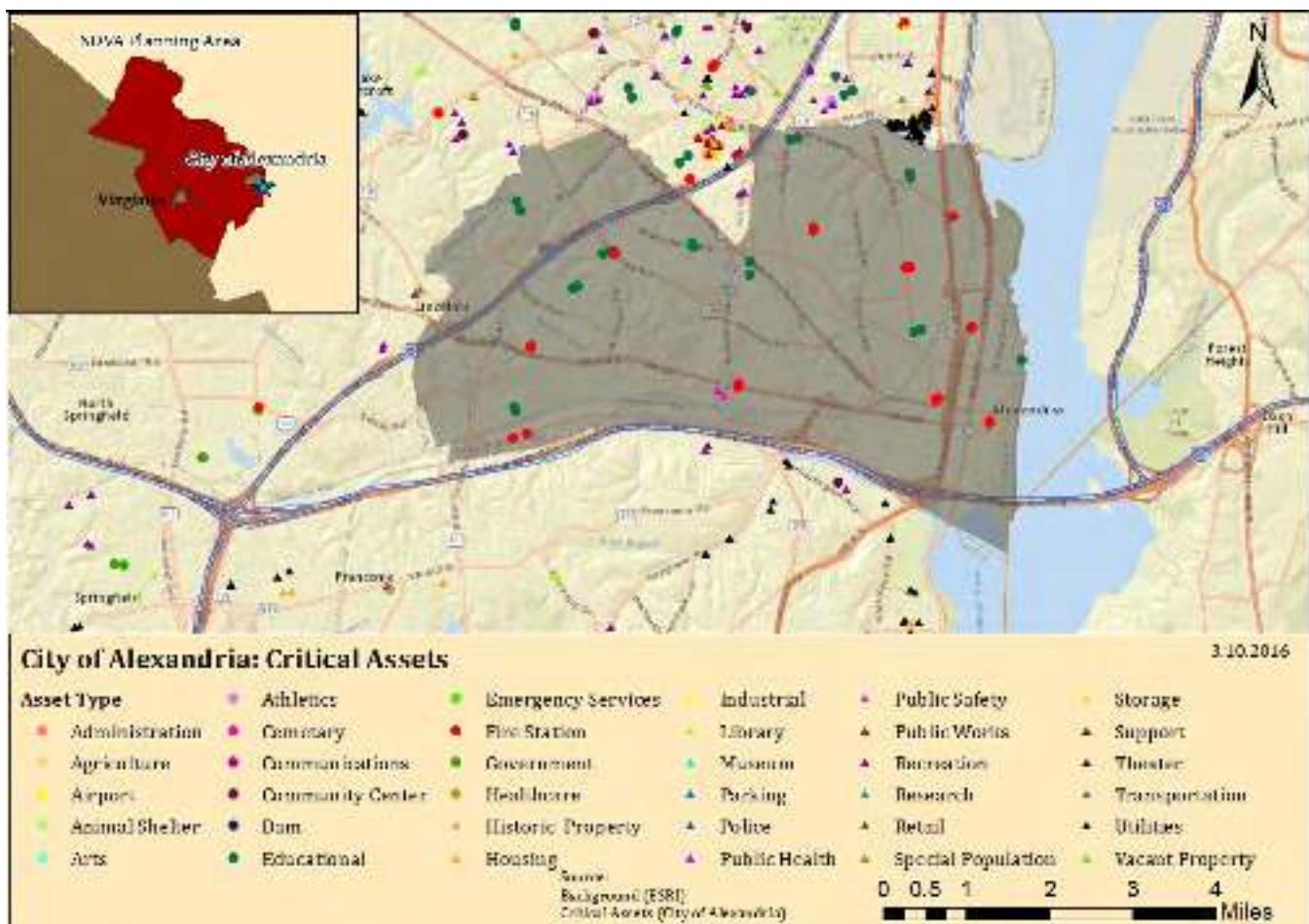


Figure 4.5. City of Alexandria local critical assets and historic structures.

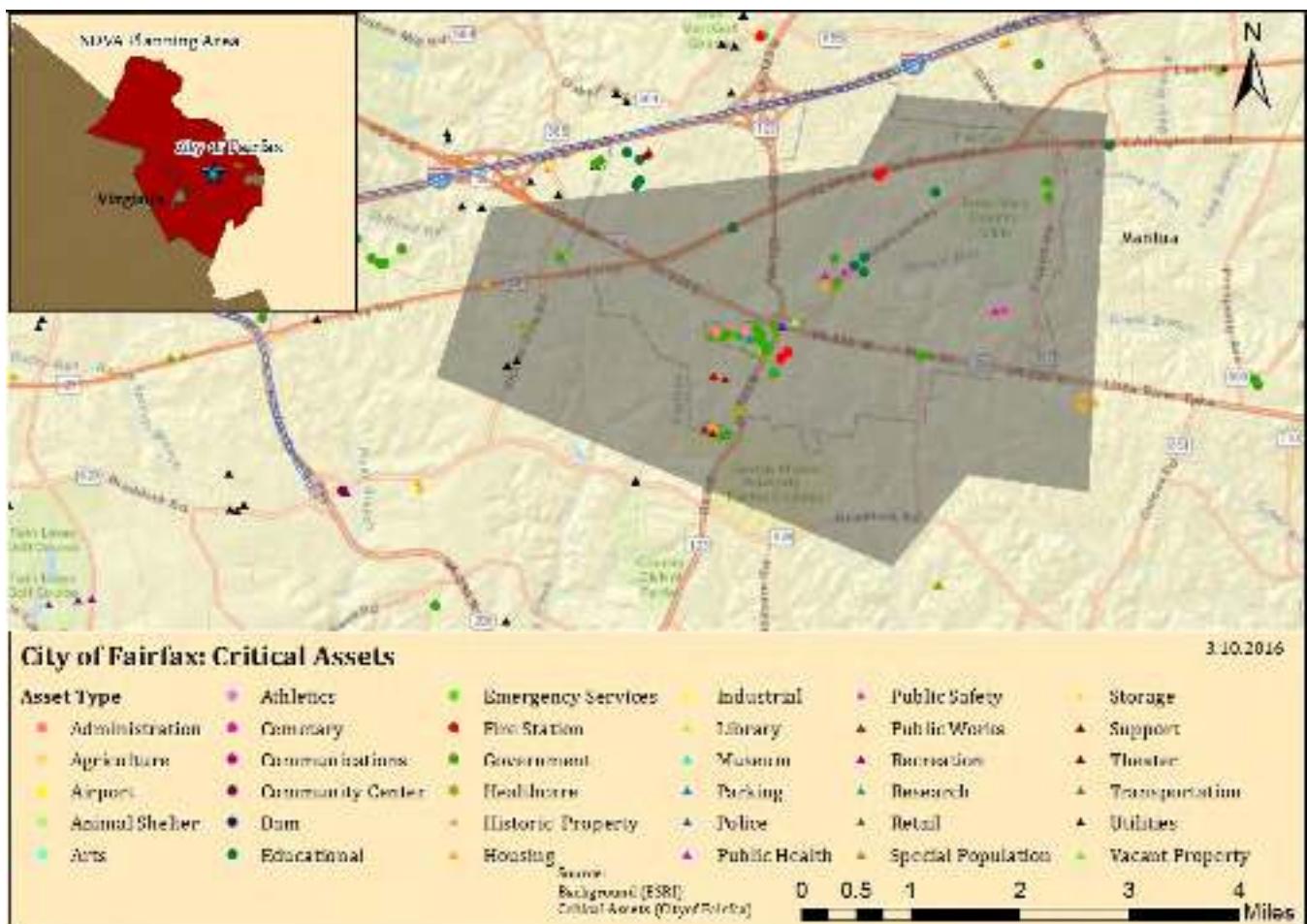


Figure 4.6. City of Fairfax local critical assets and historic structures.

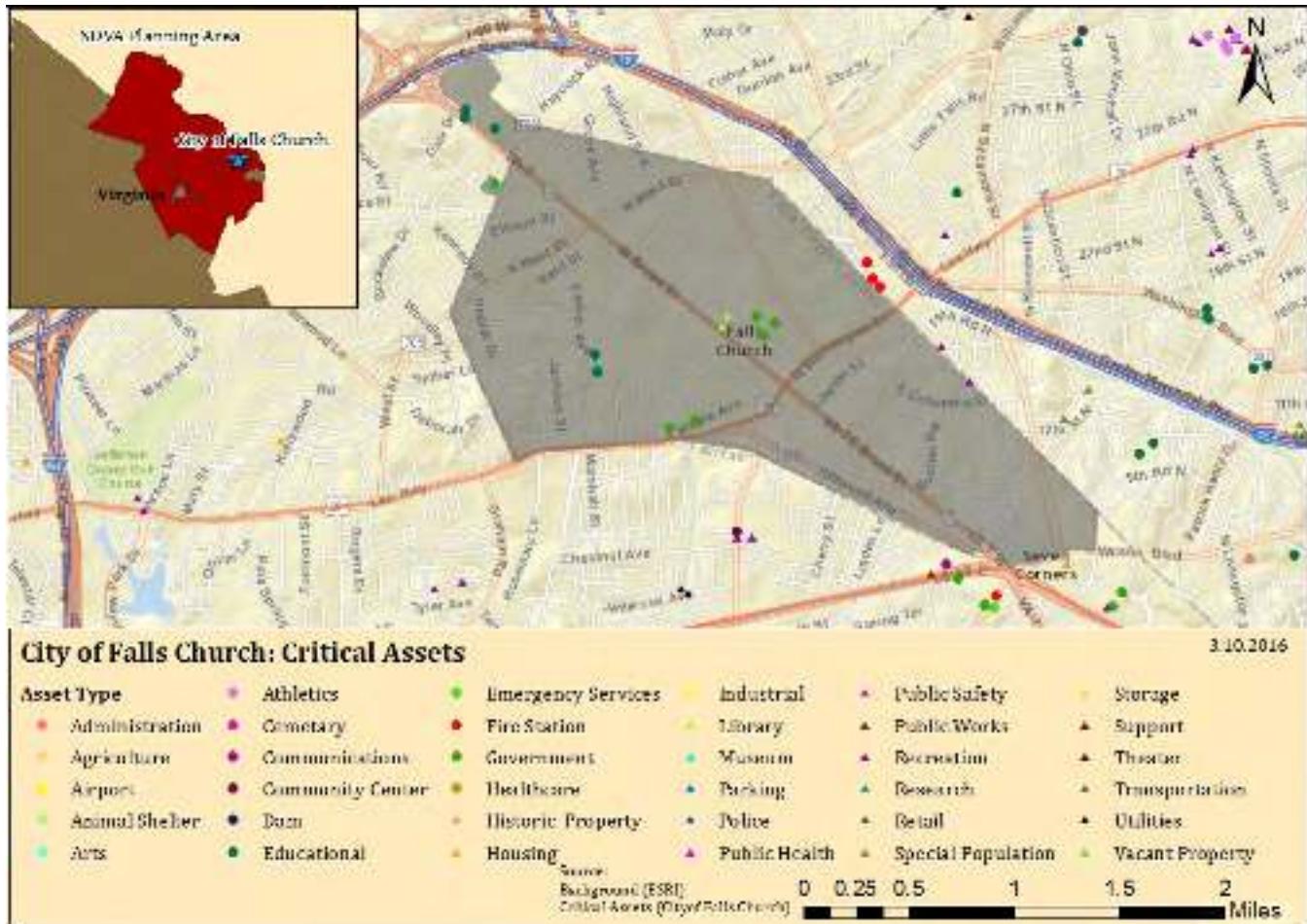


Figure 4.7. City of Falls Church local critical assets and historic structures.

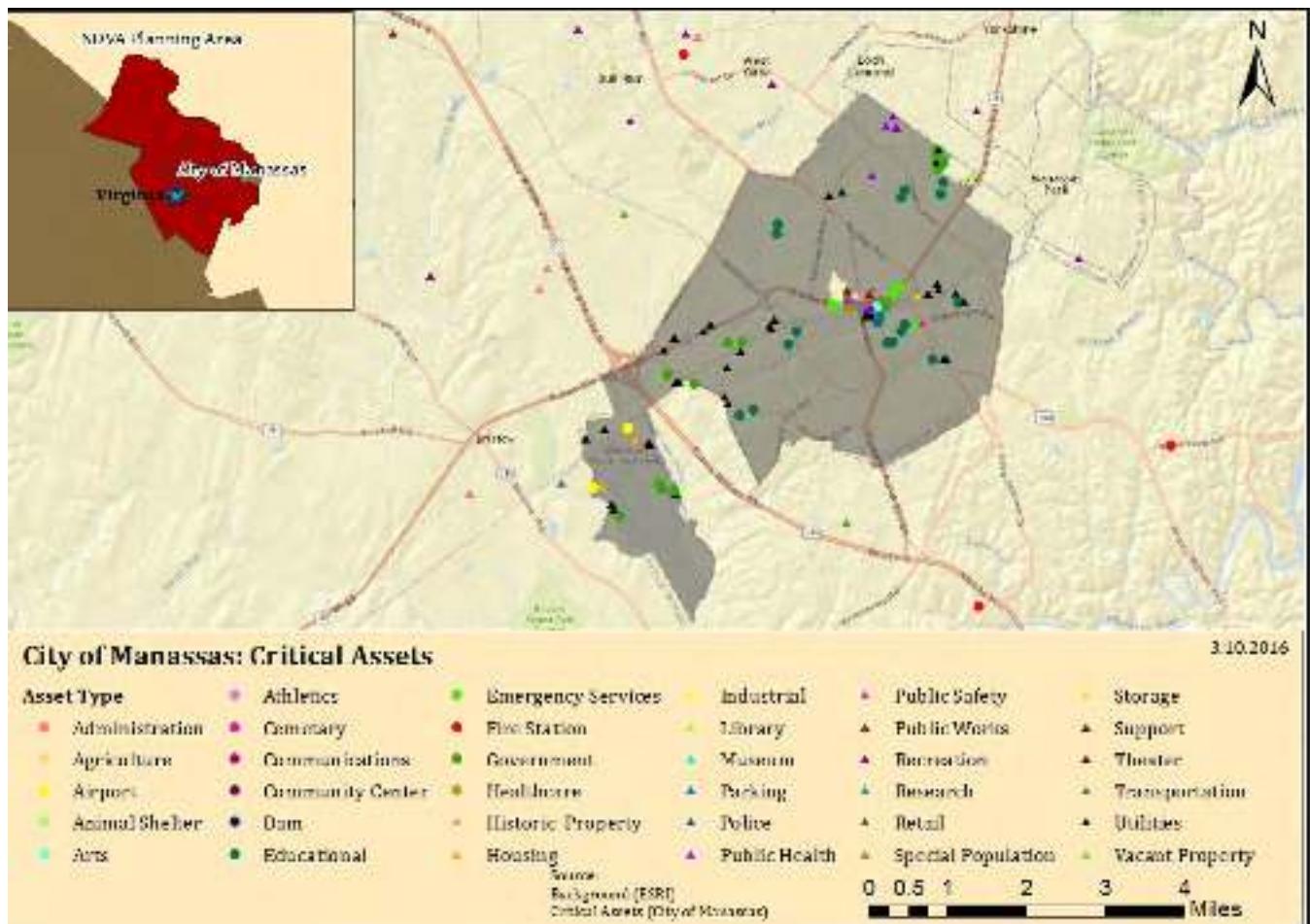


Figure 4.8. City of Manassas local critical assets and historic structures.

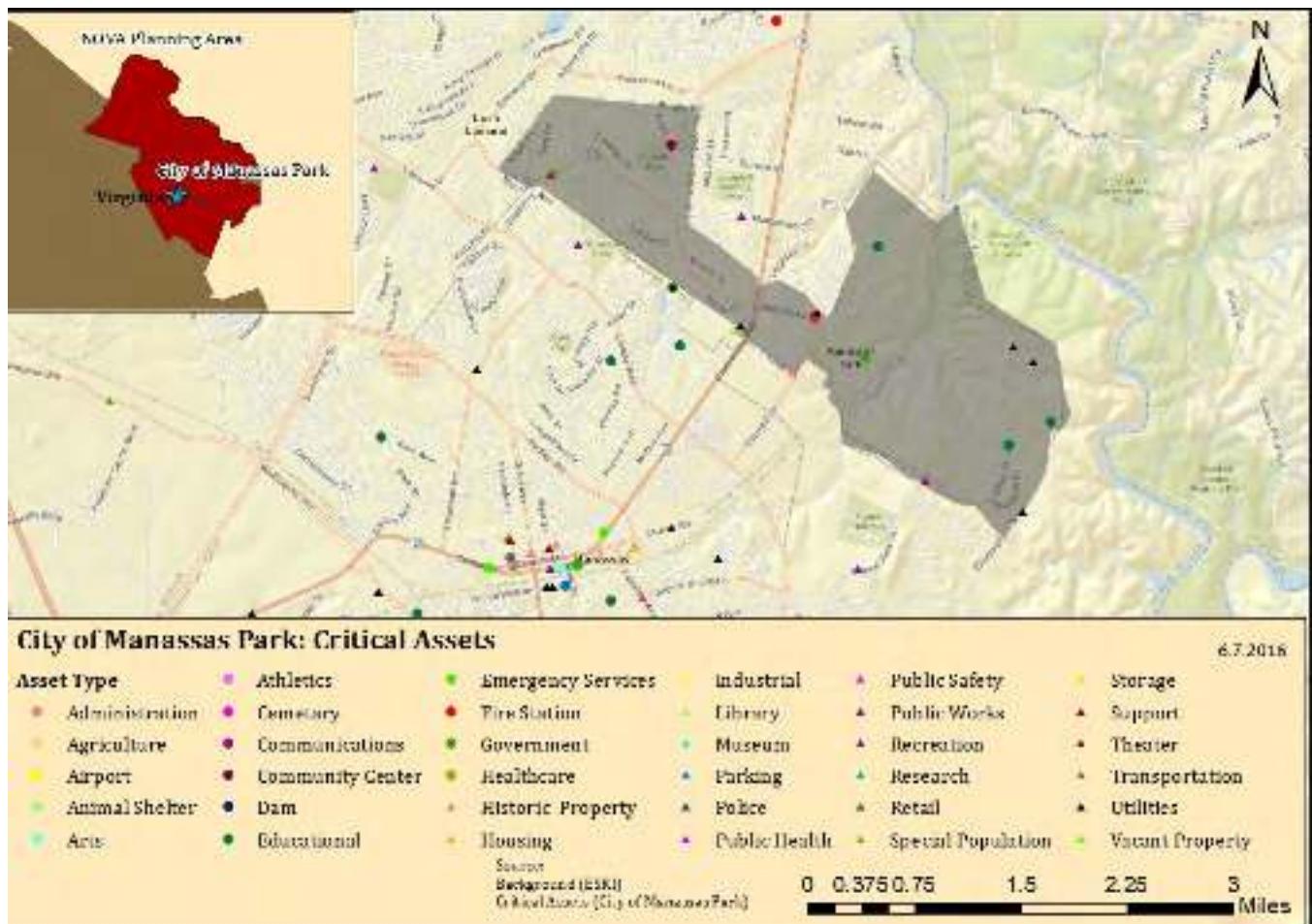


Figure 4.9. City of Manassas Park local critical assets and historic structures.

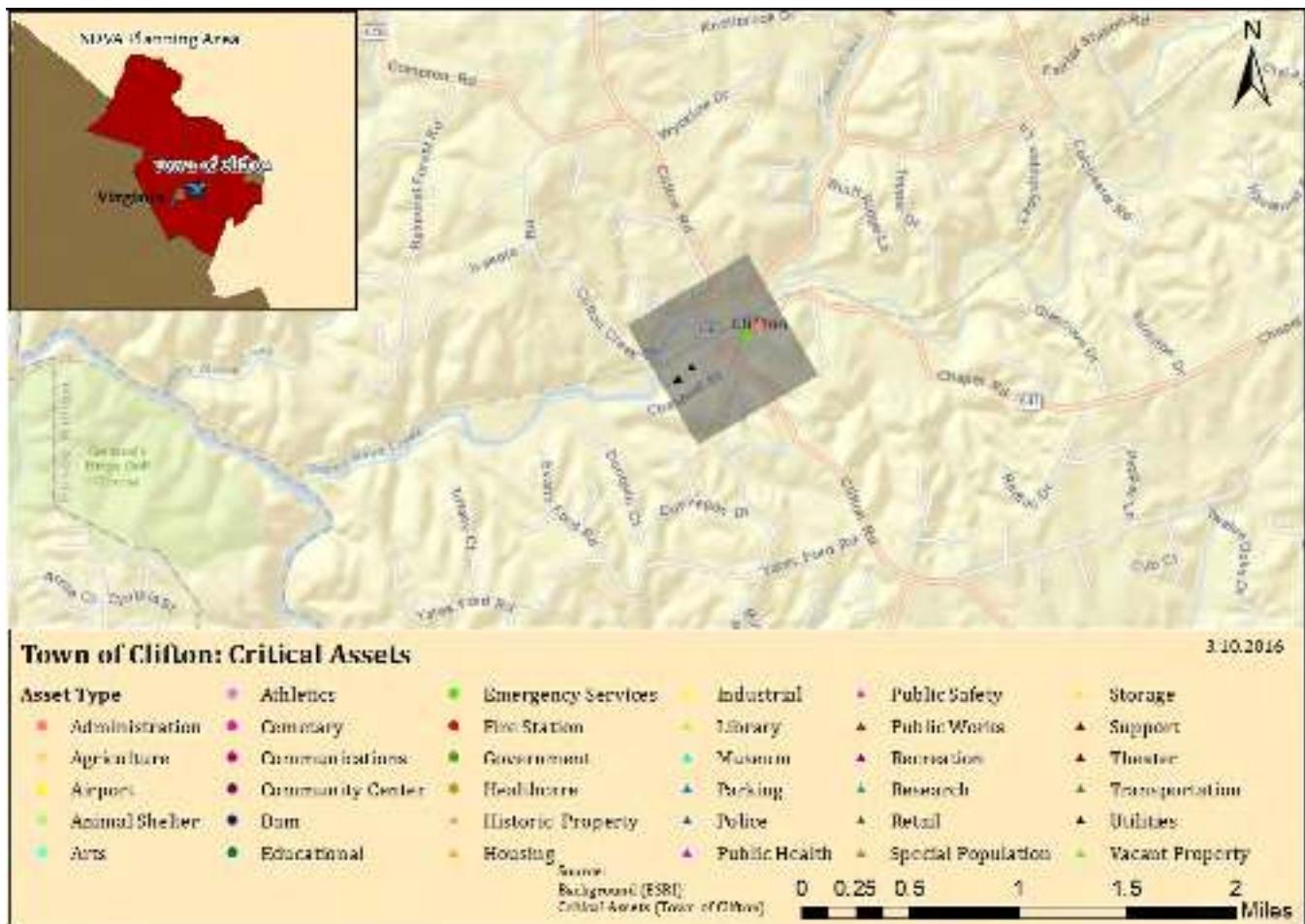


Figure 4.10. Town of Clifton local critical assets and historic structures.

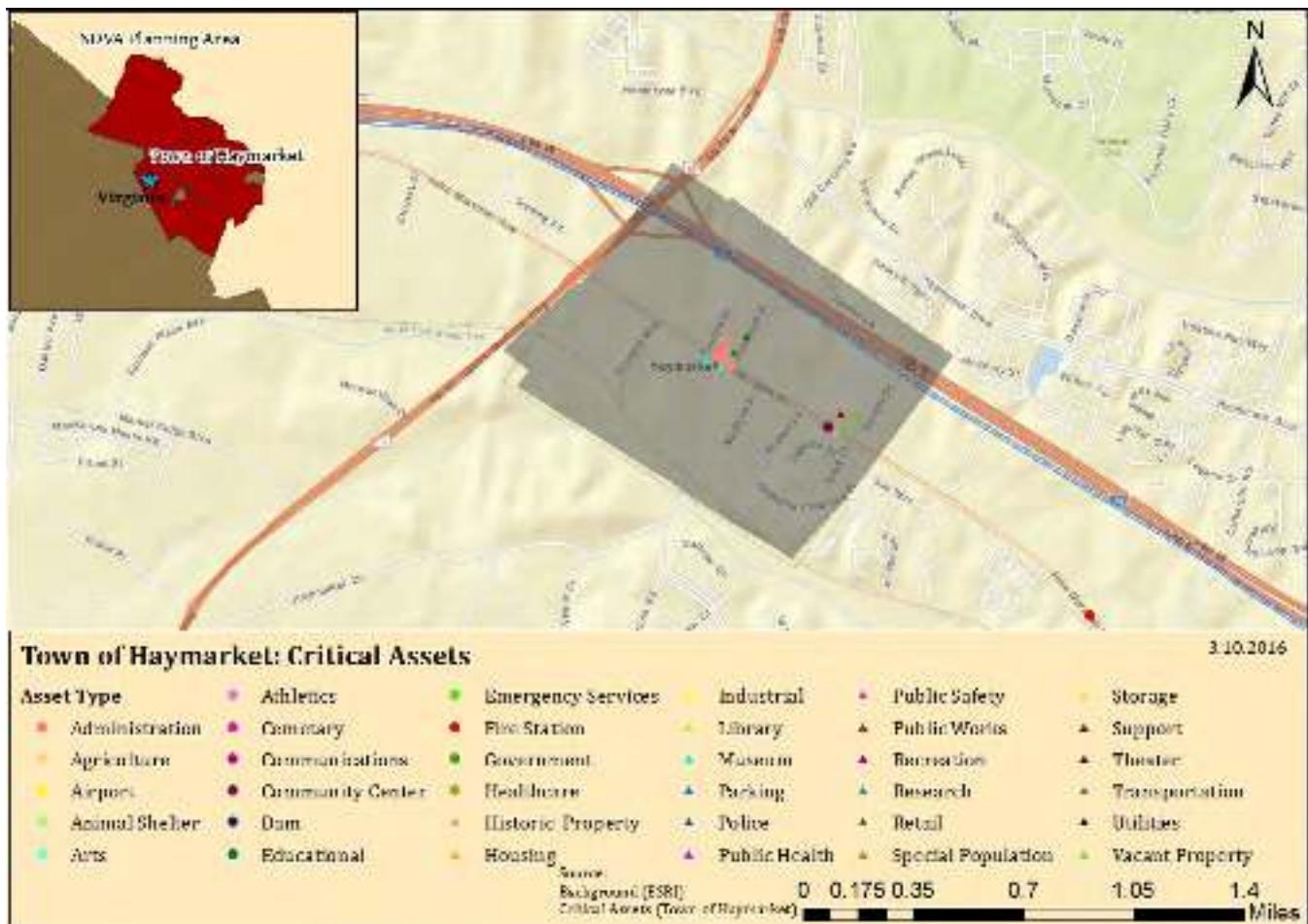


Figure 4.11. Town of Haymarket local critical assets and historic structures.

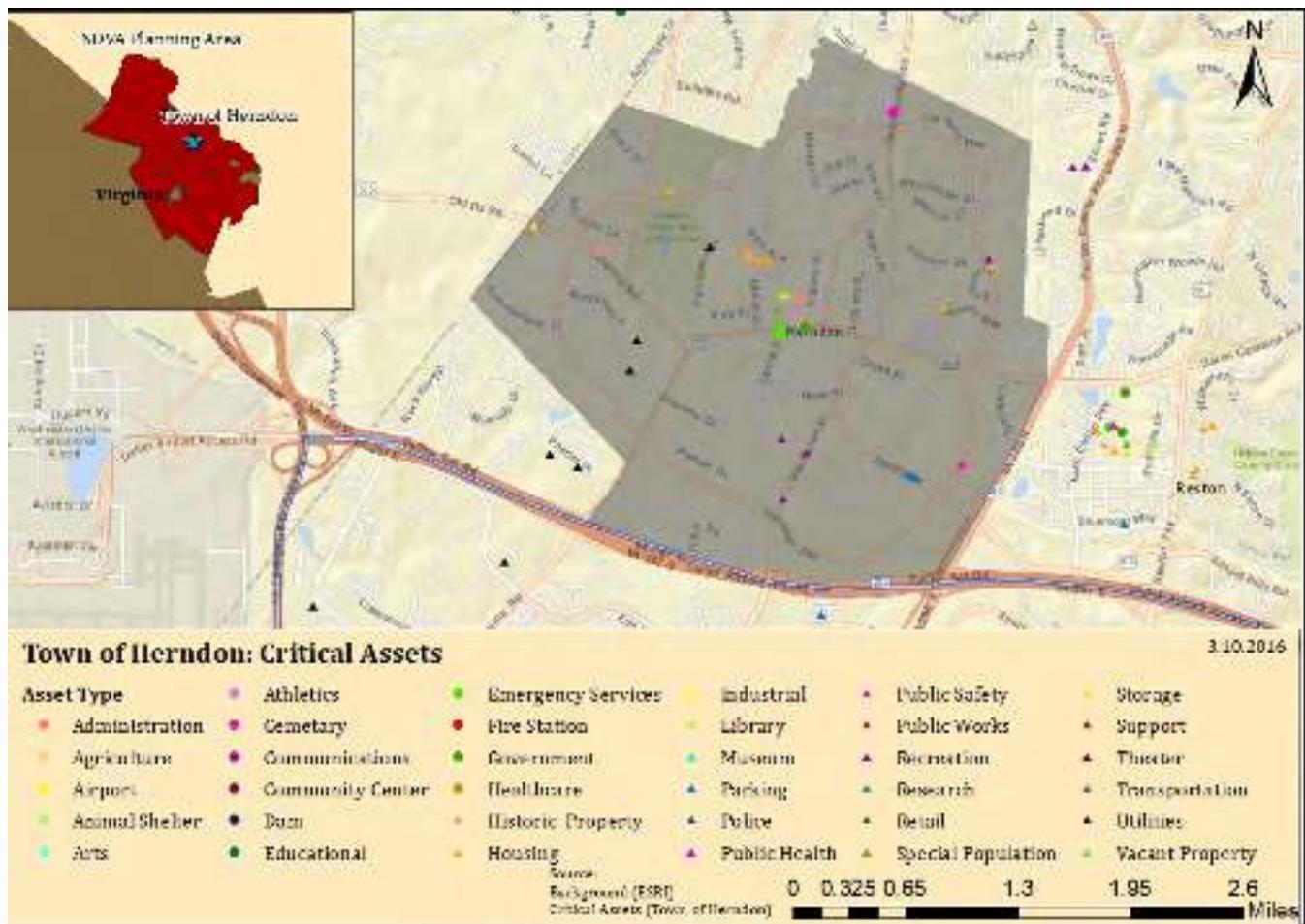


Figure 4.12. Town of Herndon local critical assets and historic structures.

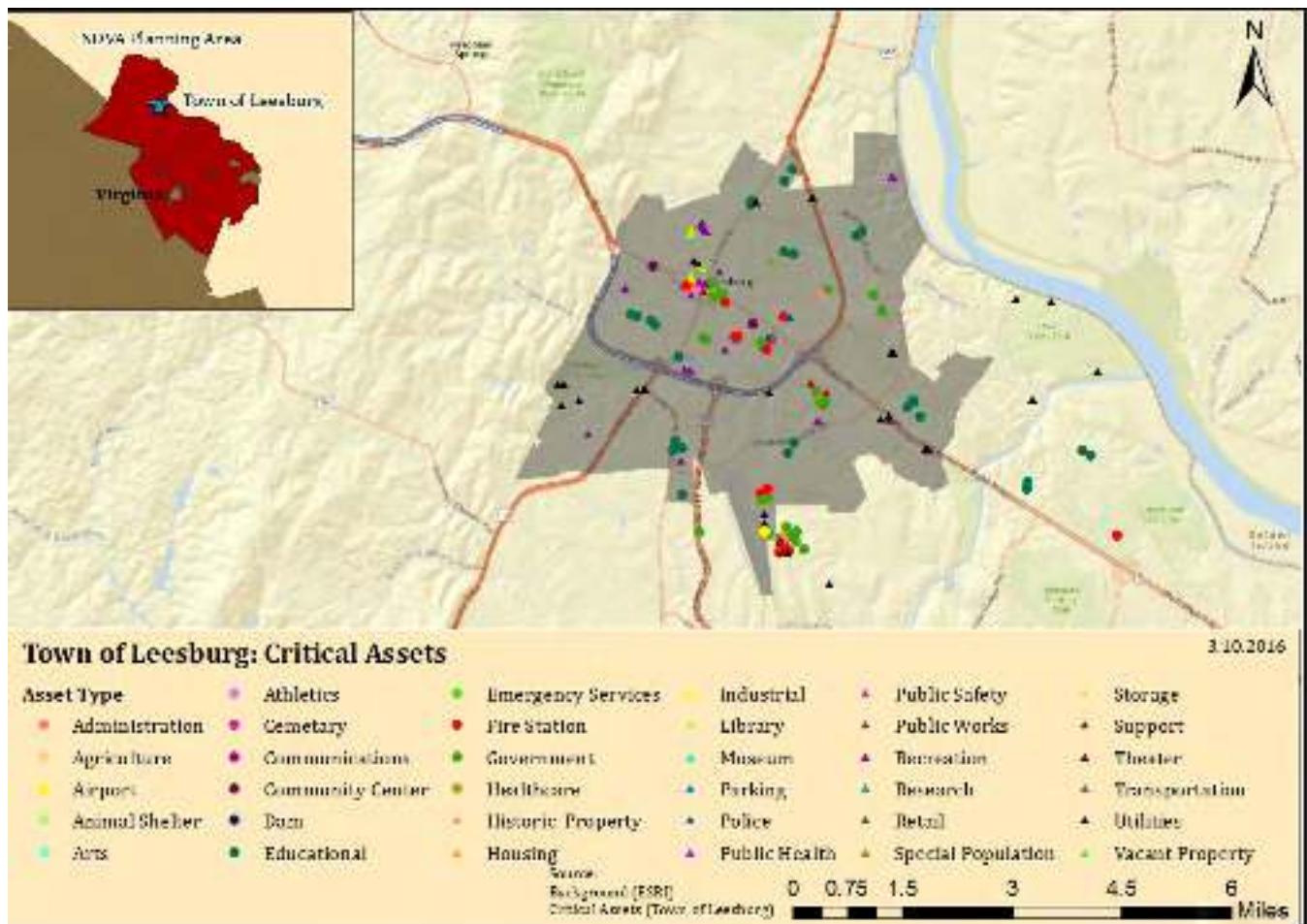


Figure 4.13. Town of Leesburg local critical assets and historic structures.

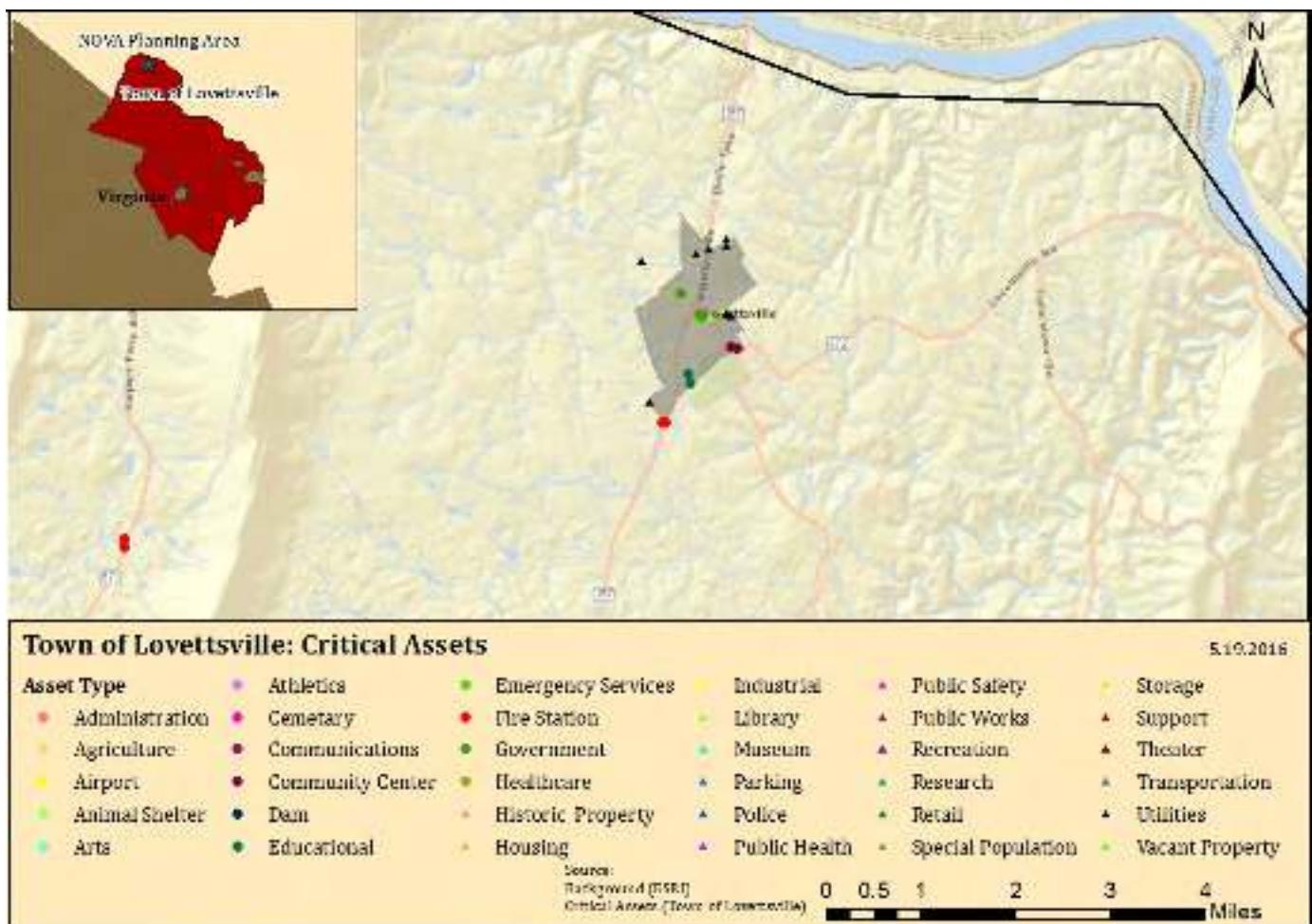


Figure 4.14. Town of Lovettsville local critical assets and historic structures.

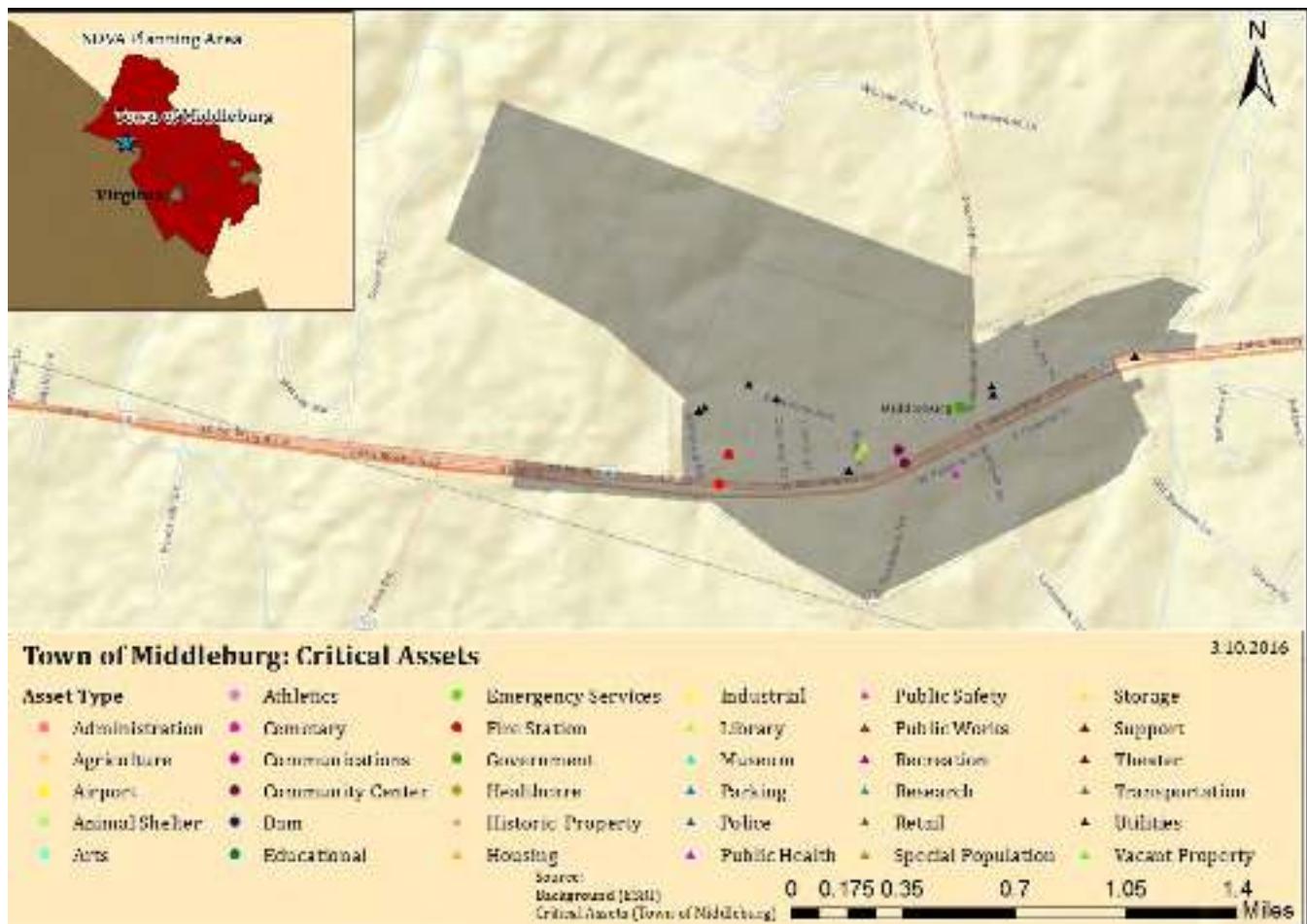


Figure 4.15. Town of Middleburg local critical assets and historic structures.

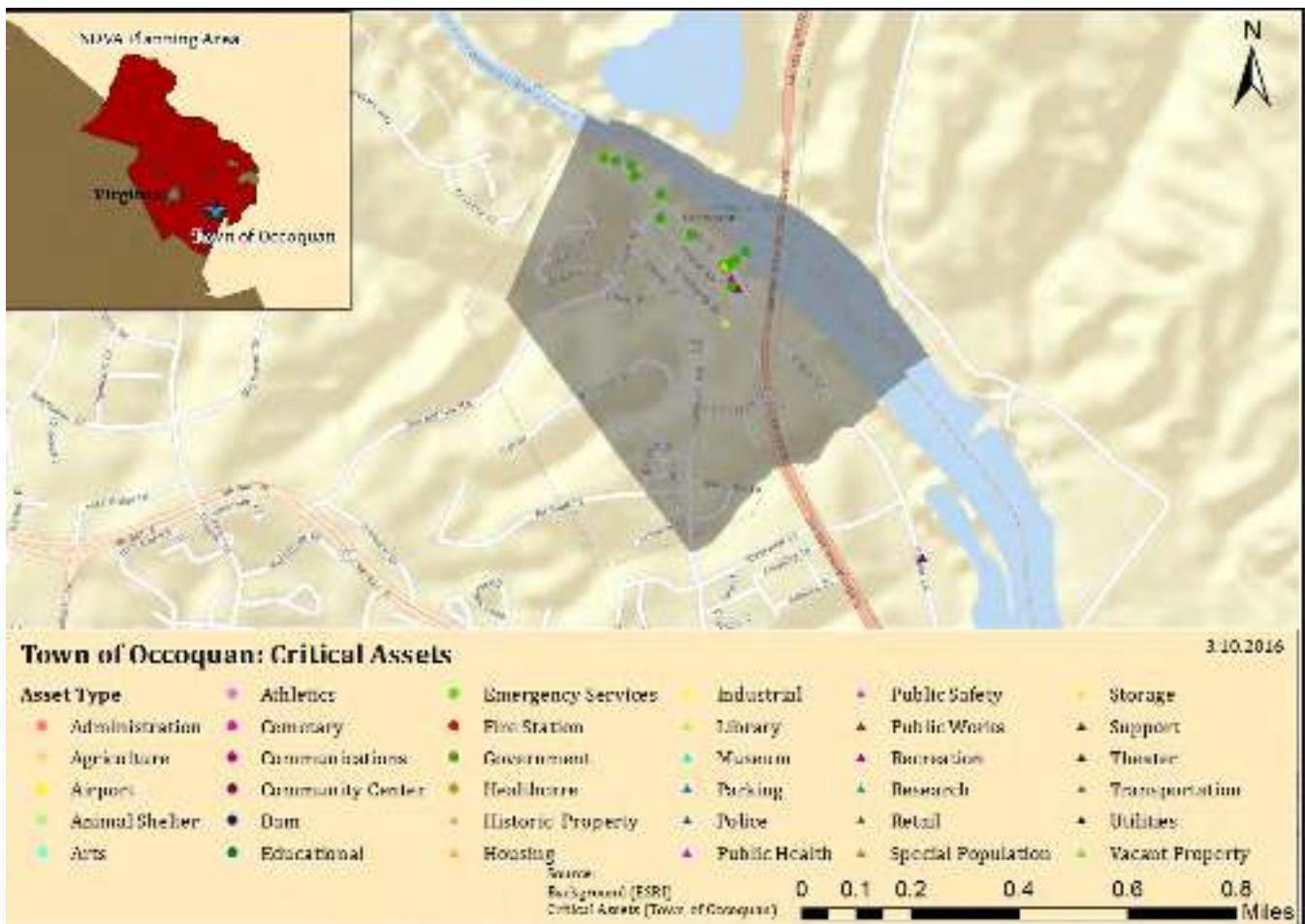


Figure 4.16. Town of Occoquan local critical assets and historic structures.

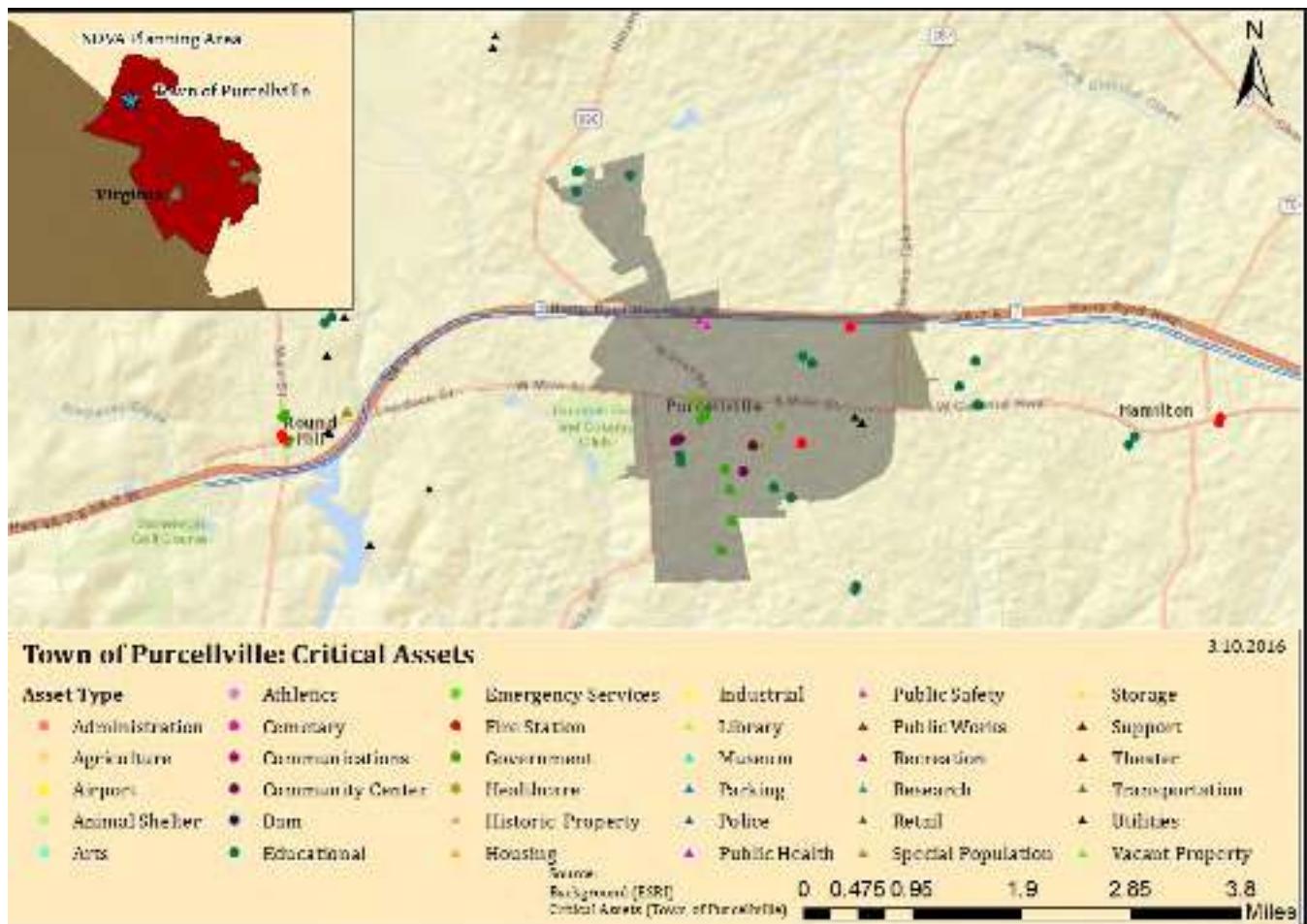


Figure 4.17. Town of Purcellville local critical assets and historic structures.

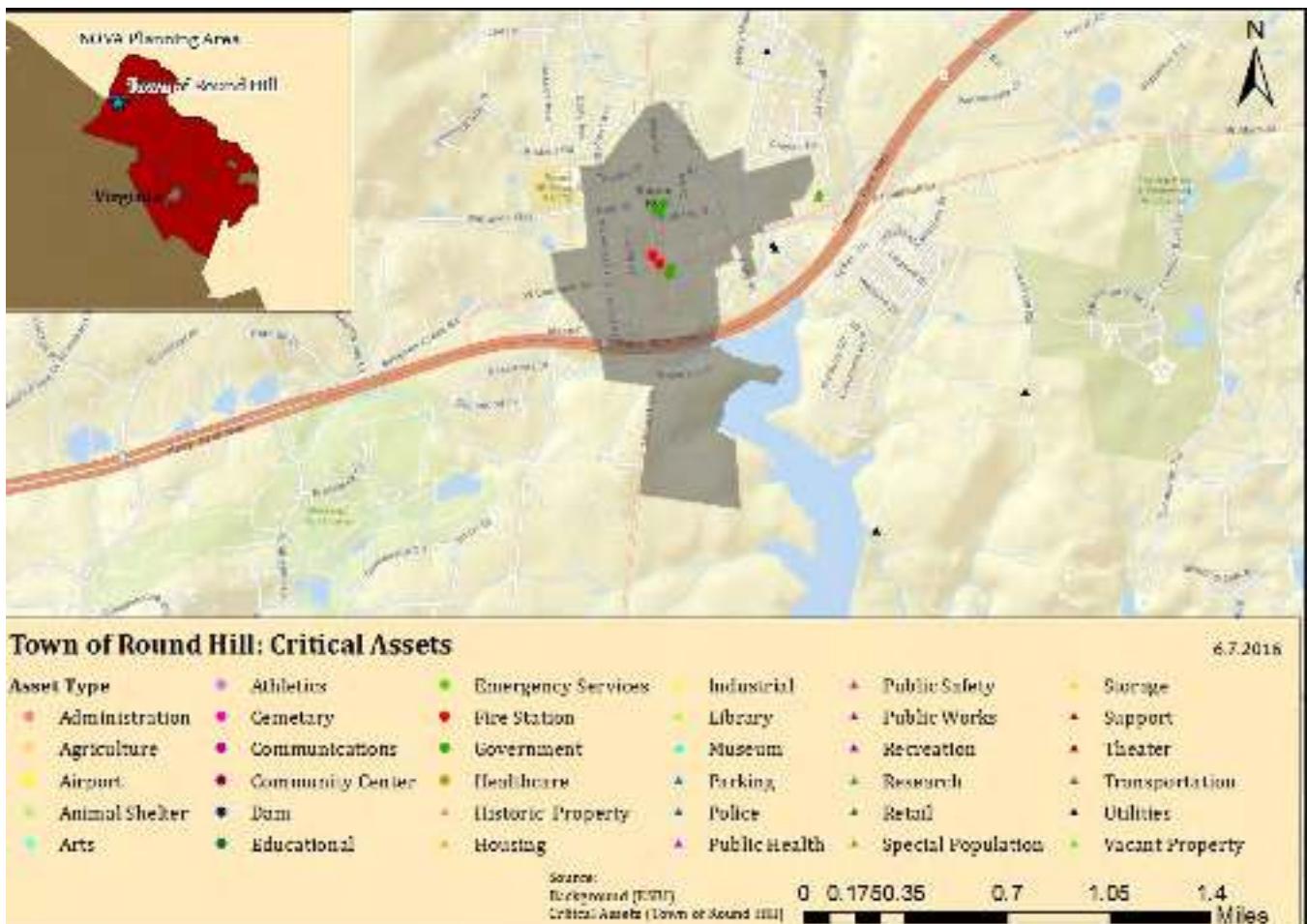


Figure 4.18. Town of Round Hill local critical assets and historic structures.

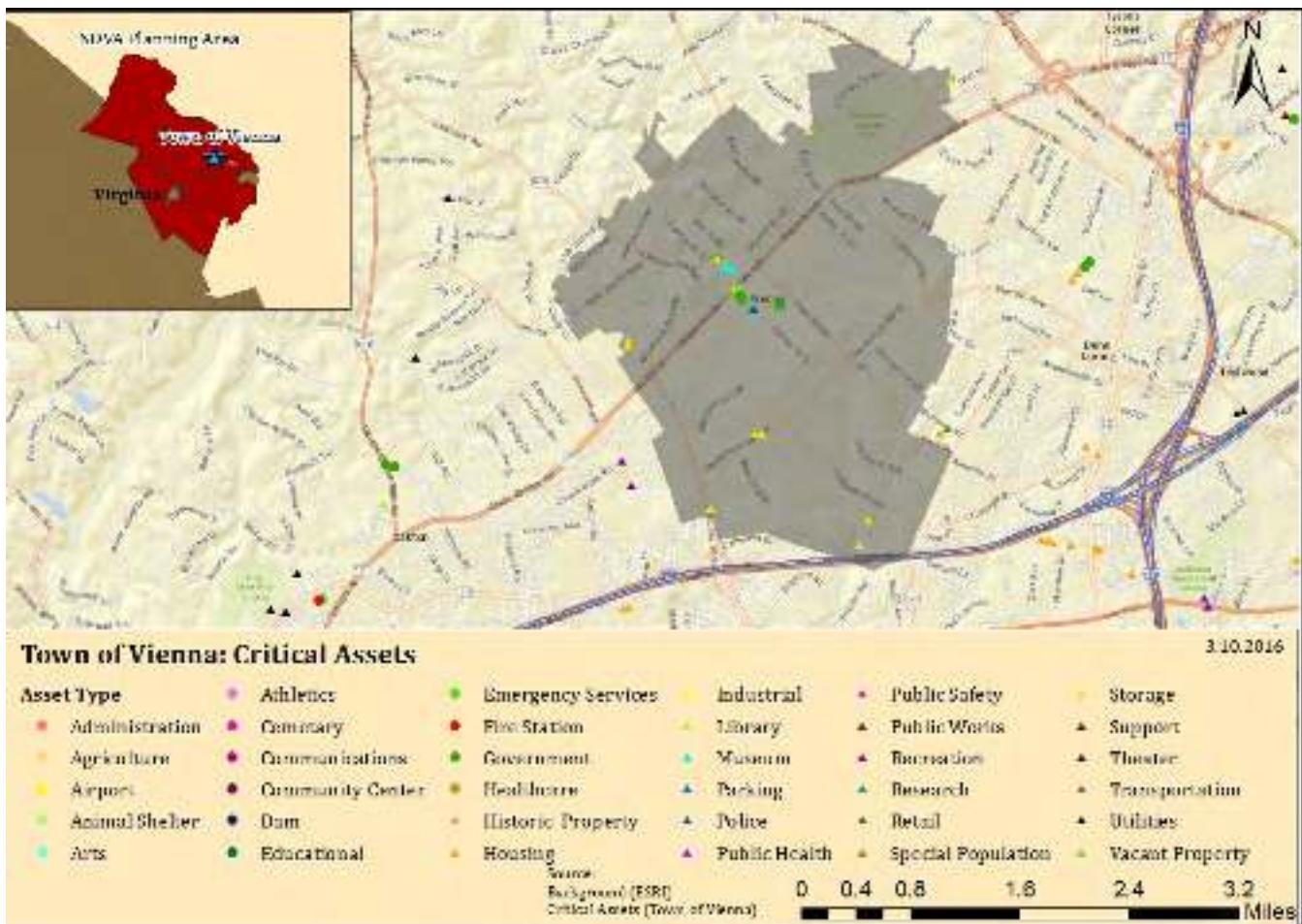


Figure 4.19. Town of Vienna local critical assets and historic structures.

No local critical assets were identified for the towns of Dumfries or Quantico; therefore, no maps were created for these jurisdictions, and no locally-identified assets were included in any risk assessment for these jurisdictions.

HAZUS^{MH} Version 3.1

HAZUS^{MH} facilities data was used to supplement the hazard-specific analysis. The HAZUS^{MH} inventory serves as the default when a user does not have better data available. This data provides a uniform look at building stock in the region. There are approximately 663,685 buildings in the region as estimated by HAZUS, categorized as residential, commercial, industrial, agricultural, religious, government, and education.

HAZUS^{MH} essential facilities are facilities vital to emergency response and recovery following a disaster, including medical care facilities, emergency response facilities, and schools. School buildings are included in this category because of the key role they often play in housing people displaced from damaged homes. With the Northern Virginia planning area, HAZUS^{MH} estimates there are approximately 762 essential facilities.

Note: For estimation purposes, building stock and essential facilities data from HAZUS^{MH} was obtained through the hurricane module. Runs for this module were completed at a smaller



regional level. HAZUS^{MH} outputs do not easily differentiate counties from independent cities, and so will often combine independent cities into county data, and cannot always distinguish the boundaries of towns and villages from counties. In most cases, aggregate building stock and essential facilities counts are provided at a ‘county’ level, and incorporate municipal and other entity building counts.

Fairfax County and the City of Fairfax have the largest number of essential facilities, 401, with almost 85% of those facilities labeled as schools. Table 4.2 below shows the number of facilities in each of the HAZUS^{MH} essential facility classes. With many national datasets, accuracy and completeness leave much to be desired.

Table 4.2 HAZUS-MH Essential Facilities for Northern Virginia planning area.

Jurisdiction	EOC	Fire Station	Hospitals	Police Stations	Schools	Total
Arlington County, The City of Alexandria, and The City of Falls Church	-	4	4	4	79	91
Fairfax County and The City of Fairfax	-	42	8	15	336	401
<i>Town of Herndon</i>						
<i>Town of Vienna</i>						
<i>Town of Clifton</i>						
Loudoun County	1	11	3	7	83	105
<i>Town of Leesburg</i>						
<i>Town of Lovettsville</i>						
<i>Town of Purcellville</i>						
<i>Town of Middleburg</i>						
<i>Town of Round Hill</i>						
Prince William County, The City of Manassas, and The City of Manassas Park	-	11	2	14	138	165
<i>Town of Dumfries</i>						
<i>Town of Haymarket</i>						
<i>Town of Occoquan</i>						
<i>Town of Quantico</i>						
Total	1	68	17	40	636	762

The HAZUS^{MH} stock inventory for the jurisdiction often differs from reality. The table above reflects only those structures contained within the HAZUS dataset, and may not accurately reflect actual assets for each jurisdiction.



Data

The HAZUS^{MH} building stock for Northern Virginia contains 663,685 structures with an estimated exposure value of approximately \$384 million (2015 dollars). HAZUS^{MH} estimates 84% of the region's general occupancy is categorized as residential, which represents 83.62% of the building value for the region. Fairfax County and the City of Fairfax represent approximately 50% of the region's total building value summarized in Table 4.3.

Table 4.3 Total Building Value per HAZUS^{MH} area (2015 dollars).				
Jurisdiction	Residential	Non-Residential	Total	% Total
Arlington County, the City of Alexandria, and the City of Falls Church	\$54,402,048,000	\$14,354,494,000	\$68,756,542,000	17.89%
Fairfax County and the City of Fairfax	\$161,437,502,000	\$32,603,535,000	\$194,041,037,000	50.49%
Loudoun County	\$46,169,251,000	\$7,131,665,000	\$53,300,916,000	13.87%
Prince William County	\$59,393,279,000	\$8,845,863,000	\$68,239,142,000	17.75%
Total	\$321,402,080,000	\$62,935,557,000	\$384,337,637,000	100%

Table 4.4 shows the estimated total exposure values by jurisdiction. Residential housing represents 84% of the building value in the region, followed by commercial properties representing 11.5%. The remaining occupancy types account for the remaining 4.5% of the region.

Table 4.4. Building stock exposure for general occupancy type by jurisdiction (2015 dollars).								
Jurisdiction	Residential	Commercial	Industrial	Agriculture	Religious	Government	Education	Total
Arlington County, the City of Alexandria, & the City of Falls Church	\$54,402,048,000	\$10,027,368,000	\$786,596,000	\$57,929,000	\$1,408,243,000	\$565,297,000	\$1,509,061,000	\$68,756,542,000
Fairfax County, the City of Fairfax, the Town of Clifton, the Town of Herndon, & the Town of Vienna	\$161,437,502,000	\$25,013,495,000	\$2,930,598,000	\$302,667,000	\$2,189,134,000	\$653,199,000	\$1,514,442,000	\$194,041,037,000

**Table 4.4. Building stock exposure for general occupancy type by jurisdiction (2015 dollars).**

Jurisdiction	Residential	Commercial	Industrial	Agriculture	Religious	Government	Education	Total
Loudoun County, the Town of Leesburg, the Town of Lovettsville, the Town of Middleburg, & the Town of Round Hill	\$49,169,251,000	\$5,027,525,000	\$1,021,465,000	\$172,981,000	\$440,995,000	\$151,487,000	\$317,212,000	\$53,300,916,000
Prince William County, the City of Manassas, the City of Manassas Park, the Town of Dumfries, the Town of Haymarket, the Town of Occoquan, & the Town of Quantico	\$59,393,279,000	\$6,248,644,000	\$1,223,616,000	\$209,192,000	\$540,415,000	\$182,663,000	\$441,333,000	\$68,239,142,000
Total	\$321,402,080,000	\$46,317,032,000	\$5,962,275,000	\$742,769,000	\$4,578,787,000	\$1,552,646,000	\$3,72,048,000	\$384,337,637,000

Building stock exposure is also classified by building type. General Building Types have been developed as a means to classify different building construction types. This provides an ability to differentiate between buildings with substantially different damage and loss characteristics. Model building types represent the average characteristics of buildings in a class. The damage and loss prediction models are developed for model building types and the estimated performance is based upon the "average characteristics" of the total population of buildings within each class. Five general classifications have been established, including wood, masonry, concrete, steel, and manufactured homes (MH). A brief description of the building types is available in Table 4.5.

Table 4.5. HAZUS-MH General Building Type Classes.

General Building Type	Description
Wood	Wood frame construction
Masonry	Reinforced or unreinforced masonry construction
Steel	Steel frame construction
Concrete	Cast-in-place or pre-cast reinforced concrete construction
MH	Factory-built residential construction

Wood construction represents the majority (60%) of building types in the region, followed by masonry, which represents 27% of building stock exposure. The remaining percentage is distributed among other building types. Table 4.6 below provides building stock exposure for



the five main building types. The differences in the building stock tables are a result of aggregation by HAZUS^{MH} and rounding. HAZUS^{MH} only provides building stock for the counties and cities in Northern Virginia. Towns participating in this plan are represented in their respective county totals.

Table 4.6: Building stock exposure for general building type by jurisdiction (2015 dollars).

Jurisdiction	Wood	Masonry	Concrete	Steel	MH	Total
City of Alexandria	\$15,742,702,000	\$7,883,135,000	\$1,177,964,000	\$2,953,902,000	\$10,899,000	\$27,768,602,000
Arlington County	\$22,903,960,000	\$10,739,683,000	\$1,393,360,000	\$3,269,160,000	\$20,238,000	\$38,326,401,000
Fairfax County and The City of Fairfax	\$123,744,041,000	\$51,405,986,000	\$4,412,824,000	\$14,332,720,000	\$145,461,000	\$194,041,032,000
City of Falls Church	\$1,561,833,000	\$724,271,000	\$78,296,000	\$297,211,000	\$0	\$2,661,611,000
Loudoun County	\$25,465,190,000	\$13,776,791,000	\$866,772,000	\$3,170,583,000	\$21,457,000	\$53,500,916,000
City of Manassas	\$3,363,297,000	\$1,516,280,000	\$189,293,000	\$705,525,000	\$11,970,000	\$5,786,365,000
City of Manassas Park	\$1,182,103,000	\$475,657,000	\$34,789,000	\$145,600,000	\$428,000	\$1,838,586,000
Prince William County	\$40,804,413,000	\$15,628,024,000	\$916,267,000	\$3,200,275,000	\$65,208,000	\$60,614,187,000
Total	\$244,767,539,000	\$102,149,827,000	\$9,069,574,000	\$28,074,976,000	\$275,662,000	\$384,337,577,000

III. Hazard Identification

While there are many different natural hazards that could potentially affect the Northern Virginia planning area, some hazards are more likely to cause significant impacts and damages than others. This analysis will quantify these potential impacts and identify the hazards that pose the greatest possible risk.

The potential hazards that could affect the Northern Virginia planning area include: flooding, winter storms, high winds, tornadoes, droughts, earthquakes, landslides, wildfires, landslides, dam failures, and extreme temperatures. Some of these hazards are interrelated (i.e., hurricanes can cause flooding and tornadoes), and some consist of hazardous elements that are not listed separately (i.e., severe thunderstorms can cause lightning; hurricanes can cause coastal erosion). Some hazards, such as severe winter storms, may impact a large area yet cause little damage; other hazards, such as a tornado, may impact a small area yet cause extensive damage. Several of these hazards have been included together (i.e. high winds/thunderstorms/hurricane winds). The hazard description in each hazard section provides a general description for each of the hazards listed above, along with their hazardous elements.



Depending on the severity, location, and timing of the specific events, each of these hazards could have devastating effects on houses, businesses, agricultural lands, infrastructure, and ultimately residents of the planning area. In order to gain a full understanding of the history of these hazards in the planning area, detailed data related to the hazard history was compiled and available in each of the hazard sections. Appendix D contains the National Climactic Data Center (NCDC) storm events database used in the 2016 analysis.

Information was collected from meetings with local community officials, existing reports and studies, state and national data sets, and local newspaper clippings, among others sources; the assessment is largely based on the NCDC databased whenever possible and practical.

The historical data collected includes accounts of all the hazard types listed above. However, some have occurred much more frequently than others with a wide range of impacts. By analyzing the historical frequency of each hazard, along with the associated impacts, the hazards that pose the most significant risks to the Northern Virginia planning area can be identified. This analysis will allow the jurisdictions included in this study to focus their hazard mitigation plans on those hazards that are most likely to cause significant impacts to their community.

To a large extent, historical records are used to identify the level of risk within the Northern Virginia region with the assumption that the data sources cited are reliable and accurate. Unless otherwise cited, all data on historical weather-related events is based on information made available through the Storm Event Database by the NWS NCDC¹. From a regional planning perspective, it is important to use a consistent source for hazard-related data such as the NCDC. That being said, descriptions of historical hazard events and numerical damage data are based on the collection of information reported by local offices of the NWS and other local users, such as emergency management officials, and should only be considered approximate figures for general analysis and planning purposes.

To complete the risk assessment, best available data was collected from a variety of sources, including local, state and federal agencies, and multiple analyses were performed qualitatively and quantitatively (further described below). Additional work will be done on an ongoing basis to enhance, expand, and further improve the accuracy of the baseline established here, and it is expected that this assessment will continue to be refined through future plan updates as new data and loss estimation methods or tools become available to the participating jurisdictions.

The findings presented in the hazard risk assessments and in the overall results were developed using best available data, and the methodologies applied have resulted in an approximation of risk. These estimates should be used to understand relative risk from hazards and the potential losses that may be incurred. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning specific hazards and their effects on the built environment, as well as incomplete data sets and approximations and simplifications that are necessary in order to provide a meaningful analysis. Further, most data sets used in this assessment contain relatively short periods of records which increases the uncertainty of any statistically-based analysis.



Federally Declared Disasters

Presidential Disaster Declarations are issued for county (including towns) or independent city jurisdictions when an event has been determined to be beyond the capabilities of State and local governments to respond. There have been a total of 62 declared disasters in Virginia, and 17 of those disasters have been declared in at least one community in the Northern Virginia planning area since 1965. The City of Alexandria has been declared in 13 of these events, and Arlington and Fairfax Counties have been declared in 10 and 11 of the disasters, respectively. Prior to January 1, 1965, presidential disaster declarations did not have county or independent city designations. The region has also experienced a significant number of additional emergencies and disasters that were not severe enough to require Federal disaster relief through a presidential declaration. Table 4.7 summarizes the disasters and the localities that were included in the declaration.

Wind-related events (severe storms, tornadoes, and flooding) dominate the Northern Virginia declared hazards, followed by winter storms events.

**Table 4.7. Major disaster declarations for Northern Virginia planning area (1965-December 2015), based on FEMA records.**

Date of Declaration	Disaster	Declared Jurisdiction								
		Arlington County	Fairfax County	Loudoun County	Prince William County	Alexandria, City of	Fairfax, City of	Falls Church, City of	Manassas, City of	Manassas Park, City of
7/27/2012	Severe Storms and Straight-line Winds	✓	✓				✓	✓		✓
11/17/11	Remnants of Tropical Storm Lee		✓		✓	✓				
9/3/2011	Hurricane Irene					✓				
4/27/2010	Severe Winter Storms and Snowstorms	✓	✓	✓	✓	✓	✓	✓	✓	✓
2/16/2010	Severe Winter Storm and Snowstorm	✓	✓		✓	✓	✓	✓	✓	✓
7/13/2006	Severe Storms, Tornadoes, and Flooding	✓	✓			✓				
9/18/2003	Hurricane Isabel	✓	✓	✓	✓	✓	✓	✓	✓	✓
3/27/2003	Severe Winter Storm	✓	✓	✓	✓	✓	✓	✓	✓	✓
9/11/2001	Terrorism	✓								
2/28/2000	Severe Winter Storm	✓	✓	✓	✓	✓	✓		✓	
10/12/1999	Hurricane Floyd		✓				✓			
10/23/1996	Hurricane Fran				✓					
2/2/1996	Blizzard of 1996	✓	✓	✓	✓	✓	✓	✓	✓	✓
11/10/1985	Severe Storms & Flooding					✓				
10/10/1972	Severe Storms & Flooding					✓				
10/7/1972	Severe Storms & Flooding					✓				
6/29/1972	Tropical Storm Agnes	✓	✓	✓	✓	✓	✓	✓		

NCDC Storm Events Database

NCDC Storm Data is published by the National Oceanic and Atmospheric Administration (NOAA), part of the U.S. Department of Commerce. The Storm Events Database contains information on storms and weather phenomena that have caused loss of life, injuries, significant property damage, and/or disruption to commerce. Efforts are made to collect the best available information, but because of time and resource constraints, information may be unverified by the NWS. The NWS does not guarantee the accuracy or validity of the information. Although the historical records in the database often vary widely in their level of detail, the NWS does have a set of guidelines used in the preparation of event descriptions.²



The NCDC is well known for having limited records of geological hazards (i.e., earthquake, landslide, and karst). In the absence of better data, it was decided to proceed with the records available in NCDC for these events, in all cases. NCDC records for these events are severe under-representations of what has happened in Northern Virginia's history. To date, no comprehensive digital databases exist for these hazards³.

In 2012, shortly after the completion of the previous plan update, major changes were made to the records in the NCDC database. These changes resulted in revisions to historic records in the database, as well as additional data being added to the database. Since this 2012 change, periodic additions of new data and revisions of existing data have been accomplished by NOAA, all with the goal of creating a better data set for general use. Because of these changes, however, the data set available from NCDC during the development of the 2016 plan update was significantly different from the data set available during previous plan activities. As a result, all previous NCDC data has been removed from the 2016 plan update, and has been replaced with the data available during the plan update process. This has resulted in different calculations and findings – in some cases significantly different – than were contained in previous versions of this plan. However, the NCDC data contained in the 2016 plan update is the best available version of the best available data.

Event records from January 1, 1950, through December 31, 2015, have been used for the HIRA analysis. There are approximately 6,101 events recorded in the NCDC storm events database for the Northern Virginia planning area spanning 1950 through 2015; approximately 2,153 of those events have not been included in the analysis – comprised of drought, winter storm, and extreme temperature events – as it is assumed the records are duplicative, as records for towns cannot be reliably separated from records for the corresponding county. Given the widespread spatial nature of those three hazards, it is reasonable to assume that a winter storm event that impacts a county would also impact the towns within the county; the same is true for extreme temperature events and drought events.

Table 4.8 shows the number of NCDC events for each county, city, and town by hazard type.

Table 4.8. Number of Storm Events in the NCDC database (1950-2015).

Jurisdiction	Drought	Flood	High Wind	Tornado	Winter Storm	Extreme Temperatures	Total
Arlington County	9	45	144	2	97	59	356
Fairfax County	10	34	63	0	123	67	297
Loudoun County	12	130	434	25	131	66	798
Prince William County	12	84	191	17	110	74	488
City of Alexandria	9	33	90	2	97	59	290
City of Fairfax	10	34	63	0	123	67	297

**Table 4.8. Number of Storm Events in the NCDC database (1950-2015).**

Jurisdiction	Drought	Flood	High Wind	Tornado	Winter Storm	Extreme Temperatures	Total
City of Falls Church	9	36	54	1	97	9	206
City of Manassas	12	28	52	2	110	74	278
City of Manassas Park	12	18	31	1	110	74	246
Town of Clifton	10	0	1	0	123	67	201
Town of Dumfries	12	7	27	2	110	74	232
Town of Haymarket	12	9	26	0	110	74	231
Town of Herndon	10	9	12	0	123	67	221
Town of Leesburg	12	38	70	5	131	66	322
Town of Lovettsville	12	1	33	6	131	66	249
Town of Middleburg	12	13	29	3	131	66	254
Town of Occoquan	12	1	1	0	110	74	198
Town of Purcellville	12	16	38	0	131	66	263
Town of Quantico	12	6	17	3	110	74	222
Town of Round Hill	12	4	21	1	131	66	235
Town of Vienna	10	7	10	0	123	67	217
Total	233	553	1,407	70	2,462	1,376	6,101

To use the NCDC data in the same fashion as it was used in the *Commonwealth of Virginia Hazard Mitigation Plan* Risk Assessment, the data had to be processed. The following excerpt on processing the NCDC data has been taken from Virginia's hazard mitigation plan.

NCDC Normalizing Data

Information for specific hazard events is sometimes reported by the NWS and found in the NCDC database only at a zonal level. This is particularly true for events that impact a wide area, such as winter storm and drought events. Each zone may contain one or many political jurisdictions. These zonal events may include information regarding deaths, injuries, and damages caused by the event, but may not break these down by individual jurisdiction. To accurately count the number of events occurring in a single county or city, the zonal data records were expanded into a set of individual city/county records, based on NCDC records. To the



extent possible, determinations were made as to if a specific event impacted a particular town or jurisdiction. Those records that could be reliably tied to a particular jurisdiction remained in the assessment. Other records were excluded. The exceptions to this are records for winter weather, drought, and extreme temperatures. Given the widespread spatial nature of these three hazards, it can be reliably assumed that reports of incidents that impacted the greater county also impacted the towns. Therefore, only reports for the counties and cities were included in the final assessment for droughts, winter weather, and extreme temperatures.

Injuries and fatalities are counted exactly as recorded from those reports that remain in the assessment.

For most hazards for which NCDC data was utilized, the period of record used for the assessment was 1950 through 2015, a total of 65 years. The exceptions are winter weather and extreme temperatures. NCDC began maintaining separate records for these hazards in 1996. Therefore, the period of record for these hazards used for the assessment was 1996 to 2015, a total of 19 years.

NCDC Damages

The damages entered into the NCDC Storm Events database portray how much damage was incurred in the year of the event. These damages are approximations or estimates only, and may not reflect the actual or final calculations of damages from other sources.

NCDC Annualizing Data

After the data was normalized, the data was annualized in order to be able to compare the results on a common system (i.e., ranking the hazards). In general, this was completed by taking the parameter of interest and dividing by the length of record for each hazard. The annualized value should only be utilized as an estimate of what can be expected in a given year. Deaths/injuries, property and crop damage, and events were all annualized in this fashion, on a per-jurisdiction basis, where data was available.

NCDC Data Compilation

The NCDC Storm Events database uses very detailed event categories. The reported storm events were summarized in simplified classifications to correspond to the major hazard types considered in this plan. Table 4.9 shows how the NCDC categories were grouped into the HIRA hazard categories. The ranking methodologies, explained later in this section, summarize how the NCDC data was used in ranking the hazards.

Table 4.9. HIRA and NCDC Event Category Classifications

HIRA Category	NCDC Event Categories
Drought	Drought
Flood	Coastal flood
	Flash Flood
	Flood
	Heavy Rain
	High Surf
	Lakeshore Flood
	Storm Surge/Tide
	Hurricane (Typhoon)
High Wind	Marine High Wind
	Marine Strong Wind
	Marine Thunderstorm Wind
	Strong Wind
	Thunderstorm Wind
	Tropical Depression
	Tropical Storm
	Thunderstorm Wind
	Funnel Cloud
	Tornado
Tornado	Water Spout
	Blizzard
	Heavy Snow
	Ice Storm
	Sleet
	Winter Storm
	Winter Weather
Winter Storm	Cold/Wind Chill
	Extreme Cold/Wind Chill
	Excessive Heat
	Frost/Freeze
	Heat
	Agricultural Freeze
Extreme Temperatures	Avalanche
	Black Ice
	Dense Fog
	Dust Devil
Not Included	



Table 4.9. HIRA and NCDC Event Category Classifications	
HIRA Category	NCDC Event Categories
	Freezing Fog
	Hail
	Lake-effect Snow
	Rip Current
	Lightning

IV. Ranking and Analysis Methodologies

HAZUS^{MH} Methodology

HAZUS^{MH} is FEMA's nationwide standardized loss estimation software package, built upon an integrated GIS platform with a national inventory of baseline geographic data (including information on the Northern Virginia region's general building stock and dollar exposure). Originally designed for the analysis of earthquake risks, FEMA has expanded the program to allow for the analysis of multiple hazards including flood and wind events. By providing estimates on potential losses, HAZUS^{MH} facilitates quantitative comparisons among hazards and may assist in the prioritization of hazard mitigation activities.

HAZUS^{MH} uses a statistical approach and mathematical modeling of risk to predict a hazard's frequency of occurrence and estimated impacts based on recorded or historic damage information. The HAZUS^{MH} risk assessment methodology includes distinct hazard and inventory parameters. For example, wind speed and building type were modeled using the HAZUS^{MH} software to determine the impact (damages and losses) on structures. Figure 4.20 shows a conceptual model of HAZUS^{MH} methodology.

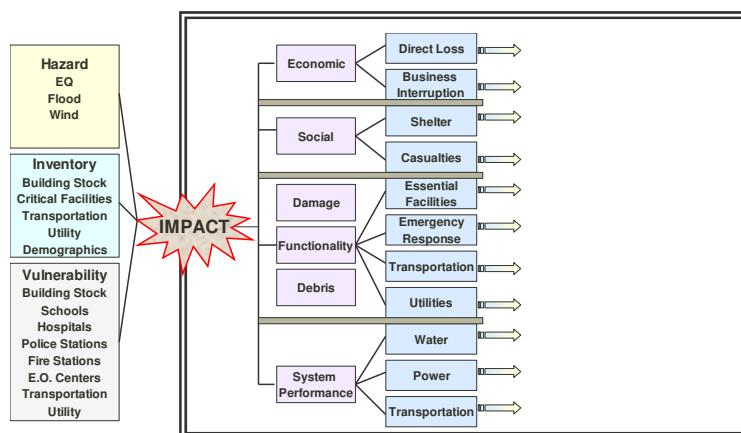


Figure 4.20. Conceptual Model of HAZUS^{MH} Methodology



As with the 2006 and 2010 update of the risk assessment, the 2016 update utilized HAZUS^{MH} to produce regional profiles and estimated losses for hazards addressed in this section: hurricane winds, earthquake, and flood. For each of these hazards, HAZUS^{MH} was used to generate probabilistic “worst case scenario” events to show the maximum potential extent of damages. It is understood that those events of less severe magnitude which could occur would likely result in fewer losses than those calculated here. During the update additional scenarios were completed for flood and earthquake to further define the region’s risk.

Supplemental Annualized Loss Estimate Methodology

The first step in conducting supplemental annualized loss calculations and risk assessment included the collection of relevant GIS data from local, state, and national sources. This began with the collection of local data from each participating jurisdiction, then continued up to best available data at the national inventory level (considered least accurate). The data determined to be “best available” was then used for purposes of this assessment. Data matrices were compiled based on the data provided by each of the localities; these may be found in Appendix D.

In order to generate hazard loss estimates beyond hurricane wind, flood, and earthquake, the following steps were conducted independent of the HAZUS^{MH} analysis:

- For the drought, severe storm, tornado, wildfire, and winter storm hazards, best available data on historical hazard occurrences (limited to NOAA NCDC and Virginia Department of Forestry [VDOF] records) was used to produce estimate of potential damages. Using this data, loss estimates were generated by totaling the amount of property damage over the period of time for which records were available, and calculating the average annual loss. In addition, for appropriate hazards, scenarios were also created to allow for additional estimation of potential losses.
- For the hazards of extreme temperatures, erosion, sinkholes, landslides, and dam failure, meaningful historical data (meaning data which would have included past property damages and other essential indicators) was virtually non-existent, and therefore potential losses for these hazards could not be calculated. For these hazard, a qualitative analysis was performed based on what limited data is available for the participating jurisdictions.

All conclusions of the HIRA completed for the Northern Virginia region are presented at the end of each of the hazard specific sections.

Critical Facility and Building Risk

In addition to generating loss estimates for particular hazards, GIS technology was further utilized to identify, quantify, and analyze potentially at-risk community assets such as public buildings, critical facilities, and infrastructure. This analysis was completed for hazards that can be spatially defined in a meaningful manner (i.e., hazards with a determined geographic extent) and for which digital GIS data layers are readily available. The analysis resulted in the identification of potentially at-risk community assets based upon their location in relation to identified hazard areas. Results of this analysis are contained within each of the hazard specific sections; the actual GIS products are found in Appendix D.

For the flood hazard, GIS was used to further assess risk utilizing the FEMA Digital Flood Insurance Risk Maps (DFIRMs) in combination with locally-available GIS data layers. Primary



data layers used include local building footprints and tax parcel data. Exposure values do not include any estimated values for building contents.

Ranking Methodology

During the 2010 HIRA update kick-off meeting, committee members liked the NCDC ranking methods developed for the Commonwealth of Virginia's HIRA. It was agreed that this approach would be used in the update to the Northern Virginia plan update. During the January 2016 HIRA update kick-off meeting, committee members determined that the same methodologies used in the 2010 update should be applied to the 2016 update, to the extent possible and practicable, to ensure that there was a means of comparison across plans, and that progress could be measured over time.

Since the methodology for the update was to mirror the State plan, with updated storm event records, the following has been taken from the Commonwealth of Virginia Emergency Operations Plan Annex 3 (Volume II) of the Standard and Enhanced Hazard Mitigation Plan Ranking Methodology.

To compare the risk of different hazards, and prioritize which are more significant, requires a system for equalizing the units of analysis. Under ideal conditions, this common unit of analysis would be “annualized dollars.” However, such an analysis requires reliable probability and impact data for all the hazards to be compared. As this is often not the case, many hazard prioritization methods are based on scoring systems, which allow greater flexibility and more room for expert judgment.

The Virginia Tech Center for Geospatial Information and Technology's (CGIT) and VDEM have developed a standardized methodology to compare different hazard's risk on a jurisdictional basis. As some of the hazards assessed in this plan did not have precisely quantifiable probability or impact data, a semi-quantitative scoring system was used to compare all of the hazards. This method prioritizes hazard risk based on a blend of quantitative factors from the available data. A number of parameters have been considered in this methodology, all of which could be derived from the NCDC database:

- History of occurrence;
- Vulnerability of people in the hazard area;
- Probable geographic extent of the hazard area; and
- Historical impact, in terms of human lives and property.

The ranking methodology tries to balance these factors, whose reliability varies from hazard to hazard due to the nature of the underlying data. Each parameter was rated on a scale of one (1) through four (4). The exact weights were highly debated, but the final conclusion was that the population vulnerability and density would each be weighted at 0.5 with a geographic extent at 1.5, relative to the other parameters. These scores are summed at a jurisdictional level for each hazard separately, permitting comparison between jurisdictions for each hazard type. A summation of all the scores from all hazards in each jurisdiction provides an overall “all-hazards” risk prioritization. The following sections provide an overview of the six parameters that were used in ranking the hazards that impact Virginia.



The NCDC data, as described above, is far from a complete data source. This data was used for the ranking because of its standardized collection of many of the hazards of interest. The data only partially represents the geological hazards, and as a result, the ranking can only characterize the current form of the data. As other data sources become available, the ranking will need to be reassessed to make sure the parameters are still valid for ranking the hazards.

Population Vulnerability and Density

Population vulnerability and density are simple, yet important factors in the risk ranking assigned to a jurisdiction. In general, a hazard event that occurs in a highly populated area has a much higher impact than a comparable event that occurs in a remote, unpopulated area. Two population parameters were used, accounting for jurisdictions with high populations and jurisdictions with densely populated areas. Each parameter was given a weighting of 0.5 in an effort to avoid overwhelming the overall ranking methodology with pure population data.

Population vulnerability was calculated as a percent of the total population of Virginia present in each jurisdiction. The 2010 U.S. Census population calculation for each jurisdiction were divided by the total population for the State and a value between one and four was assigned based on a geometric breaks pattern. By ranking jurisdictions this way, those cities and counties with significantly larger populations have effectively been given extra weight. For the purposes of this planning effort, it is assumed that the higher the population density, the higher the vulnerability of that population, as there are simply more people in the path of the hazard. Table 4.10 describes the breaks and assigned scores for population vulnerability for the individual jurisdictions of the planning area.

Table 4.10. Population Vulnerability as the percentage of people that will be affected by the occurrence of the hazard.

<i>Population Vulnerability</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 0.229 % of the total population of the State
2	0.230% - 0.749% of the total population of the State
3	0.750% - 2.099% of the total population of the State
4	> = 2.100% of the total population of the State

Population density was based on the population per square mile for each jurisdiction. The 2010 Census population calculation for each jurisdiction were divided by the total area for the jurisdiction; a value between one and four was assigned based on geometric intervals. By ranking jurisdictions this way, those cities and counties with densely populated areas have effectively been given extra weight. Table 4.11 describes the breaks and assigned scores for population density for the individual jurisdictions of the planning area.

**Table 4.11. Population Density as the number of people per square mile that will be affected by the occurrence of the hazard.**

<i>Population Density</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 60.92 people/sq. mi
2	60.93 – 339.10 people/sq. mi
3	339.11 - 1,743.35 people/sq. mi
4	>= 1,743.36 people/sq. mi

Geographic Extent

Probable geographic extent (GE) would ideally be measured consistently for each hazard; however, the available data sources vary widely in their depiction of hazard geography. As a result, one uniform ranking system could not be accomplished at this time. In this version of the plan each hazard has been assigned individual category break points based on the available hazard data. In the overall scoring system, geographic extent was given a 1.5 weighting relative to the other parameters, as geographic extent was deemed to be critically important, and more reliable than some of the other parameters. GE data sources, ranking criteria, and category breaks for the individual jurisdictions of the planning area are summarized in Table 4.12.

Table 4.12. Geographic Extent as the percentage of a jurisdiction impacted by the hazard.

<i>Geographic Extent</i>			
<i>Hazard</i>	<i>Description</i>	<i>Category Breaks</i>	
		<i>Rank</i>	<i>Definition</i>
Flood	Percent of a jurisdiction that falls within FEMA Special Flood Hazard Area (SFHA). Data: FEMA Floodplains (DFIRMs)	1	<=2.99%
		2	3.00-4.99%
		3	5.00 -9.99%
		4	>=10.00%
High Wind	Average maximum wind speed throughout the entire jurisdiction. Data: HAZUS ^{MH} 3-second Peak Gust Wind Speeds	1	<= 59.9
		2	60.0 - 73.9
		3	74.0 - 94.9
		4	>= 95.0
Wildfire	Percent of jurisdiction that falls within a “high” risk. Data: VDOF Wildfire Risk Assessment	1	<= 9.9%
		2	10.0% - 19.9%
		3	20.0% - 49.9%
		4	>= 50.0%
Karst	Percent of jurisdiction where the risk is “high” for karst related events. Data: USGS Engineering Aspects of Karst	1	<= 24.9%
		2	25.0% - 49.9%
		3	50.0% - 74.9%
		4	>= 75.0%
Landslide	Percent of jurisdiction where a high landslide risk exists.	1	<= 24.9%
		2	25.0% - 49.9%

**Table 4.12. Geographic Extent as the percentage of a jurisdiction impacted by the hazard.**

<i>Geographic Extent</i>				
<i>Hazard</i>	<i>Description</i>	<i>Category Breaks</i>		
		<i>Rank</i>	<i>Definition</i>	
	Data: USGS Landslide Incidence & Susceptibility	3	50.0% - 74.9%	
		4	>= 75.0%	
Earthquake	Average 2,500-year return period max percent of gravitational acceleration (PGA). Data: HAZUS ^{MH} 2,500-year PGA	1	<= 0.069	
		2	0.070 - 0.159	
Winter Storm	Average annual number of days receiving at least 3 inches of snow, calculated as an area-weighted average for each jurisdiction. Data: NWS snowfall statistics	3	0.160 - 0.299	
		4	>= 0.300	
Tornado	Annual tornado hazard frequency (times 1 million), calculated as an area-weighted average for each jurisdiction. Data: NCDC tornado frequency statistics	1	<= 1.49	
		2	1.50 - 1.99	
		3	2.00 - 2.99	
		4	>= 3.0	
		1	<= 1.24	
		2	1.25 - 9.99	
		3	10.00 - 99.9	
		4	>= 100.00	

Annualizing the Data for Analysis

Data from the NCDC database was annualized in order to compare the results on a common system. In general, this was completed by taking the parameter of interest and dividing by the length of record for each hazard. The annualized value should only be utilized as an estimate of what can be expected in a given year.

Annualized Deaths and Injuries

Deaths and injuries are also an important factor to evaluate when determining risk ranking. Using NCDC data, past deaths and injuries were computed for drought, flood, high wind, tornado, wildfire, and winter storm. The remaining hazards have no reported deaths or injuries in this database and as a result were assigned a ranking of one (1). Table 4.13 describes the breaks and assigned scores for annualized deaths and injuries for the individual jurisdictions of the planning area.

Table 4.13. Annualized Deaths and Injuries as the number of deaths or injuries that a hazard event would likely cause in a given year.

<i>Annualized Deaths and Injuries</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 1.019 deaths and/or injuries per year
2	1.020 – 6.279 deaths and/or injuries per year

**Table 4.13. Annualized Deaths and Injuries as the number of deaths or injuries that a hazard event would likely cause in a given year.**

<i>Annualized Deaths and Injuries</i>	
<i>Rank</i>	<i>Definition</i>
3	6.280 – 13.199 deaths and/or injuries per year
4	>= 13,200 deaths and/or injuries per year

Annualized Crop and Property Damage

Crop damage and property damage were also analyzed separately in order to give each jurisdiction a score of one (1) to four (4). This data was obtained from the NCDC storm events database and annualized according to the period of record for each event category. Table 4.14 describes the breaks and assigned scores for annualized crop and property damages for the individual jurisdictions of the planning area.

Table 4.14. Annualized Crop and Property Damage as the estimated damages that a hazard event will likely cause in a given year.

<i>Annualized Crop and Property Damage</i>		
<i>Rank</i>	<i>Definition: Crop Damage</i>	<i>Definition: Property Damage</i>
1	<= \$25,711 per year	<= \$ 136,129 per year
2	\$25,712 – \$100,270 per year	\$136,130 - \$432,555 per year
3	\$100,271 - \$291,384 per year	\$432,556 - \$1,111,067 per year
4	>= \$291,385 per year	>= \$1,111,068 per year

Annualized Events

While each hazard may not have a comprehensive database of past historical occurrences, the record of historical occurrences is still an important factor in determining where hazards are likely to occur in the future. Annualizing the NCDC storm events data yields a rough estimate of the number of times a jurisdiction might experience a similar hazard event in any given year. To do this, the total number of events in the NCDC database, for each specific hazard in each jurisdiction, was divided by the total years of record for that hazard to calculate an “annualized events” value.

There were no significant events reported for land subsidence (karst), earthquake, and landslide in NCDC; as a result, the events for these hazards all received a rank of one (1). Table 4.15 describes the annual frequency breaks for events for the individual jurisdictions of the planning area.



Table 4.15. Annualized Events as the number of times that a hazard event would likely happen in a given year.

<i>Annualized Events</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 0.09 events per year
2	0.10 – 0.99 events per year
3	1.00 – 4.99 events per year
4	>= 5.00 events per year

Overall Hazard Ranking

The scores from each of these categories were added together for each hazard to estimate the total jurisdictional risk due to that hazard. As discussed previously, the population parameters were each given a weighting of 0.5 (for a total of 1.0 for all population parameters), and Geographic Extent was given a weighting of 1.5 relative to the other factors. The total scores were broken into five categories to better illustrate the distribution of risk scores. Those jurisdictions with scores from 0 to 8.49 were determined to have a low risk in that hazard category; scores 8.50 through 9.99 were considered medium-low risk; between 10.0 and 11.49, medium risk; between 11.50 and 12.99 were considered medium-high risk; and jurisdictional hazard scores greater than 13.00 were given a high rating.

In order to assess the total risk of a county or city across all hazard categories, each of the previous categories were summed across the different hazard types. Overall, all-hazards ranking counties with a low risk have a score less than 86.00; those with a medium-low risk between 86.01 and 93.50; medium risk between 95.51 and 100.00; medium-high risk between 100.01 and 108.00; and those with a high risk have a score greater than or equal to 108.01.

Comparison of Methodologies

Differences in 2010 and 2016 annualized loss estimates can be attributed to several factors:

- Time frame of storm events database and/or data sources;
- Inflation of storm events database;
- Methodologies used for analysis (i.e., HAZUS^{MH}); and
- Differences in versions of HAZUS available for use.

Additional Risk Assessments Completed for the Northern Virginia Region

The Northern Virginia Planning region, as discussed in other sections of this plan, has numerous plans that document different aspects of the risk to natural and man-made hazards. Some of these plans are briefly outlined below:

December 2015 National Capital Region THIRA *National Capital Region Threat and Hazard Identification and Risk Assessment:* This THIRA discusses natural and human-caused hazards and provides risk summaries for each of the hazards. Threats and hazards were identified based on the likelihood of an incident and the significance of the threat/hazard's effects to the area.



Threats/Hazards considered in the THIRA:

- Pandemic
- Severe Weather Event (hurricane/winter weather)
- CBRNE
- Cyber attack
- Terrorism
- Earthquake

Limitations of Data

The data sources used in the hazard ranking and loss estimation are varied in their degree of completeness, accuracy, and precision as the ability to accurately prioritize some of the hazards would be improved by better information (e.g., landslide, karst, etc.). The participating jurisdictions should consider their internal and cooperative abilities to gather and maintain additional data for future updates to this plan.



V. Overall Hazard Results

The preceding sub-sections discuss the probability, impacts, vulnerability, and risks for each of the natural hazards that have been determined to have a significant impact on the Northern Virginia planning region. The final section of the HIRA provides an overall assessment, summary, and comparison of the overall hazard ranking and estimated losses. Risk to critical facilities has been discussed, to the extent possible, in each of the hazard sub-sections. These sections highlight the results of the analysis completed during the 2010 and 2016 plan updates. Refer to the tables in these sections to determine what facilities or facility types are at greater risk for each hazard. This information is ideal for determining structural mitigation strategies. The names and information for the HAZUS^{MH} and local critical facilities in the assessments are available in Appendix D.

Refer to the Risk Assessment Methodology section of the HIRA for a full description of the methodology and the limitations of the data used for ranking the hazards and loss estimation. For most natural hazards, the NCDC data, although somewhat limited, provides the most comprehensive historical record of events and damages available. This analysis is only representative of the NCDC data and other data that was used. It is known that the time period of this data is small in comparison to the known historical events. The data does not fully represent geological hazards, but in the absence of better data, NCDC was used to represent the risk.

Comparison of 2010 and 2016 Results

Table 4.16 provides a comparison of the 2010 and 2016 hazard rankings, by jurisdiction. Note that the list of jurisdictions that participated in the plan in 2010 is slightly different from the list of jurisdictions that participated in 2016; therefore, the rankings do not line up exactly. In addition, the configuration of the hazards included, while substantively the same, is slightly different between the 2010 and 2016 plans.

Following Table 4.16, tables are provided that show select results from the HIRA for the most probable hazards likely to impact the Northern Virginia planning area – floods, high wind, earthquake, and winter weather – by participating jurisdiction.

Table 4.16. Hazard Vulnerability Comparison, 2010 and 2016 Plans, by Jurisdiction and Hazard.

Jurisdiction	Flood		Winter Storm		High Wind		Tornado		Drought		Earthquake		Landslide		Wildfire		Geologic		Extreme Temperatures	
	2010	2016	2010	2016	2010	2016	2010	2016	2010	2016	2010	2016	2010	2016	2010	2016	2010	2016	2010	2016
Arlington County	H	H	H	H	H	H	H	H	MH	L	M	M	M	L	ML	L	ML	L	H	
Fairfax County	H	H	H	H	H	H	H	H	MH	L	M	M	ML	L	M	L	ML	L	H	
Loudoun County	H	H	H	H	H	H	H	H	H	M	M	M	MH	L	ML	M	ML	M	H	
Prince William County	H	H	H	H	H	H	H	H	H	M	M	M	ML	L	M	M	ML	L	H	
City of Alexandria	H	H	H	H	H	H	H	H	MH	L	M	M	M	L	L	L	ML	L	H	
City of Fairfax	H	H	H	H	H	H	H	H	MH	L	M	M	M	L	ML	L	L	L	H	
City of Falls Church	H	H	H	H	H	H	MH	H	M	L	ML	M	ML	L	L	L	ML	L	H	
City of Manassas	H	H	H	H	H	H	H	H	MH	L	M	M	M	L	ML	L	ML	L	H	
City of Manassas Park	H	M	H	H	H	H	MH	H	L	L	ML	M	ML	L	L	L	L	L	H	
Town of Clifton	H	L	H	H	H	H	H	H	MH	L	M	M	ML	L	M	L	ML	L	H	
Town of Dumfries	H	M	H	H	H	H	H	H	H	M	M	M	ML	L	M	M	ML	L	H	
Town of Haymarket	H	M	H	H	H	H	H	H	H	M	M	M	ML	L	M	M	ML	L	H	
Town of Herndon	H	M	H	H	H	H	H	H	MH	L	M	M	ML	L	M	L	ML	L	H	
Town of Leesburg	H	H	H	H	H	H	H	H	H	M	M	M	MH	L	ML	M	ML	M	H	
Town of Lovettsville	L		H		H		H		M		M		L		M		L			
Town of Middleburg	H	H	H	H	H	H	H	H	H	M	M	M	MH	L	ML	M	ML	L	H	
Town of Occoquan	H	L	H	H	H	H	H	H	H	M	M	M	ML	L	M	M	ML	L	H	
Town of Purcellville	H	H	H	H	H	H	H	H	H	M	M	M	MH	L	ML	M	ML	L	H	
Town of Quantico	H	M	H	H	H	H	H	H	H	M	M	M	ML	L	M	M	ML	L	H	
Town of Round Hill	H	M	H	H	H	H	H	H	H	M	M	M	MH	L	ML	M	ML	L	H	
Town of Vienna	H	M	H	H	H	H	H	H	MH	L	M	M	ML	L	M	L	ML	L	H	

**Table 4.17. Flood Events and Damages in the Northern Virginia Region, 1950–2015.**

Jurisdiction	# of Flood Events	Property Damage	Crop Damage	Total
Arlington County	45	\$4,123,000	\$0	\$4,123,000
Fairfax County	34	\$2,506,000	\$0	\$2,506,000
Loudoun County	130	\$2,138,000	\$180,000	\$2,318,000
Prince William County	84	\$775,000	\$50,000	\$825,000
City of Alexandria	33	\$718,000	\$0	\$718,000
City of Fairfax	34	\$2,506,000	\$0	\$2,506,000
City of Falls Church	36	\$620,000	\$0	\$620,000
City of Manassas	28	\$31,000	\$0	\$31,000
City of Manassas Park	18	\$11,000	\$0	\$11,000
Town of Clifton	0	\$0	\$0	\$0
Town of Dumfries	7	\$500,000	\$0	\$500,000
Town of Haymarket	9	\$173,000	\$50,000	\$223,000
Town of Herndon	9	\$0	\$0	\$0
Town of Leesburg	38	\$718,000	\$0	\$718,000
Town of Lovettsville	1	\$0	\$0	\$0
Town of Middleburg	13	\$500,000	\$0	\$500,000
Town of Occoquan	1	\$0	\$0	\$0
Town of Purcellville	16	\$500,000	\$0	\$500,000
Town of Quantico	6	\$507,000	\$0	\$507,000
Town of Round Hill	4	\$0	\$0	\$0
Town of Vienna	7	\$0	\$0	\$0
Total	553	\$16,326,000	\$280,000	\$16,606,000

Based on the data in the table above, the planning area should expect to experience flood damages in the amount of \$255,477 annually.

**Table 4.18. Annualized Loss Estimates Due to Severe Storms and High Winds, 1950-2015.**

Jurisdiction(s)	Annualized Property and Crop Damage	Total Property and Crop Damage
Arlington County	\$158,827	\$10,323,750
Fairfax County & the City of Fairfax (including Town of Clifton, Town of Herndon, and Town of Vienna)	\$315,508	\$20,508,000
Loudoun County (including Town of Leesburg, Town of Lovettsville, Town of Middleburg, Town of Purcellville, and Town of Round Hill)	\$49,732	\$3,232,600
Prince William County (including Town of Dumfries, Town of Haymarket, Town of Occoquan, and Town of Quantico)	\$268,412	\$17,446,750
City of Alexandria	\$149,538	\$9,720,000
City of Fairfax	--	--
City of Falls Church	\$149,692	\$9,730,000
City of Manassas	240,538	\$15,635,000
City of Manassas Park	\$231,261	\$15,032,000
Total	\$1,563,509	\$101,628,100

**Table 4.19. HAZUS^{MH} Estimated Damages from Probabilistic Scenario 2500-year Return Interval.**

Jurisdiction	Building Stock	Transportation Infrastructure	Utility Infrastructure	Total
Arlington County	\$343,903,000	\$4,726,000	\$3,172,000	\$347,551,000
Fairfax County	\$1,794,989,000	\$12,702,000	\$20,528,000	\$1,828,219,000
Loudoun County	\$430,261,000	\$1,985,000	\$8,280,000	\$440,526,000
Prince William County	\$679,957,000	\$4,027,000	\$15,648,000	\$699,632,000
City of Alexandria	\$274,089,000	\$3,011,000	\$4,038,000	\$281,238,000
City of Fairfax	\$63,431,000	\$28,000	\$286,000	\$63,745,000
City of Falls Church	\$274,089,000	\$0	\$154,000	\$274,243,000
City of Manassas	\$74,521,000	\$854,000	\$5,412,000	\$80,787,000
City of Manassas Park	\$20,296,000	\$131,000	\$165,000	\$20,592,000
Total	\$3,708,422,000	\$27,464,000	\$57,684,000	\$3,793,570,000

Table 4.20. Winter Storm Events and Damages in the Northern Virginia Region, 1996–2015.

Jurisdiction	# of Winter Storm Events	Property Damage	Crop Damage	Total
Arlington County (includes the Cities of Alexandria and Falls Church)	97	\$460,000	\$0	\$460,000
Fairfax County (includes the City of Fairfax and the Towns of Clifton, Herndon, and Vienna)	123	\$335,000	\$0	\$335,000
Loudoun County (includes the Towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill)	131	\$135,000	\$100,000	\$235,000

**Table 4.20. Winter Storm Events and Damages in the Northern Virginia Region, 1996–2015.**

Jurisdiction	# of Winter Storm Events	Property Damage	Crop Damage	Total
Prince William County (includes the Cities of Manassas and Manassas Park and the Towns of Dumfries, Haymarket, Occoquan, and Quantico)	110	\$55,000	\$0	\$55,000
Total	461	\$985,000	\$100,000	\$1,085,000

Based on the data in the table above, the planning area should expect to experience winter storm damages in the amount of \$57,105 annually.

VI. Flood

NOTE: As part of the 2016 plan update, the flood hazard was reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in the HIRA Introduction section. In addition, each section of the plan was also reformatted to improve clarity, and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

Flooding - Flooding is the most frequent and costly natural hazard in the United States; a hazard that has caused more than 10,000 fatalities since 1900. Nearly 90% of presidential disaster declarations result from natural events where flooding was a major component.

Floods are the result of excessive precipitation, and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time; and flash floods, the product of heavy, localized precipitation in a short time period over a given location. The severity of a flooding event is determined by the following: 1) a combination of stream and river basin topography and physiography; 2) precipitation and weather patterns; 3) recent soil moisture conditions; and 4) the degree of vegetative clearing.

Floods are events that may last for several days. The primary types of flooding include riverine, coastal, and urban. Riverine flooding is a function of excessive precipitation levels and water



runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves, and heavy rainfall produced by hurricanes, tropical storms, nor'easters, and other large coastal storms. Urban flooding occurs where man-made development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Flash Flooding - Flash flooding events can occur from a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by an ice jam. Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces. Flash flood waters move at very high speeds—“walls” of water can reach heights of 10 to 20 feet. Flash flood waters and the accompanying debris can uproot trees, roll boulders, and damage or destroy buildings, bridges, and roads.

The average global sea level has been rising at the rate of about 3.1 mm per year (data from 1993 to 2003)⁴. This same trend is apparent in the historical gage records for Washington, DC, (Station 8594900) along the tidally-influenced Potomac River where rates have averaged about 3.2 mm/year.

Sea Level Rise

Sea level rise is expected to continue and possibly accelerate as the planet warms. Based on output from multiple computer models, a low sea level rise scenario is one with a sea level rise of 7 to 15 inches by 2100. A high scenario would include a sea level rise of 10 to 23 inches by 2100. Neither scenario includes the possibility of ice sheet melting contributing to sea level rise. Some scientists suggest that should the Greenland and West Antarctic ice sheets collapse; sea level rise will be on the order of several feet higher than the high scenario shown here.⁵

Using the high Intergovernmental Panel on Climate Change (IPCC) emissions growth scenario and overlaying corresponding projected sea levels expected with that scenario, it is anticipated that significant portions of the eastern sections of Old Town Alexandria, including the eastern portions of King Street will be at risk of inundation (Figure 4.21). A study being conducted by NVRC as part of Sustainable Shorelines & Community Management indicates that approximately 49 buildings may be inundated under a high sea-level rise scenario.

Also at risk of inundation under projected rises in sea-level is Ronald Reagan Washington National Airport. Situated along the banks of the Potomac, the airport opened in 1941. The site had originally been mostly underwater and was built up by sand and gravel fill. Approximately 200 acres of the airport are within the 100-year floodplain which is 11.4 feet above mean sea level. Under the high emissions scenario, permanent inundation of portions of taxiways and access roadways is possible (See Figure 4.22).

Other low-lying areas in Northern Virginia are also at risk for sea level rise inundation. Portions of Four Mile Run in Arlington and Alexandria, Dangerfield Island, Jones Point, Huntington,



Belle Haven/New Alexandria, Dyke Marsh, Hallowing Point, Occoquan NWR, Town of Quantico, the Occoquan River and various tidal embayments may be impacted.

In addition to producing high resolution sea level rise and storm surge inundation mapping for Northern Virginia, the NVRC study, completed in late 2010, also quantified specific elements vulnerable for both the built and natural environments and developed strategies to protect, adapt or retreat communities located in areas at risk.



Figure 4.21. Projected 'high scenario' sea level rise for Old Town, Alexandria, 2100. *Source: NVRC, 2010.*



Figure 4.22. Projected “high-scenario” sea-level rise for Ronald Reagan Washington National Airport Year 2100.

Source: NVRC, 2010

Erosion

Erosion is the gradual breakdown and movement of land due to both physical and chemical processes of water, wind, and general meteorological conditions. Natural, or geologic, erosion has occurred since the Earth’s formation and continues at a very slow and uniform rate each year.

There are two general causes of soil erosion: wind and water. Both can cause significant soil loss. Winds blowing across sparsely vegetated or disturbed land can pick up soil particles and transport them to another location. Water flowing over land also transports soil particles to other locations. Wind erosion generally impacts wider, less well defined areas than water erosion, but water erosion is capable of transporting larger particles than wind. Major storms such as hurricanes may cause significant erosion by combining the impacts of high winds and high



velocity water flow over large flood areas, including storm surges that significantly impact the shoreline.

Wind erosion is the result of lateral and uplift wind forces separating individual soil particles from the soil mass and transporting them until the wind speed and resulting forces decrease to where they are insufficient to support and transport the particles. Generally, individual wind erosion events in areas of exposed silt and clay are relatively minor. However, if the exposed soil consists of sand, and the sand becomes airborne, the rate of erosion can increase by a factor of 10. Airborne sand acts as an abrasive as it is blown across the surface, which acts to dislodge significantly more soil than the wind alone.

The main causes of water erosion are stream or overland flow, and wave action. Stream or overland flow erosion is the result of mechanical or chemical removal, and transportation of soil particles to a new location. Mechanical erosion is caused by hydrodynamic forces pushing particles down-gradient; hydraulic drag forces pulling particles down-gradient, and/or hydraulic uplift. Susceptibility of an area to stream or overland flow erosion is a function of soil characteristics, vegetative cover, water quality, topography, and climate. Soils weathered from calcareous carbonate rock (i.e., limestone and dolomite), are more susceptible to chemical erosion by dissolution than other soils. Vegetative cover can be very helpful in controlling erosion by shielding the soil surface from direct water contact and reinforcing the soil, with the foliage serving as an energy dissipater and the root mat reinforcing the near surface soils. Water quality impacts both chemical and mechanical erosion; water with relatively a high concentration of carbon dioxide, oxygen, and organic acids accelerates dissolving minerals from calcareous carbonate soils. Sand and gravel that are transported during periods of high velocity flow increase mechanical erosion through abrasion of the flow bed. Topography of the area, including size, shape, and slope is a key variable in determining water flow velocity which in turn is a key variable in the magnitude of the hydraulic forces producing erosion. The greater the slope length and gradient, the more potential an area has for erosion. Climate can also affect the amount of runoff, especially the frequency, intensity, and duration of rainfall and storms. When rainstorms are frequent, intense, or of long duration, erosion risks are high. Seasonal changes in temperature and rainfall amounts define the period of highest erosion risk for the year.

During the mid to late 1960s, the importance of erosion control gained increased public attention. Implementation of erosion control measures consistent with sound agricultural and construction operations was needed to minimize the adverse effects associated with increasing settling out of the soil particles due to water or wind. The increase in government regulatory programs and public concern has resulted in a wide range of erosion control products, techniques, and analytical methodologies in the United States. The preferred method of erosion control in recent years has been the restoration of vegetation. These measures are addressed in the Northern Virginia region through local sedimentation and erosion control programs. While local erosion hazard areas are not identified, the areas of greatest concern are typically those areas consisting of steep slopes and fast running stream channels, as well as large construction sites involved in the excavation and disturbance of their natural state.



There is no known database of historic erosion events in the Northern Virginia region. Erosion events are often extremely localized in nature and often go unreported unless they damage infrastructure or the resulting topography presents a new hazard.

As far as coastal and tidal erosion, Prince William, Fairfax, and Arlington Counties and the City of Alexandria all have tidal shorelines along the Potomac River and its associated embayments and tributaries. The accretion and erosion of these shorelines are greatly influenced by wind-induced waves, littoral currents, tidal currents, sea-level rise, boat wake, and storm water runoff. Other contributing factors include the physical characteristics of the shoreline (e.g., topography, soil), as well as human activities (e.g., land use, dredging, and shoreline stabilization).

In September 1992, NVRC prepared a study entitled “Tidal Shoreline Erosion in Northern Virginia” which discusses the erosion situation for various segments of the shoreline in the Northern Virginia region, as well as identifies the locations of “priority” erosion concern. The report is intended to serve as a valuable resource document for State and local officials to assist them in planning for shoreline and erosion control throughout Northern Virginia, and is hereby incorporated by reference. In addition, the report augments a DBase IV computer data file also created by NVRC that contains the names, mailing addresses, and tax parcel numbers of tidal Potomac shoreline property owners. This data is distributed to the Shoreline Erosion Advisory Service and Northern Virginia local governments. Combined with the set of approximately 360 low altitude aerial photographs, these work products serve as an excellent historical record for current planning efforts, and also future research.

According to the report, 20% of the Northern Virginia shoreline has been artificially stabilized with 32 miles of hard structures. Prince William County has approximately 48 miles of shoreline with 8.7 miles of artificial shoreline stabilization structures. Fairfax has the most tidal shoreline in Northern Virginia (87 miles), and the most artificial stabilization (13.3 miles), but the smallest percent of stabilized shoreline (15%). The City of Alexandria has the shortest shoreline length (8.8 miles), with the largest percent stabilized (58%, or 5.1 miles). Arlington County has 13.3 miles of tidal shoreline, with 4.9 miles of hardened shoreline (37%). This information has not been updated since the 2006 plan creation, and remains the best available data for the 2016 update to this plan.

The probability of future erosion events remains likely in localized areas throughout the Northern Virginia region. According to projects researching the changing climate, including sea-level risk and increased storm events, erosion would be expected to increase.

Erosion vulnerability for the region is difficult to determine because there are no historical records for previous occurrences of erosion events. The Northern Virginia region’s vulnerability to erosion is limited to those immediate areas along rivers, creeks, and streams and to areas of loose soils with steep slopes. In most cases where erosion poses an imminent threat to property, erosion control techniques are typically applied before damages occur. Therefore, future structural damages caused by long-term erosion and associated dollar losses are expected to be negligible.



As discussed in the Hazard Analysis section, NVRC prepared a study titled “Tidal Shoreline Erosion in Northern Virginia,” which discusses the erosion situation for various segments of the shoreline in the Northern Virginia region, as well as identifies the locations of “priority” erosion concern. This publication is hereby incorporated by reference, as will be future updates to shoreline erosion studies in the Northern Virginia region.

2. Geographic Location/ Extent

There are numerous rivers and streams flowing through the Northern Virginia region. When heavy or prolonged rainfall events occur, these rivers and streams are susceptible to some degree of flooding. The most notable of these water bodies is the Potomac River, which in the past has been the source for significant storm surge and tidal flooding – particularly in waterfront communities such as Arlington and Alexandria.

The entire Northern Virginia region falls within the Potomac River Basin, which serves as the border between Maryland and Virginia and flows in a southeasterly direction. The topography of the upper reaches of the basin is characterized by gently sloping hills and valleys.

At Great Falls in Maryland, the Potomac River starts its rapid descent to sea level by plunging 76 feet through a deep gorge in less than one mile. Eastward of Great Falls, the Potomac flows between Washington, DC, Arlington, and Alexandria. Here the river dramatically broadens and is flanked by low marshes in many places along the eastern side of Prince William County, where tides further influence the river. The Potomac then continues on through the coastal plain and eventually grows to more than 11 miles wide as it reaches the Chesapeake Bay.

While some of the most dramatic flooding events in Northern Virginia are associated with the tidal flooding of the Potomac River during hurricanes or tropical storms, other more frequent inland flood hazards exist throughout the region. Too much rainfall or snowmelt in too little time causes serious flooding problems along even the smallest of tributaries or storm drainage systems. The low-lying areas prone to this type of flooding are known as floodplains or SFHAs. These locations, which are more commonly referred to as the “100-year floodplain” (areas with a one-percent-annual-chance of flooding), are routinely surveyed and mapped by FEMA as part of a Flood Insurance Study (FIS) sponsored by the NFIP. These studies and associated maps are then provided to local communities in order to regulate the development of land within these hazard areas.

Figure 4.23 shows the potential flood hazard areas throughout the Northern Virginia region based on the FEMA National Flood Hazard Layer (NFHL). Jurisdiction-specific flood maps that show the FEMA floodplain in relation to boundaries and assets in the region can be found in Appendix D.

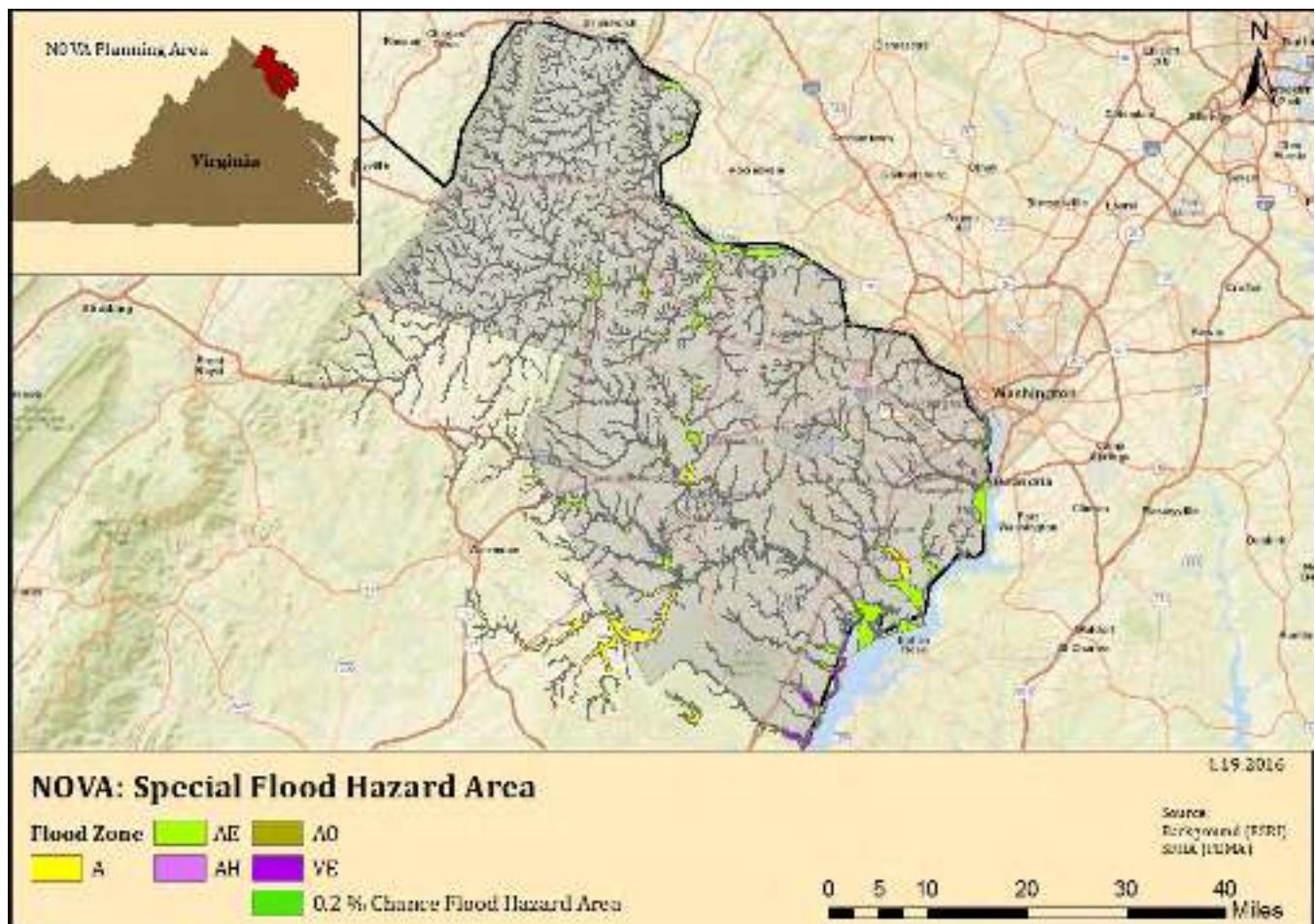


Figure 4.23 FEMA Special Flood Hazard Area Map (National Flood Hazard Layer data).

There have been a number of past flooding events throughout the region, ranging widely in terms of location, magnitude, and impact. The most frequent flooding events are quite localized in nature, resulting from heavy rains in a short period of time over urbanized areas that are not able to appropriately handle storm water runoff. These events typically do not threaten lives or property and will not result in emergency or disaster declarations, thus historical data is difficult to obtain. Table 4.21 summarizes the number of flood events (by participating jurisdiction) since 1950 which have caused a notable impact on the Northern Virginia region as recorded by the NCDC. This includes 553 flood events that have caused approximately \$16.6 million in property and crop damages.

Table 4.21. Flood Events in the Northern Virginia Region, 1950–2015 based on NCDC data.

Jurisdiction	# of Flood Events	Property Damage	Crop Damage	Total
Arlington County	45	\$4,123,000	\$0	\$4,123,000
Fairfax County	34	\$2,506,000	\$0	\$2,506,000
Loudoun County	130	\$2,138,000	\$180,000	\$2,318,000

**Table 4.21. Flood Events in the Northern Virginia Region, 1950–2015 based on NCDC data.**

Jurisdiction	# of Flood Events	Property Damage	Crop Damage	Total
Prince William County	84	\$775,000	\$50,000	\$825,000
City of Alexandria	33	\$718,000	\$0	\$718,000
City of Fairfax	34	\$2,506,000	\$0	\$2,506,000
City of Falls Church	36	\$620,000	\$0	\$620,000
City of Manassas	28	\$31,000	\$0	\$31,000
City of Manassas Park	18	\$11,000	\$0	\$11,000
Town of Clifton	0	\$0	\$0	\$0
Town of Dumfries	7	\$500,000	\$0	\$500,000
Town of Haymarket	9	\$173,000	\$50,000	\$223,000
Town of Herndon	9	\$0	\$0	\$0
Town of Leesburg	38	\$718,000	\$0	\$718,000
Town of Lovettsville	1	\$0	\$0	\$0
Town of Middleburg	13	\$500,000	\$0	\$500,000
Town of Occoquan	1	\$0	\$0	\$0
Town of Purcellville	16	\$500,000	\$0	\$500,000
Town of Quantico	6	\$507,000	\$0	\$507,000
Town of Round Hill	4	\$0	\$0	\$0
Town of Vienna	7	\$0	\$0	\$0
Total	553	\$16,326,000	\$280,000	\$16,606,000

*Prior to the 2016 Plan Update, previous damages were inflated to current values. As of the 2016 plan update, damages are presented in year of occurrence values, as reported by the NCDC.

3. Magnitude or Severity

Flooding only impacts a community to the degree that it affects the lives of its citizens and the community functions overall. Therefore, the most vulnerable areas of a community will be those most affected by floodwaters in terms of potential loss of life, damages to homes and businesses, and disruption of community services and utilities. For example, an area with a highly developed floodplain is significantly more vulnerable to the impacts of flooding than a rural or undeveloped floodplain where potential floodwaters would have little impact on the community.

The severity of a flood on a community can be magnified to the degree floodwaters affect special needs populations and critical facilities. Special needs populations are those that may require special assistance during a flood event, may not be able to protect themselves prior to an event, or may not be able to understand potential risks. These can include non-English speaking populations, elderly populations, or those in a lower socioeconomic group. Tourists and visitors to the area also have increased vulnerability, as they are less familiar with the geography of the area and the typical means of warning residents regarding dangerous conditions.



The impacts of floodwaters on critical facilities, such as police and fire stations, hospitals, and water or wastewater treatment facilities can greatly increase the overall effect of a flood event on a community. In general, relatively few of these facilities are located in areas with a high risk from flooding.

As discussed above, relative sea-level rise due to land subsidence and global sea level changes that are projected to occur in association with climate change and the possibility of more intense precipitation events, which may translate into greater storm water run-off into the future, are expected to exacerbate flooding hazards.

4. Previous Occurrences

Arlington County

From 1950 through 2015, NCDC recorded 45 flood events in Arlington County. Of these events, 11 were designated as coastal flood/storm surge, 12 were coded as flash floods, 11 were attributed to heavy rain, and the remaining were categorized as flood.

Arlington County was included in DR 1655, which occurred June 23-July 6, 2006. A nearly stationary front draped across the area combined with several low pressure systems and produced several waves of heavy rainfall across Northern Virginia over this 5-day stretch. Rainfall totals over this period were in the double digits at several locations. The pinnacle of the flooding occurred on June 26th. The VRE commuter line ceased operations and flooding in underground tunnels forced much of the Washington Metro rail service to close. Numerous roadways across the region were also underwater. Water rescues were needed for motorists that became trapped in floodwaters. In Huntington, flooding-related damages lead to 158 homes being declared uninhabitable due to contamination and lack of utilities.

On August 11, 2001, showers and thunderstorms with very heavy rainfall and frequent lightning moved across Northern Virginia during the afternoon of the 11th. In Arlington County, heavy rainfall washed out a culvert and created a sinkhole. Trees were downed along streams when the waterways overflowed their banks. Flooded roads and downed power lines were reported in North Arlington where a total of 5½ inches of rain was recorded.

Fairfax County

From 1950 through 2015, NCDC received reports of 34 flood events in Fairfax County. Of these events, two were categorized as coastal flood/storm surge events, six as flash flood events, 11 were attributed to heavy rain, and the remaining 15 as flood.

Fairfax County was included in DR 1655, which occurred June 23-July 6, 2006. A nearly stationary front draped across the area combined with several low pressure systems and produced several waves of heavy rainfall across Northern Virginia over this 5-day stretch. Rainfall totals over this period were in the double digits at several locations. The pinnacle of the flooding occurred on June 26th. The VRE commuter line ceased operations and flooding in underground tunnels forced much of the Washington Metro rail service to close. Numerous roadways across the region were also underwater. Water rescues were needed for motorists that became trapped in



floodwaters. In Huntington, flooding-related damages lead to 158 homes being declared uninhabitable due to contamination and lack of utilities.

On June 21-24, 1972, Hurricane Agnes entered Virginia as a tropical depression that produced widespread severe flooding. Sixteen inches of rain were recorded in Chantilly in Fairfax County resulting in major flooding of the Potomac River. Peak flows in the Potomac River basin ranged from two to six times previously known maximums. The Potomac River crested at 15.5 feet, 8.5 feet above flood stage.

Loudoun County

From 1950 through 2015, NCDC recorded 130 flood events in Loudoun County. Of the recorded events, 57 were categorized as flash flood events, 16 were attributed to heavy rain, and the remaining 57 as flood events.

On September 23, 2003, six inches of rain in four hours caused major flooding across the region, but particularly in Loudoun County. During the morning of the 23rd, heavy rain fell on top of already saturated ground from Hurricane Isabel, which struck a few days before. This led to widespread flooding of roads, waterways, and other low lying areas. Widespread flooding was reported, especially in the Leesburg, Purcellville, Bluemont, Aldie, and Middleburg areas.

Across the county, over 50 roads were affected by flooding. Lime Kiln Road, Evergreen Mills Road, and Route 15 were underwater for over 24 hours after Goose Creek surged nearly 11 feet above bank full stage. The Little River flooded the Oatlands Mill area and five people had to be rescued from their homes by boat. One farmhouse along Oatlands Mills Road had water up to its second story, and in Aldie the local firehouse sustained significant flood damage. St. Louis Road was completely washed away. In Leesburg, Tuscarora Creek and Town Branch overflowed into yards, basements, and parking lots. Two vans in a parking lot along Town Branch were washed downstream and residents along Shenandoah Street had to be evacuated. The Sheriff's Office administrative building was heavily damaged after the heavy rain collecting on the roof caused the ceiling to collapse. Across the county, 60 basements were flooded.

On August 11, 2001, showers and thunderstorms with very heavy rainfall and frequent lightning moved across Northern Virginia during the afternoon of the 11th. In Loudoun County, high water stranded motorists in Sterling and the bridge at Lawson Road in Leesburg was impassible after a stream overflowed its banks.

Loudoun County was included in DR 1098, which occurred January 19-February 1, 1996. Snowmelt, combined with one to three inches of rain (some locations received nearly five inches), caused the worst regional flooding in over 10 years. Warming temperatures melted most of the snow on the ground within 12 hours. The snow pack had a liquid equivalent of between two to three inches. River flooding began along the headwaters of all basins and continued downstream through the 22nd, with crests ranging from three to 21 feet above flood stage. High water caused millions of dollars in damage, closed roads, destroyed homes and businesses, and forced the evacuation of several towns.



Prince William County

From 1950 to 2015, NCDC recorded 84 flood events in Prince William County. Of these events, two were recorded as storm surge, 59 were categorized as flash floods, and the remaining 23 as flood events.

On August 11, 2001, showers and thunderstorms with very heavy rainfall and frequent lightning moved across Northern Virginia during the afternoon of the 11th. In Prince William County, side roads were flooded by heavy downpours in Manassas. Four homes and two cars were damaged by flood waters.

City of Alexandria

From 1950 through 2015, NCDC recorded 33 flood events as impacting the City of Alexandria. Of these events, 13 were attributed to coastal flooding/storm surge, nine were categorized as flash floods, and 11 as floods.

Alexandria was included in DR 1655, which occurred June 23-July 6, 2006. A nearly stationary front draped across the area combined with several low pressure systems and produced several waves of heavy rainfall across Northern Virginia over this 5-day stretch. Rainfall totals over this period were in the double digits at several locations. The pinnacle of the flooding occurred on June 26. The VRE commuter line ceased operations and flooding in underground tunnels forced much of the Washington Metro rail service to close. Numerous roadways across the region were also underwater. Water rescues were needed for motorists that became trapped in floodwaters. In Huntington, flooding-related damages lead to 158 homes being declared uninhabitable due to contamination and lack of utilities.

On January 19-February 1, 1996, Alexandria was affected by snowmelt, combined with one to three inches of rain (some locations received nearly five inches), caused the worst regional flooding in over 10 years. Warming temperatures melted most of the snow on the ground within 12 hours. The snow pack had a liquid equivalent of between two to three inches. River flooding began along the headwaters of all basins and continued downstream through the 22nd, with crests ranging from three to 21 feet above flood stage. High water caused millions of dollars in damage, closed roads, destroyed homes and businesses, and forced the evacuation of several towns. Several kayakers were also rescued while trying to navigate the rough waters. Flood waters covered Union Street and the lower part of King Street along the river in Old Town Alexandria, and affected Washington National Airport, but not the runways.

City of Fairfax

From 1950 through 2015, NCDC recorded 34 flood events for the City of Fairfax. Five events were categorized as flash floods, three as coastal flood/storm surge, 11 were attributed to heavy rain, and the remaining 15 events were flood events.

On August 11, 2001, showers and thunderstorms with very heavy rainfall and frequent lightning moved across Northern Virginia during the afternoon of the 11th. Water covered roads in the City of Fairfax.



City of Falls Church

NCDC recorded 36 flood events as impacting the City of Falls Church from 1950 through 2015. Ten of these events were categorized as coastal flood/storm surge, 13 were attributed to heavy rain, six were noted as flash floods, and the remaining seven were described as flood events.

On August 11, 2001, showers and thunderstorms with very heavy rainfall and frequent lightning moved across Northern Virginia during the afternoon of the 11th. In Falls Church, more than three inches of rain fell in two to three hours. The Red Cross Chapter Headquarters was damaged when water flooded a portion of the building.

City of Manassas

NCDC recorded 28 flood events for the City of Manassas from 1950 through 2015. Of these, eight were recorded as flash floods, one was attributed to storm surge, nine were described as heavy rain, and the remaining 10 were described as flood events.

In July 2013, the City experienced torrential rain that resulted in significant flooding at the corner of Portner and Battle Streets. Several private residences were flooded. The City's storm water system was also damaged, resulting in cleanup costs estimated at \$1.2 million, some of which was due to the age of the storm water system.

City of Manassas Park

From 1950 through 2015, NCDC recorded 18 flood events for the City of Manassas Park. Of these events, one was storm surge, two were flash floods, eight were attributed to heavy rain, and the remaining seven were described as flood events.

Town of Clifton

The Town of Clifton reported no events or damages from flooding, and none were recorded by NCDC from 1950 through 2015.

Town of Dumfries

NCDC recorded seven flood events for the Town of Dumfries from 1950 through 2015. Of these, one was recorded as storm surge, two were flood events, and the remaining four were described as flood events.

Town of Haymarket

NCDC recorded nine flood events for the Town of Haymarket from 1950 through 2015. Of these, two were flood events, and the remaining seven were described as flash flood events.

Town of Herndon

NCDC recorded nine flood events for the Town of Herndon from 1950 through 2015. Of these, three were flood events, three were heavy rain events, and the remaining three were described as flash flood events.



Town of Leesburg

NCDC recorded 38 flood events for the Town of Leesburg from 1950 through 2015. 17 events were described as flash floods, six were attributed to heavy rain, and the remaining 15 were recorded as flood events.

Town of Lovettsville

NCDC recorded one flood event impacting the Town of Lovettsville from 1950 through 2015. This event was recorded as a flash flood event in 1996.

Town of Middleburg

NCDC recorded 13 flood events for the Town of Middleburg from 1950 through 2015. Seven events were described as flash floods, two were attributed to heavy rain, and the remaining four were recorded as flood events.

Town of Occoquan

NCDC recorded one flood event impacting the Town of Occoquan from 1950 through 2015. This event was recorded as a flash flood event in 1996.

Town of Purcellville

NCDC recorded 16 flood events for the Town of Purcellville from 1950 through 2015. Nine events were described as flash floods, and the remaining seven were recorded as flood events.

Town of Quantico

NCDC recorded six flood events for the Town of Quantico from 1950 through 2015. Of these, two were flood events, one was attributed to storm surge, and the other three were described as flash flood events.

Town of Round Hill

NCDC recorded four flood events for the Town of Round Hill from 1950 through 2015 – two flash floods and two flood events.

Town of Vienna

NCDC recorded seven flood events for the Town of Vienna from 1950 through 2015. Two events were described as flash floods, three were attributed to heavy rain, and the remaining two were recorded as flood events.

National Flood Insurance Program (NFIP)

The Flood Insurance and Mitigation Administration, a component of FEMA, manages the NFIP. The three components of the NFIP are:

1. Flood Insurance;
2. Floodplain Management; and
3. Flood Hazard Mapping.

Nearly 20,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In



exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Community participation in the NFIP is voluntary.

Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods. Flood damage is reduced by nearly \$1 billion a year through communities implementing sound floodplain management requirements and property owners purchasing flood insurance. Additionally, buildings constructed in compliance with NFIP building standards suffer approximately 80% less damage annually than those not built in compliance.

In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the Nation's floodplains. Mapping flood hazards creates broad-based awareness of flood hazards, and provides the data needed for floodplain management programs and to actuarially rate new construction for flood insurance.

Table 4.22 shows the dates each of the jurisdictions were identified with Flood Hazard Boundary Maps (FHBMs), when the first FIRM became effective, the date of the current FIRMs used for insurance purposes, and the date the community entered into the NFIP.

Table 4.22. Communities Participating in the NFIP.

Community Name	Init FHBMs Identified	Init FIRM Identified	Current Effective Map Date	Reg-Emer Date
Arlington County	--	10/1/1969	8/19/13	12/31/1976
Fairfax County	5/5/1970	3/5/1990	9/17/2010	1/7/1972
<i>Town of Herndon</i>	6/14/1974	8/1/1979	9/17/2010	8/1/1979
<i>Town of Vienna</i>	8/2/1974	2/3/1982	9/17/2010	2/3/1982
<i>Town of Clifton</i>	3/28/1975	5/2/1977	9/17/2010	5/2/1977
Loudoun County ¹	4/25/1975	1/5/1978	7/5/2001	1/5/1978
<i>Town of Leesburg</i>	8/30/1974	9/30/1982	7/5/2001	9/30/1982
<i>Town of Purcellville</i>	7/11/1975	11/15/1989	7/5/2001	11/15/1989
<i>Town of Middleburg</i>	--	7/5/2001	7/5/2001	7/31/2001
<i>Town of Round Hill</i>	5/13/1977	7/5/2001	7/5/2001	1/10/2006
Prince William County	1/10/1975	12/1/1981	8/3/2015	12/1/1981
<i>Town of Dumfries</i>	6/18/1976	5/15/1980	8/3/2015	5/15/1980
<i>Town of Haymarket</i>	8/9/1974	1/17/1990	1/5/1995	1/31/1990
<i>Town of Occoquan</i>	7/19/1974	9/1/1978	1/5/1995	9/1/1978
<i>Town of Quantico</i>	11/1/1974	8/15/1978	8/3/2015	8/15/1978
City of Alexandria	8/22/1969	8/22/1969	6/16/2011	5/8/1970

¹ Loudoun County is currently participating in RiskMAP; map effective dates are expected to change during the lifecycle of the 2016 plan update.

**Table 4.22. Communities Participating in the NFIP.**

Community Name	Init FHBM Identified	Init FIRM Identified	Current Effective Map Date	Reg-Emer Date
City of Fairfax	5/5/1970	12/23/1971	6/2/2006	12/17/1971
City of Falls Church	9/6/1974	2/3/1982	7/16/2004	2/3/1982
City of Manassas	5/31/1974	1/3/1979	1/5/1995	1/3/1979
City of Manassas Park	3/11/1977	9/29/1978	1/5/1995	9/29/1978

as of 3/29/16 <http://www.fema.gov/cis/VA.html>

As of October 31, 2015, there was a total of 9,626 flood insurance policies in-force in the Northern Virginia region. These policies amounted to more than \$6.6 million in flood insurance premiums paid in the region. Approximately 2,058 claims have been filed, accounting for more than \$23 million in payments. Table 4.23 shows the NFIP policy statistics for each of the participating jurisdictions of the Northern Virginia region.

Table 4.23. NFIP policy and claim statistics.

County	Community Name	Policy Statistics (as of 10/31/2015)		Claim Statistics 1/1/1978 – 10/31/2015	
		Policies In-Force	Premiums Paid	Total Claims	Total Payment
Arlington County	Arlington County	650	\$346,450	129	\$372,316
	<i>Total</i>	<i>650</i>	<i>\$346,450</i>	<i>129</i>	<i>\$372,316</i>
Fairfax County	Fairfax County	4,849	\$3,060,806	1,028	\$10,554,103
	Town of Herndon	80	\$55,705	12	\$19,356
	Town of Vienna	120	\$82,120	19	\$222,630
	Town of Clifton	8	\$8,176	3	\$48,969
	<i>Total</i>	<i>5,057</i>	<i>\$3,206,807</i>	<i>1,062</i>	<i>\$10,835,058</i>
Loudoun County	Loudoun County	741	\$402,773	129	\$1,659,242
	Town of Leesburg	124	\$90,571	8	\$140,160
	Town of Lovettsville	6	\$2,497	-	-
	Town of Purcellville	9	\$3,283	-	-
	Town of Middleburg	19	\$4,691	-	-

**Table 4.23. NFIP policy and claim statistics.**

County	Community Name	Policy Statistics (as of 10/31/2015)		Claim Statistics 1/1/1978 – 10/31/2015	
		Policies In-Force	Premiums Paid	Total Claims	Total Payment
	Town of Round Hill	2	\$872	-	-
	<i>Total</i>	901	\$504,687	137	\$1799,402
Prince William County	Prince William County	1,351	\$856,788	150	\$4,630,540
	Town of Dumfries	16	\$20,703	9	\$34,842
	Town of Haymarket	4	\$1,803	1	\$0
	Town of Occoquan	34	\$57,025	19	\$65,187
	Town of Quantico	4	\$2,364	-	-
	<i>Total</i>	1,409	\$1,877,366	179	\$4,730,569
City of Alexandria	City of Alexandria	1,155	\$1,112,202	266	\$3,762,441
	<i>Total</i>	1,155	\$1,112,202	266	\$3,762,441
City of Fairfax	City of Fairfax	172	\$301,415	50	\$885,955
	<i>Total</i>	172	\$301,415	50	\$885,955
City of Falls Church	City of Falls Church	172	\$181,571	45	\$399.413
	<i>Total</i>	172	\$181,571	45	\$399413
City of Manassas	City of Manassas	90	\$64,445	30	\$215,536
	<i>Total</i>	90	\$64,445	30	\$215,536
City of Manassas Park	City of Manassas Park	20	\$17,927	7	\$94,804
	<i>Total</i>	20	\$17,927	7	\$94,804
NOVA Total:		9,626	\$6,674,187	2,057	\$23,105,494

Floodplain management regulations are the cornerstone of NFIP participation. Communities that participate in the NFIP are expected to adopt and enforce floodplain management regulations. These regulations apply to all types of floodplain development and ensure that development activities will not cause an increase in future flood damages. Buildings are required to be elevated at or above the BFE.



Repetitive Loss Properties

A Repetitive Loss Property is a property that is insured under the NFIP and has filed two or more claims in excess of \$1,000 each, within a 10-year period. Nationwide, Repetitive Loss properties constitute 2% of all NFIP insured properties, but are responsible for 40% of all NFIP claims. Mitigation for Repetitive Loss properties is a high priority for FEMA, and the areas in which these properties are located typically represent the most flood prone areas of a community.

The identification of Repetitive Loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Repetitive Loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund. Under the NFIP, FEMA defines a Repetitive Loss property as “any NFIP-insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced: a) four or more paid flood losses; or b) two paid flood losses within a 10-year period that equal or exceed the current value of the insured property; or c) three or more paid losses that equal or exceed the current value of the insured property.”

A second category of Repetitive Loss properties has been identified, for those properties that have sustained the highest levels of damages and claims; these are known as Severe Repetitive Loss properties. Severe Repetitive Loss properties are defined as any building that is covered under a Standard Flood Insurance Policy (SFIP) and has sustained flood damage for which: (a) four or more separate claim payments have been made under a SFIP, with the amount of each claim exceeds \$5,000, and with the cumulative amount of such claims exceeding \$20,000; or (b) at least two separate claims payments have been made under a SFIP, with the cumulative amount of those payments exceeding the fair market value of the insured structure as of the day before the loss.

A primary goal of FEMA is to reduce the number of structures that meet these criteria, whether through elevation, acquisition, relocation, or a flood-control project that lessens the potential for continual losses.

According to FEMA, there are currently 135 Repetitive Loss properties and three Severe Repetitive Loss properties within the Northern Virginia region. The specific addresses of the properties are maintained by FEMA, VDEM, and local jurisdictions, but are deliberately not included in this Plan as required by law.⁶ All of these properties are unmitigated; 35 of them are also uninsured. The insured properties have been paid more than \$9.3 million from 332 payable claims. Table 4.24 shows the total number of properties, total number of losses experienced, and losses paid for all of the communities within the planning region that have Repetitive Loss or Severe Repetitive Loss properties, according to data obtained from the NFIP through the State Floodplain Coordinator.

Table 4.24 Repetitive Loss and Severe Repetitive Loss Properties, as of October 2015.

Jurisdiction	Number of Repetitive Loss Properties			Total Number of Losses	Total Building Payment	Total Contents Payment	Total Payment
	Residential	Non-Residential	Total				
Arlington County	2	0	2	4	\$102,468	\$16,827	\$119,295
Fairfax County	76	1	77	160	\$3,015,231	\$200,340	\$3,215,571
Town of Herndon	1	0	1	2	\$5,928	\$0	\$5,928
Town of Clifton	1	0	1	2	\$18,983	\$24,750	\$42,733
Loudoun County	13	1	14	46	\$1,097,410	\$336,513	\$1,433,922
Prince William County	17	1	18	61	\$1,478,608	\$285,097	\$1,763,705
City of Alexandria	6	6	12	30	\$1,312,222	\$559,065	\$1,871,287
City of Fairfax	5	0	5	12	\$519,284	\$71,864	\$591,148
City of Falls Church	1	0	1	3	\$166,432	\$13,836	\$180,268
City of Manassas	3	1	4	10	\$46,664	\$23,845	\$70,509
City of Manassas Park	1	0	1	2	\$78,647	\$9,654	\$88,301
TOTAL	125	10	138	332	\$7,841,875	\$1,541,792	\$9,383,667



B. Risk Assessment

1. Probability of Future Occurrences

Periodic flooding of lands adjacent to rivers, streams, and shorelines (land known as floodplain) is a natural occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

A 100-year flood is not a flood that occurs every 100 years. In fact, the 100-year flood has a 26 percent chance of occurring during a 30-year period, the typical length of many mortgages. The 100-year flood is a regulatory standard used by Federal agencies, States, and NFIP-participating communities to administer and enforce floodplain management programs. The 100-year flood is also used by the NFIP as the basis for insurance requirements nationwide⁷. The main recurrence intervals used on the FIRMs are shown in the table below (Table 4.25).

Table 4.25. Annual probability based on flood recurrence intervals.	
Flood Recurrence Interval	Annual Chance of Occurrence
10 –year	10.0%
50–year	2.0%
100–year	1.0%
500–year	0.2%

Flooding remains a highly likely occurrence throughout the identified flood hazard areas of the Northern Virginia region. Smaller floods caused by heavy rains and inadequate drainage capacity in urbanized areas will be more frequent, but not as costly as the large-scale floods which may occur at much less frequent intervals.

2. Impact & Vulnerability

A number of factors contribute to the relative vulnerabilities of certain areas in the floodplain. Development, or the presence of people and property in the hazardous areas, is a critical factor in determining vulnerability to flooding. Additional factors that contribute to flood vulnerability range from specific characteristics of the floodplain to characteristics of the structures located within the floodplain.

The following is a brief discussion of some of these factors and how they may relate to the Northern Virginia planning region.

- Flood depth: The greater the depth of flooding, the higher the potential for significant damages.
- Flood duration: The longer duration of time that floodwaters are in contact with building components, such as structural members, interior finishes, and mechanical equipment, the greater the potential for damage.
- Velocity: Flowing water exerts forces on the structural members of a building, increasing the likelihood of significant damage.



- Elevation: The lowest possible point where floodwaters may enter a structure is the most significant factor contributing to its vulnerability to damage due to flooding.
- Construction Type: Certain types of construction are more resistant to the effects of floodwaters than others. Typically, masonry buildings, constructed of brick or concrete blocks, are the most resistant to damages simply because masonry materials can be in contact with limited depths of flooding without sustaining significant damage. Wood frame structures are more susceptible to damage because the construction materials used are easily damaged when inundated with water.

3. Risk

Riverine HAZUS^{MH} analysis was completed for the 2016 revision using 100-year scenarios. The following section summarizes the module and highlights the results and differences of the HAZUS^{MH} runs. The detailed reports of the HAZUS^{MH} run results can be found in Appendix D.

HAZUS^{MH} is a regional multi-hazard loss estimation model that was developed by FEMA and the National Institute of Building Sciences. The primary purpose of HAZUS^{MH} is to provide methodology and software application to develop multi-hazard losses at a regional scale. The loss estimates are used primarily by local, State, and regional officials to plan and stimulate efforts to reduce risk from multi-hazards and prepare for emergency response and recovery⁸.

Potential loss estimates analyzed in HAZUS^{MH} include:

- Physical damage to residential and commercial buildings, schools, essential facilities, and infrastructure; and
- Economic loss including lost jobs, business interruptions, repair and reconstruction costs.

The HAZUS^{MH} Flood Model analyzes both riverine and coastal flood hazards. Flood hazard is defined by a relationship between depth of flooding and the annual chance of inundation to that depth. Hazard analysis of the 100-year return interval was performed in order to assess risk to essential facilities.

Depth, duration, and velocity of water in the floodplain are the primary factors contributing to flood losses. Other hazards associated with flooding that contribute to flood losses include channel erosion and migration, sediment deposition, bridge scour and the impact of flood-born debris. The HAZUS^{MH} Flood Model allows users to estimate flood losses due to flood velocity to the general building stock. The agricultural component will allow the user to estimate a range of losses to account for flood duration. The flood model does not estimate losses due to high velocity flash floods at this time. Building stock exposure is discussed in detail in the HAZUS^{MH} building stock portion of the HIRA.

The flood analysis for the HIRA was completed using the FEMA HAZUS^{MH} software for riverine flood hazards. This assessment has been completed for streams and reaches within the identified study region with a drainage area of ten square miles. The flood depth grid was developed for the 100-year return period.

Loss estimation for this HAZUS^{MH} module is based on specific input data. The first type of data includes square footage of buildings for specified types or population. The second type of data



includes information on the local economy that is used in estimating losses. Table 4.26 displays the economic loss categories used to calculate annualized losses by HAZUS^{MH}. Data for this analysis has been provided at the census block level.

Table 4.26. HAZUS^{MH} direct economic loss categories and descriptions.

Category Name	Description of Data Input into Model	HAZUS Output
Building	Cost per sq. ft. to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Replacement value by occupancy	Cost of damage to building contents
Inventory	Annual gross sales in \$ per sq. ft.	Loss of building inventory as contents related to business activities
Relocation	Rental costs per month per sq. ft. by occupancy	Relocation expenses (for businesses and institutions)
Income	Income in \$ per sq. ft. per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services, or sales
Rental	Rental costs per month per sq. ft. by occupancy	Loss of rental income to building owners
Wage	Wages in \$ per sq. ft. per month by occupancy	Employee wage loss as described in income loss

Annualized loss is one way to determine the maximum potential annual loss. This is useful for creating a common denominator by which different types of hazards can be compared. Annualized losses are the summation of losses over all return periods multiplied by the probability of occurrence.

The HAZUS^{MH} flood analysis predicts that the Northern Virginia region can expect, annually, \$1,061,851,000 in damages due to flood events. Property or “capital stock” losses make up about \$1,059,291,000 of the damages 99.7%. This includes the values for building, content, and inventory. Business interruption accounts for 0.3% of the annualized losses and includes income, rental, wage, and relocation costs.

Table 4.27 illustrates the expected annualized losses. The majority of the expected damages for all jurisdictions can be attributed to building and content value. The flood model incorporates NFIP entry dates to distinguish pre-FIRM and post-FIRM census blocks.

The stream threshold used to delineate stream reaches included a 10 mi² threshold. The stream threshold influenced a lack of stream delineation within two communities: the City of Fairfax and City of Falls Church. This does not mean streams or floodplains do not exist in these communities, however it does mean that the automated, GIS-based method used to define a sub-watershed and the number of grid cells flowing through the community was less than the 10 mi² threshold. In order to try and compensate for the lack of data for these two communities,



coupled with the need to quantify other flood-related loss estimates, additional flood model work was performed using the 100-year scenario.

For the flood scenario models, the built-in default inventory of assets - known as the Comprehensive Data Management System (CDMS) - was utilized. No adjustments were made to the inventory to account for any locally-reporting critical assets. Therefore, discrepancies may appear related to critical assets between self-reported data, such as historic occurrences, and HAZUS-generated data, such as the data in this section. See Appendix D for a description of the methodology used for the flood scenarios described in this section, and the grouping of counties, cities, and towns in each model.

Table 4.27. HAZUS^{MH} Flood Module Annualized Building Loss (2015 dollars)

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Arlington County & the City of Falls Church	\$60,000	\$70,000	\$34,000	\$0	\$0	\$0	\$0	\$131,000
Fairfax County, the City of Fairfax, & the Towns of Clifton, Herndon, & Vienna	\$163,482,000	\$116,257,000	\$1,802,000	\$179,000	\$115,000	\$30,000	\$239,000	\$282,104,000
Loudoun County & the Towns of Leesburg, Lovettsville, Purcellville, Middleburg, & Round Hill	\$216,864,000	\$150,661,000	\$1,089,000	\$284,000	\$181,000	\$92,000	\$448,000	\$369,619,000
Prince William County, the City of Manassas Park, & the Towns of Dumfries, Haymarket, Occoquan, & Quantico	\$216,772,000	\$160,654,000	\$2,953,000	\$227,000	\$256,000	\$60,000	\$343,000	\$380,893,000
City of Alexandria	\$12,895,000	\$9,852,000	\$33,000	\$18,000	\$12,000	\$6,000	\$9,000	\$22,825,000
City of Manassas	\$2,362,000	\$3,846,000	\$10,000	\$7,000	\$37,000	\$5,000	\$12,000	\$6,279,000
Total	\$612,435,000	\$441,340,000	\$5,921,000	\$715,000	\$601,000	\$193,000	\$1,051,000	\$1,061,851,000



Essential Facilities Risk

The vulnerability of the region's building stock was assessed using GIS analysis by comparing the physical location with the extent of known hazard areas that can be spatially defined through GIS technology. Tables 4.28 and 4.29 summarize the number of potentially at-risk essential facilities in the region to flood by jurisdiction and facility type. These determinations are based solely on best available data for critical facility locations and delineable hazard areas for. The actual level of risk for each facility may only be determined by further on-site assessments.

Table 4.28. Number of HAZUS^{MH} Critical Facilities Potentially At-Risk to Flood.

Jurisdiction	Fire Stations	Hospitals	Police Stations	Schools	EOCs
Arlington County	0	0	0	0	0
Fairfax County	0	0	0	0	0
Town of Herndon	0	0	0	0	0
Town of Vienna	0	0	0	0	0
Town of Clifton	0	0	0	0	0
Loudoun County	0	0	0	0	0
Town of Leesburg	0	0	0	0	0
Town of Lovettsville	0	0	0	0	0
Town of Purcellville	0	0	0	0	0
Town of Middleburg	0	0	0	0	0
Town of Round Hill	0	0	0	0	0
Prince William County	0	0	1	0	0
Town of Dumfries	0	0	0	0	0
Town of Haymarket	0	0	0	0	0
Town of Occoquan	0	0	0	0	0
Town of Quantico	0	0	0	0	0
City of Alexandria	0	0	0	0	0
City of Fairfax	0	0	0	0	0
City of Falls Church	0	0	0	0	0
City of Manassas	0	0	0	0	0
City of Manassas Park	0	0	0	0	0

**Table 4.29. HAZUS^{MH} Estimate: Shelter Requirements.**

Jurisdiction	# of Displaced People	# of People Needing Short-Term Sheltering
Arlington County	0	0
Fairfax County	3,065	2,016
Town of Herndon	0	0
Town of Vienna	0	0
Town of Clifton	0	0
Loudoun County	3,641	2,961
Town of Leesburg	0	0
Town of Lovettsville	0	0
Town of Purcellville	0	0
Town of Middleburg	0	0
Town of Round Hill	0	0
Prince William County	4,601	3,329
Town of Dumfries	0	0
Town of Haymarket	0	0
Town of Occoquan	0	0
Town of Quantico	0	0
City of Alexandria	685	627
City of Fairfax	0	0
City of Falls Church	0	0
City of Manassas	0	2
City of Manassas Park	0	0

Information for the HAZUS^{MH} identified critical facilities in the flood zones is available in Appendix D, as is information regarding the potential flood risk for locally-identified critical assets for each jurisdiction.

The most vulnerable properties to flooding in the Northern Virginia region are located in SFHAs identified by FEMA through the completion of detailed Flood Insurance Studies. The DFIRMs depicting the SFHAs in Appendix D illustrate the location of these areas for each jurisdiction based upon the most up-to-date digital floodplain data as provided by the FEMA Map Service



Center. Digital data was available for all of the localities within the Northern Virginia planning region.

4. Overall Loss Estimates and Ranking

The loss estimates and ranking results for the flood hazard in the Northern Virginia region is principally based on the results of the detailed GIS and HAZUS^{MH} analysis, NCDC storm events, and the Commonwealth of Virginia's 2013 HIRA.

There have been a number of past flooding events throughout the region, ranging widely in terms of location, magnitude, and impact. The most frequent flooding events are quite localized in nature, resulting from heavy rains in a short period of time over urbanized areas that are not able to appropriately handle storm water runoff. These events typically do not threaten lives or property and will not result in emergency or disaster declarations, thus historical data is difficult to obtain. Table 4.21 (earlier in this section) summarizes the number of flood events since 1950 which have caused a notable impact on the Northern Virginia region as recorded by the NCDC. This includes 553 flood events that have caused approximately \$16.6 million in property and crop damages.

The Commonwealth of Virginia's 2013 hazard mitigation plan ranking was based on the NCDC database. This update to the Northern Virginia plan used this same framework to establish a common system for evaluating and ranking hazards. The geographic extent score for each jurisdiction is based on the percent of the jurisdiction that falls within the SFHA, as defined by FEMA.

For the 2016 plan update, the qualitative assessment was organized by participating jurisdiction. Jurisdictions with a determined probability of 'Highly Likely' were determined to have 'High' vulnerability to the flood hazard. Those with 'Likely' probabilities were determined to have 'Moderate' vulnerability. Those with 'Unlikely' probability were determined to have 'Low' vulnerability.

Arlington County

Table 4.30. 2016 Qualitative Assessment for Flood.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.31. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*Fairfax County***Table 4.32. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.33. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*Town of Clifton***Table 4.34. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Minor	Negligible	6 to 12 hours	Less than one week

Table 4.35. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*Town of Herndon***Table 4.36. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.37. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*Town of Vienna***Table 4.38. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.39. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Loudoun County***Table 4.40. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.41. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Town of Leesburg***Table 4.42. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.43. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Town of Lovettsville***Table 4.44. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Moderate	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.45. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Town of Middleburg***Table 4.46. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.47. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Town of Purcellville***Table 4.48. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.49. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Town of Round Hill***Table 4.50. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Moderate	Moderate	6 to 12 hours	Less than one week

Table 4.51. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Minor	Negligible	More than 24 hours	More than one week

*Prince William County***Table 4.52. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.53. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*Town of Dumfries***Table 4.54. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.55. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*Town of Haymarket***Table 4.56. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.57. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Town of Occoquan***Table 4.58. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Minor	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.59. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*Town of Quantico***Table 4.60. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.61. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*City of Alexandria***Table 4.62. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.63. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*City of Fairfax***Table 4.64. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.65. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*City of Falls Church***Table 4.66. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week

Table 4.67. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week

*City of Manassas***Table 4.68. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.69. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

*City of Manassas Park***Table 4.70. 2016 Qualitative Assessment for Flood.**

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Critical	Moderate	6 to 12 hours	Less than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

Table 4.71. 2016 Qualitative Assessment for Erosion.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Minor	Negligible	More than 24 hours	More than one week
	Probability	Impact	Spatial Extent	Warning Time	Duration

VII. Winter Storm

NOTE: As part of the 2016 plan update, the Winter Storm hazard was reexamined and new analyses performed. This new analyses included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining the number of hazard events and losses by jurisdiction using NCDC and other data sources (where available); 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4 Section IV Ranking and Analysis Methodologies. Extreme Cold was separated from the winter storm section for the 2016 plan update, and included in the Extreme Temperatures section. Each section of the plan was also reformatted for improved clarity, and new maps and imagery, when available and appropriate, were inserted.



A. Hazard Profile

1. Description

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Some winter storms impact multi-State regions. Winter storms may be accompanied by low temperatures, ice, and heavy and/or blowing snow, which can severely impair visibility.

Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Sleet – raindrops that freeze into ice pellets before reaching the ground – usually bounce when hitting a surface and do not stick to objects; however, sleet can accumulate like snow and cause a hazard to motorists. Freezing rain is rain that falls onto a surface with a temperature below freezing, forming a glaze of ice. Even small accumulations of ice can cause a significant hazard, especially on power lines and trees. An ice storm occurs when freezing rain falls and freezes immediately upon impact. Communications and power can be disrupted for days, and even small accumulations of ice may cause extreme hazards to motorists and pedestrians.

A freeze is weather marked by low temperatures, especially when below the freezing point (zero degrees Celsius or 32 degrees Fahrenheit). House fires and carbon monoxide poisoning are possible as people use supplemental heating devices (wood, kerosene, etc.) and fuel burning lanterns or candles for emergency lighting.

2. Geographic Location/ Extent

The Northern Virginia region is located in a part of the country that experiences hazardous winter weather conditions, including severe winter storms that bring heavy accumulations of snow, sleet, and freezing rain. On average, the region receives approximately 15 to 21 inches of snow annually. The region's biggest winter storms are typically associated with Nor'easters. During these events, winds around the storm's center can become intense, building waves that erode the Potomac shoreline and sometimes pile water inland causing extensive coastal flooding and severe erosion. These systems may also produce blinding snowfall that can accumulate to a foot or more or mixed precipitation that may leave a coating of ice. Other types of winter weather systems are more of a nuisance and generally do not cause major damage. Weather systems such as the "Alberta Clipper" (a fast moving storm from the Alberta, Canada region), or a cold front sweeping through from the west, generally do not bring more than a few inches of snow in a narrow 50 to 60-mile-wide band. Figures 4.24 and 4.25 (later in this chapter) show the average number of days in Virginia with at least 3 and 6 inches of snowfall, as calculated by VDEM.

3. Magnitude or Severity

The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin and Louis Uccellini attempts to rank Northeast snowstorms based on the impacts these systems have on society. The scale is broken into five categories ranging from Category 1 which is considered a "Notable" event, to a Category 5 which is considered "Extreme." The amount of snowfall for a particular storm and the population impacted are the factors used in assigning NESIS values. This scale is



mentioned here as background information for the reader and is infrequently referenced by the media or the NWS in describing significant snowfall events.

4. Previous Occurrences

Since 1996, there have been 461 winter storm event reports recorded by the NCDC for the Northern Virginia region, causing more than \$1 million in crop and property damage. (Most storm damages are attributable to traffic accidents and roof or other structural collapses. It is important to note that the considerable costs associated with lost wages and business opportunities, lowered productivity, and snow and ice removal are not factored into NCDC loss estimates, and are therefore not accounted for here.) Table 4.72 illustrates the distribution of these events. Note that the NCDC records winter storm events at a geographic county level, and because of this, all towns and cities within the same geographic area are included in the storm and damage estimates for that area. This is because of the typically widespread spatial nature of winter storm events. Therefore, the table below illustrates the data in the same manner, by geographic area, with specific jurisdictions included noted.

Table 4.72. Winter Storm Events in the Northern Virginia Region, 1996–2015, based on NCDC data.

Jurisdiction	# of Winter Storm Events	Property Damage	Crop Damage	Total
Arlington County, the City of Alexandria, & the City of Falls Church	97	\$460,000	\$0	\$460,000
Fairfax County, the City of Fairfax, & the Towns of Clifton, Herndon, and Vienna	123	\$335,000	\$0	\$335,000
Loudoun County & the Towns of Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill	131	\$135,000	\$100,000	\$235,000
Prince William County, the City of Manassas, the City of Manassas Park, & the Towns of Dumfries, Haymarket, Occoquan, and Quantico	110	\$55,000	\$0	\$55,000
Total	461	\$985,000	\$100,000	\$1,085,000

Planning Area Occurrences

The winter of 2014 was particularly harsh in the planning area. In January, four separate storms moved through the area, each dumping ice or snow in the area. The January 21st event was



particularly harsh, with the majority of the planning area receiving in excess of five inches of snow. The City of Manassas reported receiving 6-10 inches of snow, and partially activating their EOC for the event. February 12-13 saw the next round of snow, with more than two inches falling on the 12th and another six inches or more falling the next day. March 3rd saw yet another round of significant snowfall throughout the area, with more than five inches recorded throughout the area; some area, such as the City of Manassas, reported accumulations of 6-10 inches.

Arlington County, Fairfax County, Loudoun County, Prince William County, the City of Alexandria, the City of Fairfax, the City of Falls Church, the City of Manassas, and the City of Manassas Park were all included in DR 1905, which occurred February 5-11, 2010. This event was declared as a result of severe winter storms and snowstorms. Record-breaking snowfall fell over Northern Virginia and much of the Mid-Atlantic. A storm system moving through the Midwest phased with another system moving across the South, growing more powerful off the Carolina coast. The system then tracked northeast and then east along the Mid-Atlantic coast before heading out to sea. Snow began during the afternoon hours of February 5 and continued into the early evening of February 6. As much as 32.4 inches fell over the two-day period at the NWS Forecast Office in Sterling, Virginia near Dulles International Airport, with 17.8 inches at Ronald Reagan Washington National Airport. Whether by air, rail, or roadway, travel became nearly impossible, as winds gusting over 35 mph whipped snow into drifts of up to four feet deep. This storm was the second paralyzing snowstorm of the season for what would turn out to be (according to NWS data) northern Virginia's snowiest winter on record. The storm was nicknamed 'Snowpocalypse' and 'Snowmageddon' by local media and others. The snow forced the shutdown of the Federal government for four and a half consecutive days.

A dry, powdery snow accompanied by wind gusts of 40 to 50 mph caused white-out conditions across a considerable portion of northern Virginia, particularly on the morning of February 10. Snow drifts up to four feet high leftover from the storm of February 5-6 and up to a foot of additional accumulation from this storm brought travel in the area to a standstill once again. Conditions were so fierce that at 7am, the Virginia Department of Transportation ceased snowplow operations citing visibility of less than 100 feet at times. Total accumulations from this storm were greatest over the eastern and northern sections of the region where 10 to 14 inches was common near the borders with the District of Columbia and Maryland. Lighter amounts of generally 5 to 9 inches fell over the rest of the region.

Arlington County, Fairfax County, Prince William County, the City of Alexandria, the City of Fairfax, the City of Falls Church, the City of Manassas, and the City of Manassas Park were also included in DR 1874, which occurred December 18-20, 2009. A storm system that formed over the Gulf of Mexico gathered strength as it tracked to a position off the Carolina coast and then along the Eastern Seaboard. Snow began over northern Virginia during the evening of Friday, December 18, and continued into much of the following day. The storm caused travel to ground to a halt as roads, railways, and runways became snow covered and in some cases impassable. The initial heavy, wet nature of the snow combined with winds that gusted to over 35 mph at times left thousands in the Mid-Atlantic without power. Ronald Reagan Washington National Airport recorded 15 inches of snow on December 19, for a two-day storm total of 16.4 inches.



Slightly higher amounts fell just to the west and south with Dulles International Airport receiving 19.3 inches.

B. Risk Assessment

1. Probability of Future Occurrences

The probability of future winter weather events is usually determined based on an examination of the historical frequency of occurrence of such events. The NCDC Storm Events database contains winter weather events and damages dating back to 1996, but it does not systematically document the magnitude or intensity of each event. The NCDC database also records these events at a geographic county level, with individual accounts from municipalities or unincorporated areas of the county included in the reports. Long-term weather station observation data provides more detailed information on event magnitude (as measured by snowfall depth, precipitation types, and temperature), but does not provide any information regarding historical impacts.

Rather than relying solely on existing climatology information, independent analyses of weather station data were performed for the Commonwealth of Virginia Emergency Operations Plan to estimate the probability of specific winter weather occurrences.

Using daily weather station data involves decisions about which weather stations to include in the analysis and how to handle any gaps in the data record. In deciding which weather stations to use, the location, period of record, and data variables reported are the key considerations. Virginia stations with substantially complete data from 1960 through 2000 were chosen for the Virginia Hazard Mitigation Plan analysis. Small interruptions or gaps exist in these stations' data records, which may indicate periods when the station was not operational. Entire years with no data were removed from consideration when conducting the analyses in this report, but smaller data gaps were ignored. As a result, the statistics generated from this data may slightly underestimate the frequency or intensity of winter weather phenomena. Future plan updates might consider more involved techniques, which could potentially improve this area of the analysis.

As part of the analysis for the State plan, weather station data was downloaded from the NCDC archives. A selection of cooperative weather stations operating between 1960 and 2000 was loaded into a Microsoft Access database in order to determine the annual frequency of occurrence of certain conditions. The daily station data variables relevant to this investigation include 24-hour snowfall depth, minimum temperature, and daily weather type codes.

The NCDC archives, and specifically the Daily Surface Data records (DS3200 / 3210 / 3205 / 3206), provide data in comma-delimited text files, which must be transformed in order to create a database table as a single daily record. This transformation was accomplished using a macro written with Visual Basic for Applications in Access. This macro converts the data from its original format, with all days of a month in one record, to a format containing only one day per record. With the daily data thus transformed, a second macro calculated and reported the annual frequency of occurrence for user-specified conditions. In this instance, the probability that a given year would contain at least three days with three inches of snowfall was examined.



Figures 4.24 and 4.25 are a selection of results from CGIT analysis of the daily snowfall and temperature weather station data from the Virginia Hazard Mitigation Plan. These figures illustrate a general trend towards more frequent and more intense winter weather at higher elevations and at higher latitudes. In these figures, the station-specific statistics have been used as the basis for a seamless statewide estimate based on multiple linear regressions between the weather statistics (dependent variable) and elevation and latitude (independent variables). The analysis shows that the average number of days with at least three inches of snowfall varies from approximately two to almost seven days in western portions of Loudoun County, to two to three days throughout the remainder of Northern Virginia. The average number of days with at least six inches of snowfall was between one and 1.5 over western sections of Loudoun County and generally one day or fewer in the remainder of Northern Virginia. This data was validated for this plan update, and found to be accurate.

Based on this analysis and the historical record, winter storms will remain a highly likely occurrence for the entire Northern Virginia region. If history continues to hold true, western sections of Loudoun County can expect a slightly higher likelihood of experiencing accumulating snowfall relative to the remainder of Northern Virginia.

Long range climate modeling suggests that as the planet warms, a trend of more winter precipitation taking the form of liquid precipitation, rather than snowfall would result.⁹ Future hazard mitigation plan updates might consider factoring the latest climate science as part of a quantitative method for determining the probability of future occurrence of wintry weather.

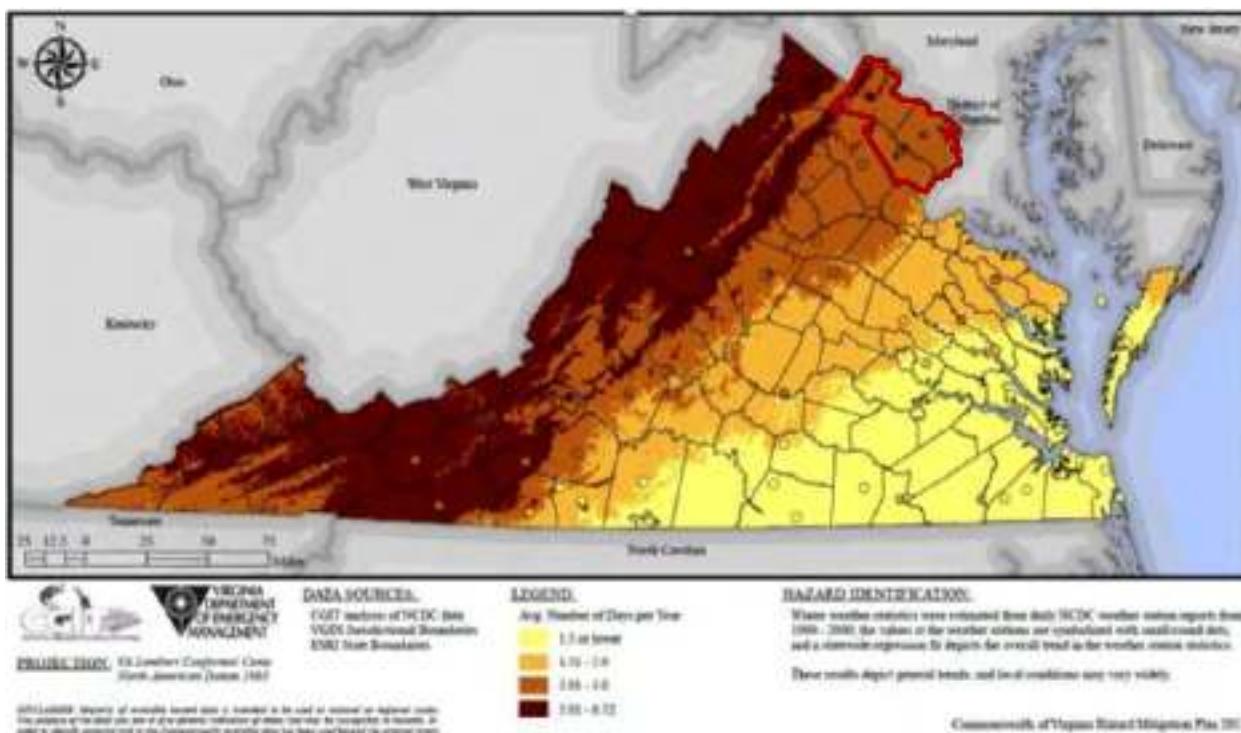


Figure 4.24. Average Number of Days with at Least Three Inches of Snow.

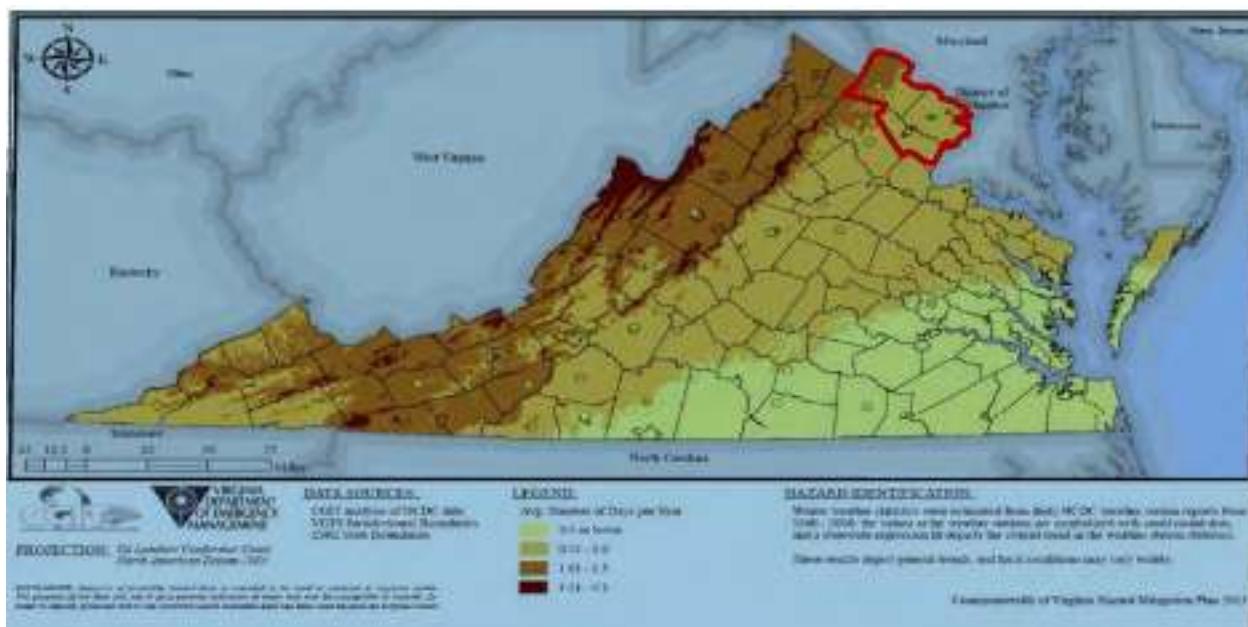


Figure 4.25. Average Numbers of Days with at Least Six Inches of Snow.



2. Impact & Vulnerability

Winter storm vulnerability can be thought of in terms of individual, property, and societal elements. For example, the exposure of individuals to extreme cold, falling on ice-covered walkways, and automobile accidents is heightened during winter weather events. Property damage due to winter storms includes damage done by and to trees, water pipe breakage, structural failure due to snow loads, and injury to livestock and other animals. The disruption of utilities and transportation systems, as well as lost business and decreased productivity are vulnerabilities of society as a whole. The vulnerability to these damages varies in large part due to specific factors; for example, proactive measures such as regular tree maintenance and utility system winterization can minimize property vulnerability. Localities accustomed to winter weather events are typically more prepared to deal with them and therefore less vulnerable than localities that rarely experience winter weather.

The impacts of winter storms are primarily quantified in terms of the financial cost associated with preparing for, response during, and recovering from them. The primary source of data providing some measurement of winter storm impacts is the NCDC Storm Events database. The database includes winter event data back to 1993, but is not necessarily complete or consistent from event to event. Although a more comprehensive, labor-intensive analysis consisting of using weather station data, NCDC damages, and other data sources could possibly produce an intensity-damage relationship between winter weather occurrences and resultant damages, this type of analysis was not performed for the update of this or the State Plan. The branches of government most often affected by winter storms include the Virginia Department of Transportation and local public works and transportation departments. Roadway treatment operations often begin in advance of a winter storm, and continue for as long as necessary.

3. Risk

Risk, as defined as probability multiplied by impact, cannot be fully estimated for winter storms due to the lack of intensity-damage models for this hazard. Instead, estimates of the financial impacts of winter storms can be developed based on NCDC winter weather event data that runs from January 1996 to December 2015. Examination of NCDC data shows that there were at least 461 winter weather events in the database, producing an estimated annualized loss of \$57,105, based on total estimated losses of more than \$1 million for the 19-year period of record.

The winter weather frequency data from the Commonwealth shows a strong trend toward more winter weather occurring in areas at higher latitudes and at higher elevations. The mountainous western portion of the State and the northern portions of the State, including Northern Virginia, experience winter weather more often and with greater severity than other portions of Virginia. While the magnitude of damages from winter storms are perhaps not typically as great as experienced in association with extreme flooding or a severe earthquake, winter storms occur much more frequently and usually over broader areas. In addition, storm events with relatively low intensity can nevertheless cause significant impacts, especially in areas unaccustomed to such events.

Losses associated with winter storms are typically related to snow removal and business interruption, although power failure is also a significant secondary hazard commonly associated with winter storms, and particularly ice events. In addition to the impacts on transportation,



power transmission, and communications, severe winter storms in the Northern Virginia region have at times cause severe property damage due to roof collapses. According to FEMA, most injuries and fatalities related to winter storms are caused by vehicle accidents and hypothermia. The entire Northern Virginia region is generally equally susceptible to winter storms, and has experienced similar numbers of events and levels of damage. Due to higher residential and commercial densities, Arlington and Fairfax counties may be more severely impacted by winter storms in terms of interruption to services (transportation, communication, etc.), but are not considered significantly more vulnerable.

Critical Facility Risk

Quantitative assessment of critical facilities for winter storm risk was not feasible for this update. Even so, it is apparent that transportation structures are at greater risk from winter storms. In addition, building construction type – particularly roof span and construction method, are factors that determine the ability of a building to perform under severe stress weights from snow. Finally, not all critical facilities have redundant power sources and may not even be wired to accept a generator for auxiliary heat. Future plan updates should consider including a more comprehensive examination of critical facility vulnerability to winter storms.

Existing Buildings and Infrastructure Risk

Risk to existing buildings and infrastructure is largely determined by building construction type – particularly roof span and construction method. Both are factors that determine the ability of a building to perform under severe stress weights from snow.

Overall Loss Estimates and Ranking

The Commonwealth of Virginia's 2013 HIRA ranking was based largely on the NCDC storm events database. The 2016 update to the Northern Virginia plan used this same framework to establish a common system for evaluating and ranking hazards. In determining a score and ranking for winter storm, the geographic extent score for each jurisdiction is based on the analysis of the average annual number of days receiving at least three inches of snow (Figure 4.24, calculated as an area weighted average for each jurisdiction.) The methodology for the scoring and ranking of hazards is described in detail in the Risk Assessment and Methodology section. Based on this methodology, all of Northern Virginia is considered at 'High' risk for winter storms and winter weather.

For the 2016 plan update the qualitative assessment was performed by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard. Therefore, to avoid repetition, Table 4.73 provides the results of the qualitative assessment for all participating jurisdictions, as all jurisdictions were found to have the same results.

Table 4.73. 2016 Qualitative Assessment for Winter Storm.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week



VIII. High Wind/ Severe Storms (Including thunderstorms and hurricanes)

NOTE: As part of the 2016 plan update, the High Wind/Severe Storm hazard was reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profiles; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4, Section IV Ranking and Analysis Methodologies. Each section of the plan was also reformatted for improved clarity and new maps and imagery, when available and appropriate, were inserted.

a. Hazard Profile

i. Description

Wind is the motion of air past a given point caused by a difference in pressure from one place to another. Wind poses a threat to Northern Virginia in many forms, including wind produced by severe thunderstorms and tropical weather systems. The effects can include blowing debris, interruptions in elevated power and communications utilities, and intensified effects of winter weather. Harm to people and animals as well as damage to property and infrastructure may result.

Severe Thunderstorms

According to the NWS, more than 100,000 thunderstorms occur each year in the United States, though only about 10% of these storms are classified as *severe*. A thunderstorm with wind gusts in excess of 58 miles per hour (50 knots) and/or hail with a diameter of 3/4" or more is classified as a severe thunderstorm. Although thunderstorms generally affect a small area, they are dangerous because of their ability to generate tornadoes, hail, strong winds, flash flooding, and lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those areas are ideal for generating and feeding these powerful storms.

Thunderstorms are caused when air masses of varying temperatures and moisture content meet. Rapidly rising warm moist air serves as the driving force for thunderstorms. These storms can occur singularly, in lines, or in clusters. They can move through an area very quickly or linger for several hours.

Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a bolt when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching



Multiple cloud-to-ground and cloud-to-cloud lightning strikes observed during a nighttime thunderstorm.
(Photo courtesy of NOAA Photo Library, NOAA Central Library; OAR/ERL/National Severe Storms Laboratory)



50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 89 people are killed each year by lightning strikes in the United States.

Some storms produce a particular type of high wind called a derecho. Derechos are widespread, long-lived, straight-line wind storms associated with severe thunderstorms. They can cause hurricane-force winds, tornadoes, heavy rains, and flooding. Derechos travel quickly, with sustained winds that often exceed hurricane-force. They typically occur in the summer months, though they can occur any time of year and at any time of the day or night.

ii. Geographic Location/ Extent

Although most frequent in the Southeast and parts of the Midwest, thunderstorms are a relatively common occurrence across Northern Virginia and have been known to occur in all calendar months. The NWS collected data for thunderstorm days, number and duration of thunder events, and lightning strike density for the 30-year period from 1948 to 1977. The analysis of this data determined that on average, 50 to 60 thunderstorm events occur annually in Northern Virginia. No one portion of Northern Virginia is deemed to be more likely to experience thunderstorms than another portion of the region.

Figure 4.26 illustrates thunderstorm hazard severity based on the annual average number of thunder events from 1948 to 1977. The planning area is highlighted in green on the map.

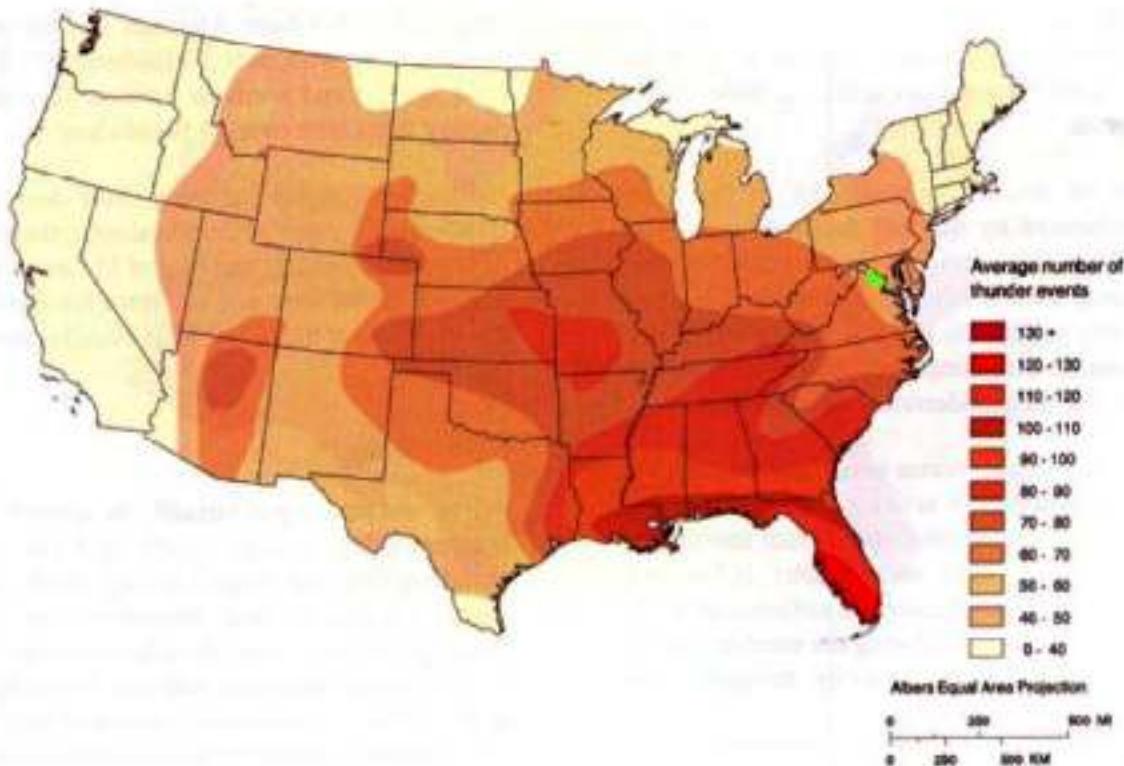


Figure 4.26. Annual Average Number of Thunder Events.

Source: Federal Emergency Management Agency



iii. Magnitude or Severity

Straight-line winds, which in extreme cases have the potential to cause wind gusts that exceed 100 miles per hour, are responsible for most thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation. Figure 4.27 shows how the frequency and strength of extreme windstorms vary across the United States. The map was produced by FEMA and is based on 40 years of tornado history and over 100 years of hurricane history. Zone IV, the darkest area on the map, has experienced both the greatest number of tornadoes and the strongest tornadoes. As shown by the map key, wind speeds in Zone IV can be as high as 250 MPH. As depicted in this figure, the planning area is highlighted in green and falls within Zone II, a hurricane-susceptible region where winds can be as high as 160 MPH.

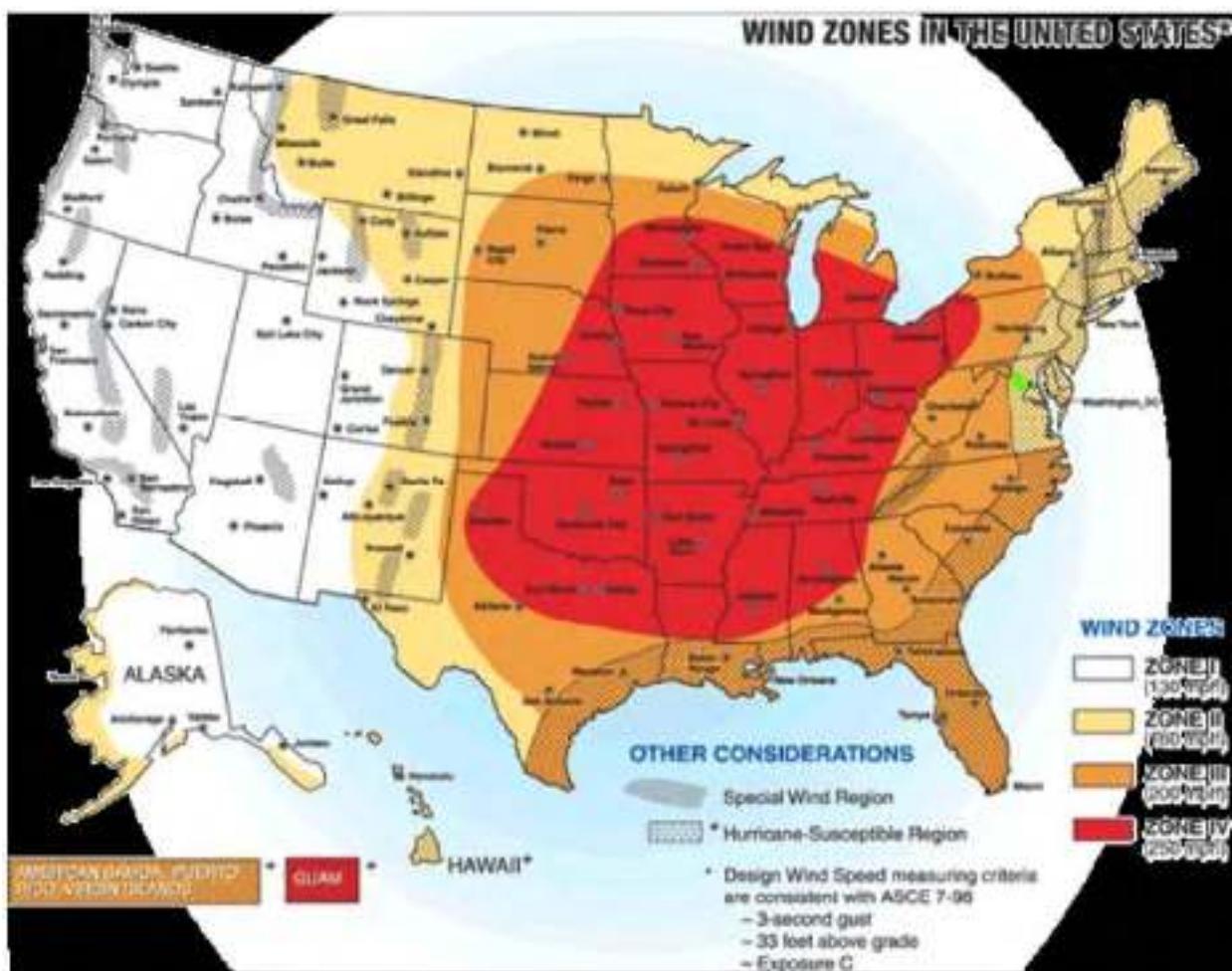


Figure 4.27. Wind Zones in the United States.

Source: Federal Emergency Management Agency



Hailstorms are another potential damaging outgrowth of severe thunderstorms. Early in the developmental stages of a hailstorm, ice crystals form within a low-pressure front due to the rapid rising of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation — as balls or irregularly shaped masses of ice greater than 0.75 in. (1.91 cm) in diameter. The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Higher temperature gradients relative to elevation above the surface result in increased suspension time and hailstone size. Figure 4.28 shows the annual frequency of hailstorms in the United States. The planning area is highlighted in green on the map.



Large hail collects on streets and grass during a severe thunderstorm. Larger stones appear to be nearly two to three inches in diameter. (NOAA Photo Library, NOAA Central Library; OAR/ERL/National Severe Storms Laboratory)

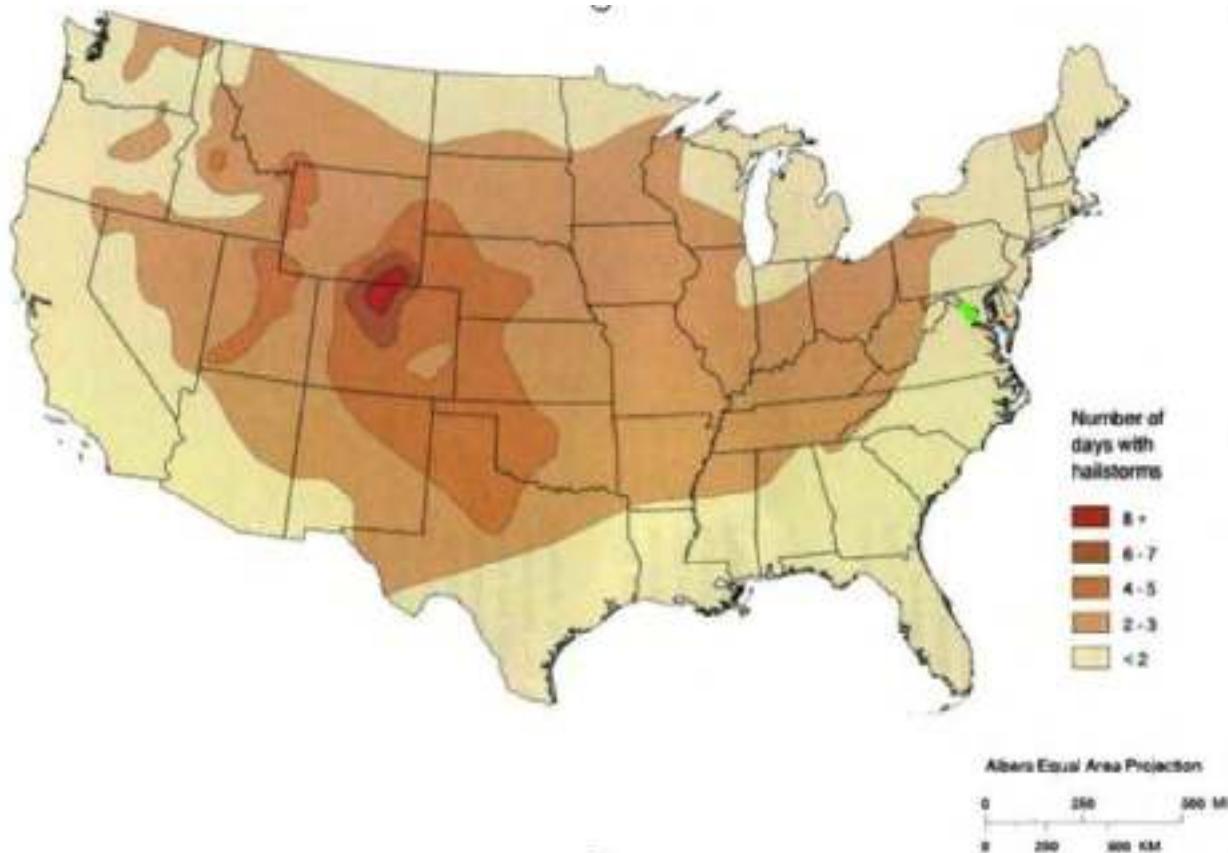


Figure 4.28. Annual Frequency of Hailstorms in the United States
Source: Federal Emergency Management Agency



Though more frequent in the Mississippi River Valley, derechos occur often enough in the eastern United States for the National Weather Service to map their typical frequency of occurrence. Figure 4.29 illustrates the typical distribution of occurrences, as determined by the NWS. Based on this data, the planning area, which is highlighted in green, could expect to experience at least one derecho every 2-4 years, on average.



Figure 4.29. Derecho Climatology in the United States.

Source: The National Weather Service Forecast Office, Cleveland, Ohio.

In addition to high winds and hail associated with these events, severe storms can also bring dangerous lightning that can cause fires, property damage, and death or serious injury to humans.

iv. Previous Occurrences

There have been a number of past severe storm and high wind events throughout the region, ranging widely in terms of location, magnitude, and impact; these events are captured and reported by the NCDC. Where possible, NCDC tracks reports separately by impacted jurisdiction; it is not always possible, however, to estimate damages below a county or city level. In most cases, therefore, damages that were reported for counties and cities include damages that occurred within towns. Therefore, Table 4.74 illustrates the number of events reported by participating jurisdiction, and the number of injuries reported, but assumes that all reported damage estimates are captures at the county and city level. To avoid duplication, no damages are



reported in the table following for towns. This table summarizes the number of severe storm and high wind events (by participating jurisdiction) since 1950 which have caused a notable impact on the Northern Virginia region as recorded by the NCDC. This includes 1,344 events that have caused approximately \$101.6 million in property and crop damages and have resulted in approximately 87 injuries. In addition, at least four fatalities were recorded by NDCD – two each in Fairfax and Loudoun Counties.

Note: In the case of Fairfax County and the City of Fairfax, the number of events reported, the number of fatalities and injuries, and the approximate dollar amount of damages reported were identical, leading to the conclusion that the reports for each jurisdiction are duplicates. Therefore, for the purposes of this calculation, the jurisdictions were combined into a single line item, to avoid over-estimation of occurrences and damages.

Table 4.74. Severe Storm & High Wind Events in the Northern Virginia Region, 1950–2015 based on NCDC data.

Jurisdiction	# of Severe Storm & High Wind Events	Property Damage	Crop Damage	Total
Arlington County	144	\$10,318,000	\$5,750	\$10,323,750
Fairfax County & the City of Fairfax	63	\$20,468,000	\$40,000	\$20,508,000
Loudoun County	434	\$2,943,000	\$289,600	\$3,232,600
Prince William County	191	\$17,365,000	\$81,750	\$17,446,750
City of Alexandria	90	\$9,720,000	\$0	\$9,720,000
City of Fairfax	--	--	--	--
City of Falls Church	54	\$9,730,000	\$0	\$9,730,000
City of Manassas	52	\$15,556,000	\$79,000	\$15,635,000
City of Manassas Park	31	\$14,955,000	\$77,000	\$15,032,000
Town of Clifton	1	--	--	--
Town of Dumfries	27	--	--	--
Town of Haymarket	26	--	--	--
Town of Herndon	12	--	--	--
Town of Leesburg	70	--	--	--
Town of Lovettsville	33	--	--	--
Town of Middleburg	29	--	--	--
Town of Occoquan	1	--	--	--
Town of Purcellville	38	--	--	--
Town of Quantico	17	--	--	--
Town of Round Hill	21	--	--	--
Town of Vienna	10	--	--	--
Total	1344	\$101,055,000	\$573,100	\$101,628,100



Arlington County

In late June and early July of 2012, the planning area experienced a number of severe storms and straight-line winds, including a derecho – a phenomenon that previously had not been recorded in the planning area. These storms resulted in DR-4072, issued on July 27, 2012.

Fairfax County - including the Town of Clifton, the Town of Herndon, and the Town of Vienna

In late June and early July of 2012, the planning area experienced a number of severe storms and straight-line winds, including a derecho – a phenomenon that previously had not been recorded in the planning area. These storms resulted in DR-4072, issued on July 27, 2012.

Loudoun County - including the Town of Leesburg, the Town of Lovettsville, the Town of Middleburg, the Town of Purcellville, and the Town of Round Hill

In late June and early July of 2012, the planning area experienced a number of severe storms and straight-line winds, including a derecho – a phenomenon that previously had not been recorded in the planning area. These storms resulted in DR-4072, issued on July 27, 2012.

On July 25, 2010, severe thunderstorms raked the area during the late afternoon producing damaging winds in excess of 60 mph that brought down trees and power lines. Torrential rainfall caused flash flooding of low-lying and poorly drained areas. A large tree struck and killed a child in Claude Moore Park near Sterling Park in Loudoun County. Numerous trees were also downed in Leesburg. A roof collapsed on a parking garage near Reston where wind gusts were estimated at 75 mph.

Prince William County - including the Town of Dumfries, the Town of Haymarket, the Town of Occoquan, and the Town of Quantico

In late June and early July of 2012, the planning area experienced a number of severe storms and straight-line winds, including a derecho – a phenomenon that previously had not been recorded in the planning area. These storms resulted in DR-4072, issued on July 27, 2012. In Prince William County, the derecho caused power outages and wind damages to the Public Safety Communications Center, resulting in the temporary loss of 911 service to the area.

City of Alexandria

On August 5, 2010, thunderstorm outflow winds of between 70 and 90 mph tore through parts of Northern Virginia knocking down hundreds of trees and power lines and causing extensive damage to homes, businesses, and vehicles. The mid-afternoon storms hit Arlington and Alexandria particularly hard and resulted in the closure of major roadways including the George Washington Parkway near Slaters Lane, and the loss of power to thousands of residents for several days. Damage from the storms also halted Metrorail service at Alexandria's King Street station for a time.

City of Fairfax

In late June and early July of 2012, the planning area experienced a number of severe storms and straight-line winds, including a derecho – a phenomenon that previously had not been recorded in the planning area. These storms resulted in DR-4072, issued on July 27, 2012.



City of Falls Church

In late June and early July of 2012, the planning area experienced a number of severe storms and straight-line winds, including a derecho – a phenomenon that previously had not been recorded in the planning area. These storms resulted in DR-4072, issued on July 27, 2012.

City of Manassas

The City of Manassas reported derecho winds of 60-80 MPH on June 29, 2012, with periodic gusts in excess of 50 MPH lasting for another 15-20 minutes. Because of these winds, the 911 call center was inoperable for approximately 36 hours, causing emergency services to rely on ham radio operators throughout the City.

City of Manassas Park

In late June and early July of 2012, the planning area experienced a number of severe storms and straight-line winds, including a derecho – a phenomenon that previously had not been recorded in the planning area. These storms resulted in DR-4072, issued on July 27, 2012. As a result of this derecho, the city experienced power outages.

b. Risk Assessment

i. Probability of Future Occurrences

Since severe storms are difficult to predict, it is extremely difficult to determine probability of future occurrence with any degree of accuracy. It can, however, with considerable confidence, based on historical record, be projected that Northern Virginia will continue to experience severe thunderstorms with great frequency – several times a year, in most cases. Based on analysis of previous events in the NCDC database, it appears that those events causing injury, death or damage have occurred on a seemingly random basis with no particular portion of Northern Virginia more likely to experience them than any other.

Climate change is projected to increase the frequency and intensity of extreme weather events, including severe thunderstorms. Using global climate models and a high-resolution regional climate model, one study that investigated the link between severe thunderstorms and global warming found a net increase in the number of days with environmental conditions that foster the development of severe thunderstorms. This was true for much of the United States, including northern Virginia.¹⁰

ii. Impact & Vulnerability

The Northern Virginia region faces uniform susceptibility to the effects of severe thunderstorms, including high winds, lightning, and hail.

Similar to hurricane and tropical storm force-winds, the most at-risk buildings to thunderstorm winds are assumed to include manufactured homes and older residential structures (see discussion under *Hurricanes and Tropical Storms*). Another great concern for the Northern Virginia region with regard to high winds is damage to electric power lines which regularly cause power outages for residents and businesses across the area, and have disrupted the availability of emergency services, including 911. During past events, storm winds have downed



trees across power lines, snapped utility poles and even blown down transformers resulting in widespread outages. Downed power lines create a dangerous threat to public safety; while difficult to quantify, long-term power outages can result in significant hardship for residents and major economic impacts for local businesses.

Lightning presents a significant threat to human safety and has historically caused injuries and death in the Northern Virginia region. Lightning has also been known to cause structural fires that can destroy property and present further life/safety issues. According to the Virginia State Climatology Office, most lightning related deaths and injuries in Virginia have been males between the ages of 20 and 40 years old who were caught outdoors on golf courses, ball fields, near open water or under trees.

Hail, while not a major threat to human safety, can be extremely destructive to crops and personal property (particularly vehicles, as well as roofs, siding, and windows of buildings). Most hail damage recorded for the Northern Virginia region has been in Fairfax and Loudoun counties, though all areas are considered to be equally at risk.

iii. Risk

Risk, as defined as probability multiplied by impact, cannot be fully estimated for damaging thunderstorm wind, hail, and lightning events due to the lack of intensity-damage models for these hazards. Instead, financial impacts of damaging thunderstorm events can be developed based on NCDC Storm Events data. Using this data, property and crop damage related to severe storm and high wind events totaled more than \$101 million.

Critical Facility Risk

Quantitative assessment of critical facilities for thunderstorm wind risk was not feasible for this update. Even so, the type and age of construction plays a role in vulnerability of facilities to thunderstorm winds. In general, concrete, brick, and steel-framed structures tend to fare better in thunderstorm wind events than older, wood-framed structures. Finally, it is important to note that not all critical facilities have redundant power sources and may not even be wired to accept a generator. Future plan updates should consider including a more comprehensive examination of critical facility vulnerability to thunderstorm winds.

Existing Buildings and Infrastructure Risk

Risk to existing buildings and infrastructure is largely determined by building construction type. As explained in Critical Facility Risk, concrete, brick, and steel-framed structures tend to fare better in thunderstorm wind events than older, wood-framed structures.

Overall Loss Estimates and Ranking

Based on data obtained from the NCDC Storm Event database (presented earlier in Table 4.74), severe storm and high wind events have produced a total of approximately \$101.6 million in property and crop damages for the region. Table 4.75 (following) provides a breakdown of these damages in both real estimates and an annualized format, by participating jurisdiction.

**Table 4.75. Loss Estimates Due to Severe Storms and High Winds.**

Jurisdiction(s)	Annualized Property and Crop Damage	Total Property and Crop Damage
Arlington County	\$158,827	\$10,323,750
Fairfax County & the City of Fairfax (including Town of Clifton, Town of Herndon, and Town of Vienna)	\$315,508	\$20,508,000
Loudoun County (including Town of Leesburg, Town of Lovettsville, Town of Middleburg, Town of Purcellville, and Town of Round Hill)	\$49,732	\$3,232,600
Prince William County (including Town of Dumfries, Town of Haymarket, Town of Occoquan, and Town of Quantico)	\$268,412	\$17,446,750
City of Alexandria	\$149,538	\$9,720,000
City of Fairfax	--	--
City of Falls Church	\$149,692	\$9,730,000
City of Manassas	240,538	\$15,635,000
City of Manassas Park	\$231,261	\$15,032,000
Total	\$1,563,509	\$101,628,100

For the 2016 plan update the qualitative assessment was organized by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard, and a vulnerability of ‘High’. Therefore, to avoid repetition, Table 4.76 provides the results of the qualitative assessment for all participating jurisdictions, as all jurisdictions were found to have the same results.

Table 4.76. 2016 Qualitative Assessment for High Wind & Severe Storms.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	6 to 12 hours	Less than one week



c. Hurricanes and Tropical Storms

Hurricanes and tropical storms, as well as nor'easters and typhoons, are classified as cyclones and defined as a closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a safety-valve, limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation, and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves, and tidal flooding which can be more destructive than cyclone wind.

The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force created by the earth's rotation, and the absence of significant wind shear in the lowest 50,000 feet of the atmosphere. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, or Gulf of Mexico during the official Atlantic hurricane season, which encompasses the months of June through November. The peak of the Atlantic hurricane season is in early to mid-September.

i. Geographic Location/ Extent

Although the Northern Virginia region rarely experiences the wrath of a direct land falling hurricane, it is located in an area quite susceptible to the remnants of such storms. This includes the perils of hurricane and tropical storm force winds, heavy rains, and significant storm surge and tidal flooding. These events can be extremely dangerous and costly across a large geographic area, as was learned during Hurricane Isabel in 2003 when the region suffered approximately \$32 million in damages (nearly \$2 billion statewide). In 2011, the remnants of Tropical Storm Lee impacted Fairfax and Prince William Counties, and the City of Alexandria. The storm dropped between five and seven inches of rain over the Northern Virginia area. In Fairfax County, VDOT estimated the storm caused approximately \$10 million in damages to roads and bridges throughout the county. In late October 2012, Hurricane Sandy blanketed the region with heavy rain and high winds, resulting in downed trees, debris issues, and transportation interruptions.

Figure 4.30 shows the probability of a named tropical storm or hurricane affecting any single area during a June to November Atlantic hurricane season. The figure was created by the NOAA's Hurricane Research Division using data from 1944 to 1999 and counting hits when a storm or hurricane was within approximately 100 miles (165 km) of each location.

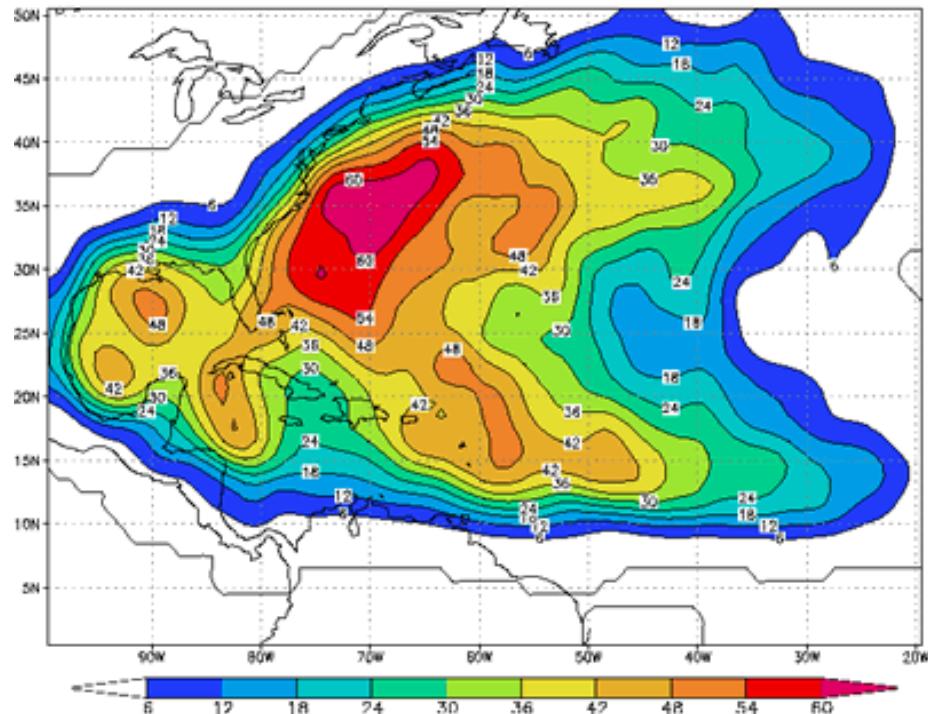


Figure 4.30. Empirical Probability of a Named Storm.

Source: National Oceanic and Atmospheric Administration, Hurricane Research Division

ii. Magnitude or Severity

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale currently in use by NOAA's National Hurricane Center (see Table 4.77), which rates hurricane intensity on a scale of 1 to 5, with 5 being the most intense.

Table 4.77. Saffir-Simpson Scale.

Category	Maximum Sustained Wind Speed (MPH)	Minimum Surface Pressure (Millibars)
1	74—95	Greater than 980
2	96—110	979—965
3	111—130	964—945
4	131—155	944—920
5	155+	Less than 920



The Saffir-Simpson Scale categorizes hurricane intensity based upon maximum sustained winds and barometric pressure which are combined to estimate potential damage. Categories 3, 4, and 5 are classified as “major” hurricanes, and while hurricanes within this range comprise only 20% of total tropical cyclone landfalls, they cause 70% of the damage in the United States. Table 4.78 describes expected damage per hurricane category.

Table 4.78. Hurricane Damage Classification.

Category	Damage Level	Description
1	Minimal	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage.
2	Moderate	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings.
3	Extensive	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
4	Extreme	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.
5	Catastrophic	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.

Source: National Hurricane Center

A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane, up to 20 feet or more in a Category 5 storm. The storm surge arrives ahead of the storm’s eye making landfall and the more intense the hurricane is, the sooner the surge arrives. Water rise can be very rapid, posing a serious threat to those who have not yet evacuated flood prone areas. A storm surge is a wave that has outrun its generating source and become a long period swell. The surge is highest in the right-front quadrant of the direction in which the hurricane is moving. As the storm approaches shore, the greatest storm surge will be to the north of the hurricane eye. Such a surge and associated breaking waves can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast.

Storm surge heights, and associated waves, are dependent upon the shape of the continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Damage during hurricanes may also result from spawned tornadoes and inland flooding associated with heavy



rainfall that usually accompanies these storms. Hurricane Floyd, as an example, was at one time a Category 4 hurricane racing towards the North Carolina coast. As far inland as Raleigh, the State capital located more than 100 miles from the coast, communities were preparing for extremely damaging winds exceeding 100 miles per hour. However, Floyd made landfall as a Category 2 hurricane and will be remembered for causing the worst inland flooding disaster in North Carolina's history. In Virginia, Floyd dropped 10-20 inches of rain over southeast Virginia, causing the closure of more than 300 roads from flooding and downed trees. A total of 64 jurisdictions were affected by the more \$255 million in storm damages.

Similar to hurricanes, nor'easters are ocean storms capable of causing substantial damage to coastal areas in the eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast. These storms track up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful.

Nor'easters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surfs that cause severe beach erosion and coastal flooding. There are two main components to a nor'easter: (1) a Gulf Stream low-pressure system (counter-clockwise winds) generated off the southeastern coast, gathering warm air and moisture from the Atlantic, and pulled up the East Coast generating strong northeasterly winds along the western forward quadrant of the storm; and (2) an Arctic high-pressure system (clockwise winds) which meets the low-pressure system with cold, arctic air blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation and have the potential for creating dangerously high winds and heavy seas. As the low-pressure system deepens, the intensity of the winds and waves will increase and cause serious damage to coastal areas as the storm moves northeast. Table 4.79 shows an intensity scale proposed for nor'easters that is based on levels of coastal degradation.

Table 4.79. Dolan-Davis Nor'easter Intensity Scale.

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

Source: North Carolina Division of Emergency Management



iii. Previous Occurrences

Most hurricanes and tropical storms that have affected Virginia have originated in the Atlantic Ocean. Since 1851, there have been a total of 32 storms to come within 75 miles of the Northern Virginia region. Other notable storms, including hurricanes Floyd (1999), Fran (1996), and Agnes (1972) are discussed herein, but were beyond the 75-mile radius used for this analysis. A chosen distance of 75 miles was used for this analysis in order to focus on those storms that came through areas closest to the Northern Virginia region. However, the effects of large hurricanes and tropical storms may be felt up to 200 miles away from the center of circulation. Six of these storms were classified as hurricanes (including Isabel in 2003 and Irene in 2011), and 25 as tropical storms as they impacted the region. These events are listed in Table 4.80 with a graphical depiction of historical hurricane tracks between 1851 and 2012 shown in Figure 4.31.

Table 4.80. Historical Hurricane and Tropical Storms in the Northern Virginia Region, 1851–2015.

Year	Month	Name	Wind Speed (MPH)	Intensity
1872	October	Not named	45	Tropical Storm
1874	September	Not named	60	Tropical Storm
1876	September	Not named	80	Category 1
1878	October	“Gale of ‘78”	105	Category 2
1882	September	Not named	45	Tropical Storm
1883	September	Not named	45	Tropical Storm
1888	September	Not named	50	Tropical Storm
1888	September	Not named	40	Tropical Storm
1893	August	Not named	70	Tropical Storm
1893	October	Not named	90	Category 1
1893	October	Not named	50	Tropical Storm
1896	September	Not named	80	Category 1
1899	October	Not named	65	Tropical Storm
1904	September	Not named	65	Tropical Storm
1928	September	Not named	45	Tropical Storm
1933	August	Not named	60	Tropical Storm
1943	October	Not named	40	Tropical Storm
1944	August	Not named	50	Tropical Storm
1945	September	Not named	40	Tropical Storm
1949	August	Not named	45	Tropical Storm
1952	September	Able	45	Tropical Storm
1954	October	Hazel	78	Tropical Storm
1955	August	Connie	60	Tropical Storm
1955	August	Diane	65	Tropical Storm
1979	September	David	45	Tropical Storm
1983	September	Dean	45	Tropical Storm
1992	September	Danielle	45	Tropical Storm
1996	July	Bertha	70	Tropical Storm
2003	September	Isabel	75	Category 1
2008	September	Hanna	40	Tropical Storm

**Table 4.80. Historical Hurricane and Tropical Storms in the Northern Virginia Region, 1851–2015.**

Year	Month	Name	Wind Speed (MPH)	Intensity
2011	September	Irene	120	Category 1
2011	September	Lee (remnants)	60	Tropical Storm
2012	October	Sandy ²	80	Category 1

Of these, eight storm tracks made direct paths through the region. This includes the “Gale of ’78,” a category 2 hurricane which is further described under Previous Occurrences. An additional 25 storm tracks for tropical depressions and extratropical systems came within 75 miles of the region.

Although some good narrative information has been gathered on the impacts of these events (see Previous Occurrences), data on estimated property damages could only be accessed through the NCDC since the mid-1990s. Table 4.81 summarizes estimated damage figures caused by hurricane and tropical storm events since 1993 as recorded by the NCDC, and includes all damages recorded for all participating jurisdictions. These events have amounted to more than \$45 million in property damages, most of which is attributable to effects of storm surge and tidal flooding resulting from the storms. More detailed information on historical hurricane and tropical storm events can be obtained through the NCDC Storm Event database, referenced earlier in this section.

Table 4.81. Historical Hurricane and Tropical Storm Damages in the Northern Virginia Region, 1993–2015, Based on NCDC Data.

Estimated Property Damage	
Total	\$45,204,000

² Note that the Northern Virginia area was not included in the designated disaster area for the federal disaster declaration, but did receive some impacts from the storm as it passed by the area.

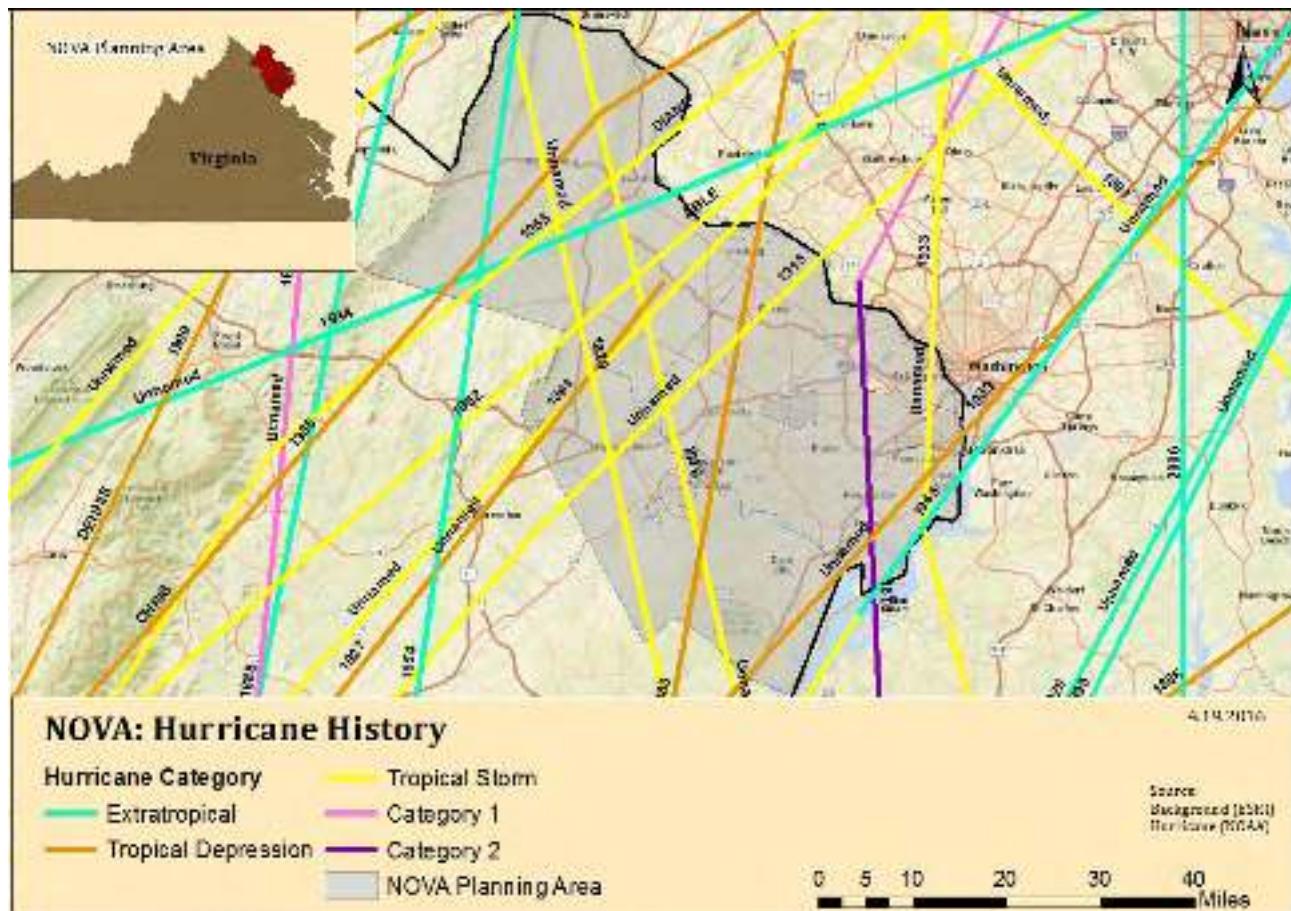


Figure 4.31. Historic Hurricane Tracks, 1851-2012

Significant Historical Events

Planning Area

On October 29, 2012, Hurricane Sandy passed by Northern Virginia on her way up the Atlantic Coast, before she turned northwest and made landfall northeast of Maryland. On her way, she brought high winds and heavy rains to the Northern Virginia regions, resulting in tropical storm force winds throughout the area, downed trees and power lines, river flooding, and some isolated flash flooding. Some structures were damaged throughout the area, mostly due to falling trees, which displaced some residents.

On September 4, 2011, Tropical Storm Lee made landfall in southern Louisiana. Several days later, the remnants of Lee arrived in Northern Virginia. Record rainfall, coming on the heels of Hurricane Irene a few days before, resulted in flooding of most of the creeks and waterways throughout Northern Virginia, leading to an estimated four fatalities, all from drowning. In Manassas Park, one home was displaced in a dry creek bed on the west side of the city.

On August 27-28, 2011, Hurricane Irene impacted the entire Northern Virginia area. Widespread power outages impacted utility production and distribution throughout the area, resulting in



several utility service providers being offline and tens of thousands of residents and businesses without electrical service. Trees were also downed throughout the area, and some minor flooding was reported, including basement flooding.

On September 6-7, 2008, Tropical Storm Hanna made landfall between North and South Carolina on September 6, 2008, with maximum sustained winds of near 70 mph. The storm tracked north and then northeast through eastern Virginia, traveling just to the east of Northern Virginia through the Chesapeake Bay, before moving into the Northeast and New England. Slowly weakening, maximum sustained winds were between 40 and 50 mph at the time of the center's closest proximity to Northern Virginia. Peak winds across Northern Virginia gusted to between 35 and 45 mph and the storm produced rainfall amount of three to eight inches across the area. Weak or decaying trees were downed and flooding of low-lying areas was reported.

On September 18-19, 2003, Hurricane Isabel made landfall on the North Carolina coast. Its huge wind field was already piling water up into the southern Chesapeake Bay. By the time Isabel moved into central Virginia, it had weakened and was downgraded to a tropical storm. Isabel's eye tracked well west of the bay, but the storm's 40 to 60 mph sustained winds pushed a bulge of water northward up the bay and its tributaries producing a record storm surge. The Virginia western shore counties of the Chesapeake Bay and the tidal tributaries of the Potomac, Rappahannock, and other smaller rivers, experienced a storm surge which reached five to nine feet above normal tides.

Arlington County had two homes destroyed and 46 with major damage, while another 146 residences had minor damage. Costs of flooding and damage from falling trees were estimated at \$2.5 million. In Fairfax County, 160 homes and 60 condominiums were flooded in the Bellevue area south of Alexandria. Over 2,000 units had minor to moderate damage from storm surge flooding. In addition, many trees fell causing additional property damage across the county. In Prince William County, seven homes were destroyed and 24 homes and three businesses had major damage. Scattered trees and wires were down causing roads to be closed. The storm surge washed away 20 feet of embankment along the Potomac which caused one of the CSX tracks to collapse along the Cherry Hill Peninsula. Damages at Quantico Marine Base were significant. Quantico's weather station recorded a two-minute sustained wind of 54 miles per hour with a peak gust of 78 miles per hour between 11 pm and Midnight on the 18th. Damages to the base included buildings, houses, and vehicles hit by fallen trees and flooding destroyed their marina. Total damages were reported to be \$9.5 million.

In Alexandria, the water level in Old Town reached 9.5 feet above sea level. Numerous businesses were flooded and the marinas were hard hit. Winds also knocked trees down around the city. Damages totaled \$2 million. Storm surge water flooded the employee parking lot of Ronald Reagan Washington National Airport. In the City of Fairfax, 15 homes had major damage from trees. Fairfax County damages came to \$18 million.

On September 16, 1999, Hurricane Floyd made landfall just east of Cape Fear, North Carolina, in the early morning hours of the 16th and moved north-northeast across extreme southeast Virginia to near Ocean City, Maryland, by evening on the 16th. Rain bands on the outer edge of the hurricane began to affect Northern Virginia shortly after 8:00 AM on the 15th and continued



to cross the area through afternoon on the 16th. Winds and rain combined to topple 130 trees in Arlington County and the City of Alexandria. One tree damaged a home and 4,500 power outages were reported. In Fairfax County, a 61-year-old woman was killed when a tree fell onto her car and crushed it on Fair Lakes Drive. In Loudoun County, a handful of trees were downed and a road was blocked near Mt. Weather. Siding was also torn from a few homes. In Prince William County, 17 trees came down on roads and power lines, and two homes were slightly damaged by fallen trees. One business was destroyed by fallen trees and another in Falls Church was damaged. A 70-foot oak tree fell onto a home and tore a hole in the 2nd floor, shattering windows and tearing off rain gutters. The tree also damaged a detached garage and a swing set. A few trees were downed in the Manassas area.

On September 6, 1996, the rapid runoff produced by the heavy rains from Hurricane Fran caused substantial, damaging, and in some cases record river flooding across much of the Northern Virginia watershed from late on the 6th until early on the 10th. Flash flooding on the 6th rapidly became river flooding late on the 6th along the headwaters of the Potomac, Shenandoah, and Rappahannock River basins, and continued throughout the basins over the weekend and into early the following week. Crests at gauging points in these basins were similar to those in January 1996 across the Lower Main Stem of the Potomac. Levels were one to five feet higher across the Upper Main Stem Potomac and Rappahannock Rivers. The Shenandoah Basin had levels similar to the October 1942 flood with three points reaching record levels (Lynnwood, Cootes Store, and Strasburg). There were numerous road closures, rescues, evacuations, washed out and damaged bridges, and culverts; the flood also produced major agricultural damage. Debris covered pasture and farmland, and filled small creeks and streams to levels higher than surrounding roads, which redirected the natural stream flow. River sand and mud covered streets and multiple levels of homes and businesses. There were several electric and phone outages. Three deaths occurred in the northern half of Virginia due to flash flooding.

Washington National Airport in southern Arlington County had damage with the river crest late Sunday into Monday morning. Flooding tore out security fence and flooded boat houses where rescue equipment is kept, while mud and debris had to be removed from the grounds.

In June 1972, Hurricane Agnes, in its tropical storm stage, caused torrential rains over Virginia and the Mid-Atlantic States. All rivers in Virginia were affected. Ten inches of rain fell over Northern Virginia resulting in widespread flash flooding and major flooding on the Potomac River.

On October 22-23, 1878, Hurricane Gale's eye made landfall at Cape Fear, NC and moved north across Richmond and Washington, DC, and seemed to lose little strength. The storm was thought to resemble that of Hurricane Hazel in 1954. Winds downed trees and fences and unroofed homes, and very high tides occurred on the coast. Fields of corn were submerged in the ensuing flood around Washington, DC. Rock Creek became a raging river, but produced little damage. Many young shade trees in the area were leveled. Telegraph lines fell between Baltimore and New York. Flooding from the Potomac inundated many basements and county roads crossing the Stickfoot Branch of the Anacostia River were washed out.



Arlington County

From 1950 through 2015, NCDC recorded four tropical storm events as impacting Arlington County, resulting in more than \$4.6 million in property damages and 26 injuries.

Fairfax County

From 1950 through 2015, NCDC reports describe six occurrences of tropical storms impacting Fairfax County. These tropical storms caused more than \$18 million in property and crop damages, one fatality, and one injury.

Loudoun County

NCDC recorded two tropical storms that impacted NCDC from 1950 through 2015. These events resulted in approximately \$5,000 in damages.

Prince William County

NCDC recorded impacts to Prince William County from three tropical storms between 1950 and 2015, resulting in more than \$14.5 million in property damages and approximately \$50,000 in crop damages. No injuries or fatalities were attributed to these events.

City of Alexandria

From 1950 through 2015, NDCCD recorded four occurrences of tropical storms impacting the City of Alexandria. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the City of Alexandria.

City of Fairfax

NDCCD reports verify that the City of Fairfax experienced six tropical storms from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the City of Fairfax.

City of Falls Church

For the City of Falls Church, NCDC reports verify that four tropical storms impacted the City between 1950 and 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the City of Falls Church.

City of Manassas

NCDC reports indicate that three tropical storms impacted the City of Manassas from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the City of Manassas.

City of Manassas Park

NCDC reports indicate that three tropical storms impacted the City of Manassas Park from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the City of Manassas Park.



Town of Clifton

NCDC reports indicate that no tropical storms impacted the Town of Clifton from 1950 through 2015.

Town of Dumfries

NCDC reports indicate that two tropical storms impacted the Town of Dumfries from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the Town of Dumfries.

Town of Haymarket

NCDC reports indicate that one tropical storm impacted the Town of Haymarket from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the Town of Haymarket.

Town of Herndon

NCDC reports indicate that two tropical storms impacted the Town of Herndon from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the Town of Herndon.

Town of Leesburg

NCDC reports indicate that one tropical storm impacted the Town of Leesburg from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the Town of Leesburg.

Town of Lovettsville

NCDC reports indicate that no tropical storms impacted the Town of Lovettsville from 1950 through 2015.

Town of Middleburg

NCDC reports indicate that no tropical storms impacted the Town of Middleburg from 1950 through 2015.

Town of Occoquan

NCDC reports indicate that no tropical storms impacted the Town of Occoquan from 1950 through 2015.

Town of Purcellville

NCDC reports indicate that no tropical storms impacted the Town of Purcellville from 1950 through 2015.



Town of Quantico

NCDC reports indicate that one tropical storm impacted the Town of Quantico from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the Town of Quantico.

Town of Round Hill

NCDC reports indicate that no tropical storms impacted the Town of Round Hill from 1950 through 2015.

Town of Vienna

NCDC reports indicate that one tropical storm impacted the Town of Vienna from 1950 through 2015. Damage reports for these occurrences are captured in the reports for larger geographic areas, cannot be reliably separated to account for specific damages to the Town of Vienna.

d. Risk Assessment

i. Probability of Future Occurrences

Although not likely to experience a direct hit from a Category 4 or Category 5 hurricane, the Northern Virginia region remains susceptible to the effects from such storms making landfall along the Atlantic coast of the United States. According to HAZUS^{MH}, the Northern Virginia region can expect to see hurricane force winds (with peak gust wind speeds of up to 89 miles per hour) at least once every 50 years. The effects of tropical storms will be more frequent, particularly from those storms making landfall further south and proceeding up the Atlantic seaboard.

ii. Impact & Vulnerability

Based on a range of long-term global climate models under IPCC warming scenarios, it is likely that hurricanes will become more intense, with stronger winds and heavier precipitation throughout the 21st century. Using an ensemble-mean of 18 climate models, IPCC A1B emissions scenario¹¹, and operational hurricane forecast models, one study¹² showed a decrease in the total number of tropical storms and hurricanes, but an increase in the number of intense hurricanes, particularly Category 4 or 5 hurricanes.

Historical evidence shows that the Northern Virginia region is vulnerable to damaging hurricane and tropical storms. For purposes of this assessment, vulnerability is quantified for hurricane and tropical storm-force winds. For the most part, the Northern Virginia region faces a uniform susceptibility to hurricanes and tropical storm winds. Though historical data and computer models indicate that Fairfax County may on average face higher wind speeds than other areas, the difference in peak gusts is not deemed significant (less than 20 miles per hour). However, based on the higher amount of residential and commercial exposure, Fairfax and Arlington counties are considered to be slightly more vulnerable to these winds.

iii. Risk

The hurricane wind analysis for the HIRA was completed using HAZUS^{MH}. The model uses state of the art wind field models, calibrated and validated hurricane data. Wind speed has been



calculated as a function of central pressure, translation speed, and surface roughness. This assessment is based on a Level 1 analysis. A Level 1 analysis involves using the HAZUS^{MH} provided data with no local data adjustments. This is an acceptable level of information for mitigation planning; future versions of this plan can be enhanced with Level 2 and 3 analyses. Dollar values shown in this report should only be used to represent cost of large aggregations of building types. Highly detailed, building specific, loss estimations have not been completed for this analysis as they require additional local data inputs, which could not be accomplished for this update. Note that storm surge and waves have not been implemented in the present version of the Hurricane Model¹³.

Additional information generated by HAZUS^{MH} for the planning area can be found in Appendix D, including additional imagery of wind fields for the area, presented by participating jurisdiction.

Loss estimation for this HAZUS^{MH} module is based on specific input data. The first type of data includes square footage of buildings for specified types or population. The second type of data includes information on the local economy that is used in estimating losses. Table 4.82 displays the economic loss categories used to calculate annualized losses by HAZUS^{MH}.

Table 4.82. HAZUS^{MH} direct economic loss categories and descriptions.

Category Name	Description of Data Input into Model	HAZUS ^{MH} Output
Building	Cost per sq. ft. to repair damage by structural type and occupancy for each level of damage	Cost of building repair or replacement of damaged and destroyed buildings
Contents	Replacement value by occupancy	Cost of damage to building contents
Inventory	Annual gross sales in \$ per sq. ft.	Loss of building inventory as contents related to business activities
Relocation	Rental costs per month per sq. ft. by occupancy	Relocation expenses (for businesses and institutions)
Income	Income in \$ per sq. ft. per month by occupancy	Capital-related incomes losses as a measure of the loss of productivity, services, or sales
Rental	Rental costs per month per sq. ft. by occupancy	Loss of rental income to building owners
Wage	Wages in \$ per sq. ft. per month by occupancy	Employee wage loss as described in income loss

For the hurricane wind scenario models, the built-in default inventory of assets - known as the Comprehensive Data Management System (CDMS) - was utilized. No adjustments were made to the inventory to account for any locally-reporting critical assets. Therefore, discrepancies may appear related to critical assets between self-reported data, such as historic occurrences, and HAZUS-generated data, such as the data in this section. See Appendix D for a description of the methodology used for the hurricane wind scenarios, and the grouping of counties, cities, and towns in each model.

Annualized loss is defined as the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities for the 10-, 20-, 50-, 100-, 200-, 500-, and



1000-year return periods. HAZUS^{MH} estimates direct and indirect economic losses due to hurricane wind speeds that include:

- Damage to buildings and contents
- Economic loss (business interruptions)
- Social Impacts

The figures contained in Appendix D illustrate the 3-second peak wind gust speeds for the 100- and 1000-year return periods. Wind speeds are based on estimated 3-second gusts in open terrain at 10 meters above ground at the centroid of each census tract. Buildings that must be designed for a 100-year mean recurrence interval wind event include¹⁴:

- Buildings where more than 300 people congregate in one area
- Buildings that will be used for hurricane or other emergency shelter
- Buildings housing a day care center with capacity greater than 150 occupants
- Buildings designed for emergency preparedness, communication, or emergency operation center or response
- Buildings housing critical national defense functions
- Buildings containing sufficient quantities of hazardous materials

For Northern Virginia, HAZUS^{MH} wind gust data for the 1000-year and 100-year return period events indicate that the southeastern portions of Northern Virginia are generally more likely to experience the highest wind gusts in both scenarios. This corresponds to the strongest winds associated with hurricanes typically occurring in the storm's right front quadrant (relative to the direction of the storm's movement). For a 1000-year event, southeastern sections of both Fairfax and Prince William counties can expect to see gusts topping 90 mph. Although slightly lower wind gusts are expected in this scenario in western Loudoun County and far western Prince William County, gusts may still exceed 80 mph in both locations. For a 100-year event, wind gusts of slightly greater than 70 mph may impinge on portions of Fairfax and Arlington counties, with gusts of between 50 and 70 mph expected elsewhere in Northern Virginia.

Critical Facility Risk

HAZUS^{MH} estimates very minor expected damage to critical facilities for the different return periods.

- The expected loss of use for the 100-year event is less than one day for the planning area as a whole. EOCs and hospitals for all the modeled return periods result in 100% functionality.
- For the 1000-year event, hospitals in the areas of Arlington and Fairfax counties may experience a least moderate damage, resulting in at least 50% functionality. Hospitals in the Loudoun and Prince William counties areas may expect to retain full functionality even in a 1000-year hurricane.
- Fire stations, police stations, and schools throughout the planning area may expect to retain the vast majority of their functionality even during a 1000-year hurricane event, and would have less than a day of loss of function.

The HAZUS^{MH} model also estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. Based on the probabilistic analysis, one household in Alexandria and two in Arlington County would be displaced and seek shelter from a 1000-



year event, though no people would be expected to require short-term sheltering. In Fairfax County and the City of Fairfax, 46 households would be displaced, with five persons requiring short-term sheltering from a 1000-year event. For Loudoun County and its associated townships, even a 1000-year event would not displace any households or persons, and no one would require short-term sheltering; the same is the case for Prince William County, its associated towns, the City of Manassas, and the City of Manassas Park.

Existing Buildings and Infrastructure Risk

The most at-risk buildings to high wind events are assumed to include manufactured homes, along with residential structures that were built many years ago (due to probable deterioration and less stringent building code enforcement during original construction).

Table 4.83 summarizes the HAZUS^{MH} information for the Northern Virginia region. Residential buildings make up the majority of damages due to hurricane winds. The more frequent return periods result in fewer damages that fall within the moderate to destruction classifications. The 500- and 100-year return periods result in severe damage and destruction to buildings in the Northern Virginia region.

Table 4.83. HAZUS^{MH} Estimate: Number of buildings damaged.

Return Period	Minor		Moderate		Severe		Destruction		Total	
	Residential	Total	Residential	Total	Residential	Total	Residential	Total	Residential	Total
10	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0
50	92	134	0	0	0	0	0	0	92	134
100	426	564	8	11	0	0	0	0	434	575
200	517	2,050	81	84	0	0	0	0	598	2,134
500	10,277	10,906	705	736	1	2	0	0	10,983	11,644
1000	22,999	24,228	2,111	2,212	4	11	8	8	25,122	26,459

In the case of a 100-year hurricane event, HAZUS^{MH} estimates the building loss for Northern Virginia to be approximately \$77.9 million. Should the region experience a 1000-year hurricane event, the model estimates the building loss for the region would be approximately \$1.2 billion. Tables 4.84, 4.85, and 4.86 provide summaries of losses by jurisdiction.

Note that details for some of the participating jurisdictions were included with other jurisdictions by the model, and could not be reliably separated out in this Level 1 assessment.

Table 4.84. HAZUS^{MH} Estimate: Total Annualized Building Loss by Jurisdiction.

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Arlington County	\$613,000	\$77,000	\$0	\$26,000	\$2,000	\$17,000	\$3,000	\$738,000
Fairfax County and the City of Fairfax	\$2,632,000	\$388,000	\$1,000	\$78,000	\$5,000	\$33,000	\$6,000	\$3,143,000

**Table 4.84. HAZUS^{MH} Estimate: Total Annualized Building Loss by Jurisdiction.**

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Town of Herndon	Included	Included	Included	Included	Included	Included	Included	Included
Town of Vienna	Included	Included	Included	Included	Included	Included	Included	Included
Town of Clifton	Included	Included	Included	Included	Included	Included	Included	Included
Loudoun County	\$684,000	\$104,000	\$0	\$24,000	\$1,000	\$8,000	\$1,000	\$822,000
Town of Leesburg	Included	Included	Included	Included	Included	Included	Included	Included
Town of Lovettsville	Included	Included	Included	Included	Included	Included	Included	Included
Town of Purcellville	Included	Included	Included	Included	Included	Included	Included	Included
Town of Middleburg	Included	Included	Included	Included	Included	Included	Included	Included
Town of Round Hill	Included	Included	Included	Included	Included	Included	Included	Included
Prince William County	\$779,000	\$140,000	\$0	\$0	\$0	\$0	\$0	\$919,000
Town of Dumfries	Included	Included	Included	Included	Included	Included	Included	Included
Town of Haymarket	Included	Included	Included	Included	Included	Included	Included	Included
Town of Occoquan	Included	Included	Included	Included	Included	Included	Included	Included
Town of Quantico	Included	Included	Included	Included	Included	Included	Included	Included
City of Alexandria	\$451,000	\$65,000	\$0,000	\$20,000	\$2,000	\$12,000	\$3,000	\$553,000
City of Falls Church	\$42,000	\$7,000	\$0	\$2,000	\$0	\$1,000	\$0	\$51,000
City of Manassas	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
City of Manassas Park	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$5,201,000	\$781,000	\$1,000	\$150,000	\$10,000	\$71,000	\$137,000	\$5,398,000

Table 4.85. HAZUS^{MH} Estimate: 100-Year Hurricane Building Loss by Jurisdiction.

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Arlington County	\$6,358,000	\$505,000	\$0	\$12,000	\$0	\$0	\$0	\$6,875,000
Fairfax County and the City of Fairfax	\$34,415,000	\$4,434,000	\$0	\$9,000	\$0	\$0	\$0	\$38,858,000
Town of Herndon	Included	Included	Included	Included	Included	Included	Included	Included
Town of Vienna	Included	Included	Included	Included	Included	Included	Included	Included
Town of Clifton	Included	Included	Included	Included	Included	Included	Included	Included
Loudoun County	\$7,662,000	\$1,044,000	\$0	\$0	\$0	\$0	\$0	\$8,706,000
Town of Leesburg	Included	Included	Included	Included	Included	Included	Included	Included
Town of Lovettsville	Included	Included	Included	Included	Included	Included	Included	Included
Town of Purcellville	Included	Included	Included	Included	Included	Included	Included	Included
Town of Middleburg	Included	Included	Included	Included	Included	Included	Included	Included
Town of Round Hill	Included	Included	Included	Included	Included	Included	Included	Included

**Table 4.85. HAZUS^{MH} Estimate: 100-Year Hurricane Building Loss by Jurisdiction.**

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Prince William County	\$14,481,000	\$1,333,000	\$0	\$6,000	\$0	\$0	\$0	\$15,820,000
<i>Town of Dumfries</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Haymarket</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Occoquan</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Quantico</i>	Included	Included	Included	Included	Included	Included	Included	Included
City of Alexandria	\$5,409,000	\$590,000	\$0	\$8,000	\$0	\$0	\$0	\$6,007,000
City of Falls Church	\$465,000	\$258,000	\$0	\$0	\$0	\$0	\$0	\$723,000
City of Manassas	\$723,000	\$57,000	\$0	\$0	\$0	\$0	\$0	\$780,000
City of Manassas Park	\$243,000	\$1,000	\$0	\$0	\$0	\$0	\$0	\$244,000
Total	\$69,756,000	\$8,222,000	\$0	\$35,000	\$0	\$0	\$0	\$42,914,000
								78,004,000

Table 4.86 HAZUS^{MH} Estimate: 1000-Year Hurricane Building Loss by Jurisdiction

Jurisdiction	Building Loss	Content Loss	Inventory Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
Arlington County	\$129,966,000	\$11,858,000	\$15,000	\$5,533,000	\$216,000	\$3,955,000	\$78,000	\$151,620,000
Fairfax County and the City of Fairfax	\$529,472,000	\$64,624,000	\$69,000	\$15,476,000	\$729,000	\$7,663,000	\$264,000	\$618,298,000
<i>Town of Herndon</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Vienna</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Clifton</i>	Included	Included	Included	Included	Included	Included	Included	Included
Loudoun County	\$134,753,000	\$14,012,000	\$18,000	\$4,632,000	\$0	\$1,687,000	\$0	\$155,102,000
<i>Town of Leesburg</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Lovettsville</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Purcellville</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Middleburg</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Round Hill</i>	Included	Included	Included	Included	Included	Included	Included	Included
Prince William County	\$184,839,000	\$18,273,000	\$26,000	\$5,690,000	\$74,000	\$44,000	\$2,196,000	\$211,142,000
<i>Town of Dumfries</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Haymarket</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Occoquan</i>	Included	Included	Included	Included	Included	Included	Included	Included
<i>Town of Quantico</i>	Included	Included	Included	Included	Included	Included	Included	Included
City of Alexandria	\$100,724,000	\$11,129,000	\$18,000	\$4,096,000	\$429,000	\$2,886,000	\$155,000	\$119,437,000

**Table 4.86 HAZUS^{MH} Estimate: 1000-Year Hurricane Building Loss by Jurisdiction**

Jurisdiction	Building Loss	Content Loss	InVENTORY Loss	Relocation Loss	Income Loss	Rental Loss	Wage Loss	Total Loss
City of Falls Church	\$7,482,000	\$927,000	\$1,000	\$254,000	\$0	\$127,000	\$0	\$8,790,000
City of Manassas	\$14,600,000	\$1,181,000	\$3,000	\$553,000	\$0	\$234,000	\$0	\$16,571,000
City of Manassas Park	\$5,346,000	\$180,000	\$26,000	\$5,690,000	\$74,000	\$2,196,000	\$44,000	\$5,817,000
Total	\$1,107,479,000	\$122,184,000	\$196,000	\$41,924,000	\$1,522,000	\$18,792,000	\$2,737,000	\$1,286,777,000

Overall Loss Estimates and Ranking

Based on the HAZUS^{MH} models, the annualized losses due to hurricanes in Northern Virginia total approximately \$6.5 million. The models used the HAZUS^{MH} probabilistic hurricane scenario to compute loss which takes into the expected value of loss in any one year, and is developed by aggregating the losses and exceedance probabilities for the 10-, 20-, 50-, 100-, 200-, 500-, and 1000-year return periods.

On an annual basis, NCDC records estimate property and crop losses in Northern Virginia due to severe storm and high wind events, including tropical storms and hurricanes, totals an estimated \$1.5 million. Actual losses for the period of record (1950-2015) total more than \$101.6 million. The details of these estimates, by participating jurisdiction, were presented earlier in this section, in Table 4.75.

The Commonwealth of Virginia's 2013 Hazard Mitigation Plan ranking was based largely on the NCDC database. The update to the Northern Virginia plan used this same framework to establish a common system for evaluating and ranking hazards. In determining a score and ranking for high wind, the geographic extent score for each jurisdiction is based on the average maximum wind speed throughout the entire jurisdiction as determined through GIS analysis of HAZUS^{MH} generated data. The high wind hazard ranking factors damaging wind events that include severe thunderstorms, hurricanes, and non-thunderstorm related wind events.

Based on this analysis and available data, the high wind/severe storm hazard is ranked as being 'High' for all jurisdictions in Northern Virginia.

Although a separate ranking was not made for hurricanes, historical damage due to hurricane wind is included in the 2016 ranking assessment for severe storms/high wind below. The high wind/severe storm hazard incorporates both thunderstorm wind and hurricane/tropical storm winds along with non-thunderstorm related wind damage.

Refer to the Risk Assessment Methodology section of the HIRA for a full description of the methodology and the limitations of the data used for ranking the hazards. NCDC data, although somewhat limited, provides a comprehensive historical record of natural hazard events and damages.



For the 2016 plan update, the qualitative assessment was performed by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard. Therefore, to avoid repetition, Table 4.87 provides the results of the qualitative assessment for all participating jurisdictions, as all jurisdictions were found to have the same results.

Table 4.87. 2016 Qualitative Assessment for Hurricane & Tropical Storm-Force Winds.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	12 to 24 hours	Less than one week

IX. Tornadoes

NOTE: As part of the 2016 plan update, the Tornado hazard was reexamined and new analyses performed. These new analyses included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4 Section IV Ranking and Analysis Methodologies. Each section of the plan was also reformatted for improved clarity and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes and other tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the NWS, tornado wind speeds normally range from 40 to more than 300 miles per hour. The most violent tornadoes have rotating winds of 250 miles per hour or more and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles.

According to NOAA, each year an average of over 800 tornadoes is reported nationwide, resulting in 80 deaths and 1,500 injuries, on average. They are more likely to occur during the spring and early summer months of March through June and can occur at any time of day, but are more likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and only touchdown briefly, but even small, short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes may carve out a path over a mile wide and several miles long.



Waterspouts are weak tornadoes that form over warm water and are most common along the Gulf Coast and southeastern states. Waterspouts occasionally move inland, becoming tornadoes that cause damage and injury. However, most waterspouts dissipate over the open water causing threats only to marine and boating interests. Typically, a waterspout is weak and short-lived, and because they are so common, most go unreported unless they cause damage.

The destruction caused by tornadoes ranges from light to devastating depending on the intensity, size, and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction such as residential homes (particularly mobile homes), and tend to remain localized in impact. The Fujita-Pearson Scale for Tornadoes (F Scale) was developed in 1971 to rate tornado intensity based on associated damages. An Enhanced Fujita Scale (EF Scale) was developed and implemented operationally in 2007 and is shown in Table 4.88, along with a comparison of the original F Scale.

Table 4.88. Enhanced Fujita Scale for Tornadoes Vs. Fujita Scale.

Fujita Scale			Enhanced Fujita Scale	
F Number	Fastest 1/4-mile (mph)	3 Second Gust (mph)	EF Number	3 Second Gust (mph)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

2. Geographic Location/ Extent

According to the NOAA Storm Prediction Center (SPC), the highest concentration of tornadoes in the United States has been in Oklahoma, Texas, Kansas and Florida respectively. Although the Great Plains region of the central United States does favor the development of the largest and most dangerous tornadoes (earning the designation of ‘tornado alley’), Florida experiences the greatest number of tornadoes per square mile of all states (SPC, 2002). Although the region is located outside of “tornado alley” and does not experience as many tornadoes as Florida, there are many examples of tornadoes tracking through Northern Virginia. Figure 4.32 shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

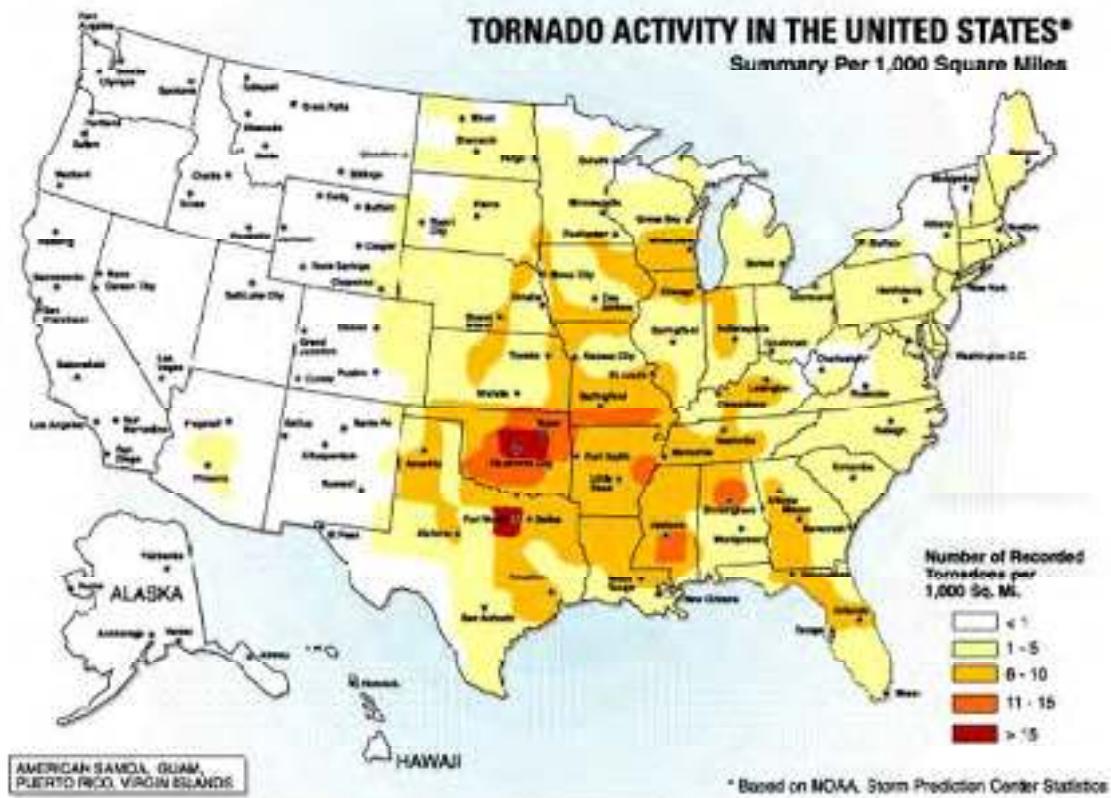


Figure 4.32. Tornado Activity in the United States

Source: American Society of Civil Engineers

The tornadoes associated with tropical cyclones are most frequent in September and October when the incidence of tropical storm systems is greatest. This type of tornado usually occurs around the perimeter of the storm, and most often in the northeast quadrant and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

3. Magnitude or Severity

When compared with other states, Virginia ranks 29th in the nation in number of tornado events, 25th in tornado deaths, 26th in tornado injuries, and 28th in damages. These rankings are based upon data collected for all states and territories for tornado events between 1950 and 1994 by NOAA's SPC. Most tornadoes that occur in Virginia are less intense (F0 through F2 on the Fujita-Pearson Scale) than those that occur elsewhere in the country, but occasionally they are of significant magnitude causing major damage and destruction.

From 1950 through the year 2001, 376 tornadoes were documented in Virginia (an average of seven tornadoes per year). Nationally, statistics have suggested that prior to 1990, only a third of all tornadoes were actually recorded. Many occurred in unpopulated areas or caused little property damage and therefore are not reported to the NWS, while others may have been recorded separately as high wind events instead of tornadoes. Thus, the actual average number of tornadoes that Virginia experiences in a given year is likely higher than historical NOAA records indicate. Tornado fatality records began in 1916.

According to NCDC records, the Northern Virginia region experienced approximately 70 funnel cloud and tornado events from 1950 through 2015. Figure 4.33 graphically depicts the touchdown points and tracks of the tornadoes, as well as the Fujita scale rating for each of those events. As can be seen in the figure, most of these events were recorded as either F0 or F1 events although there have also been some stronger F2 and F3 events.

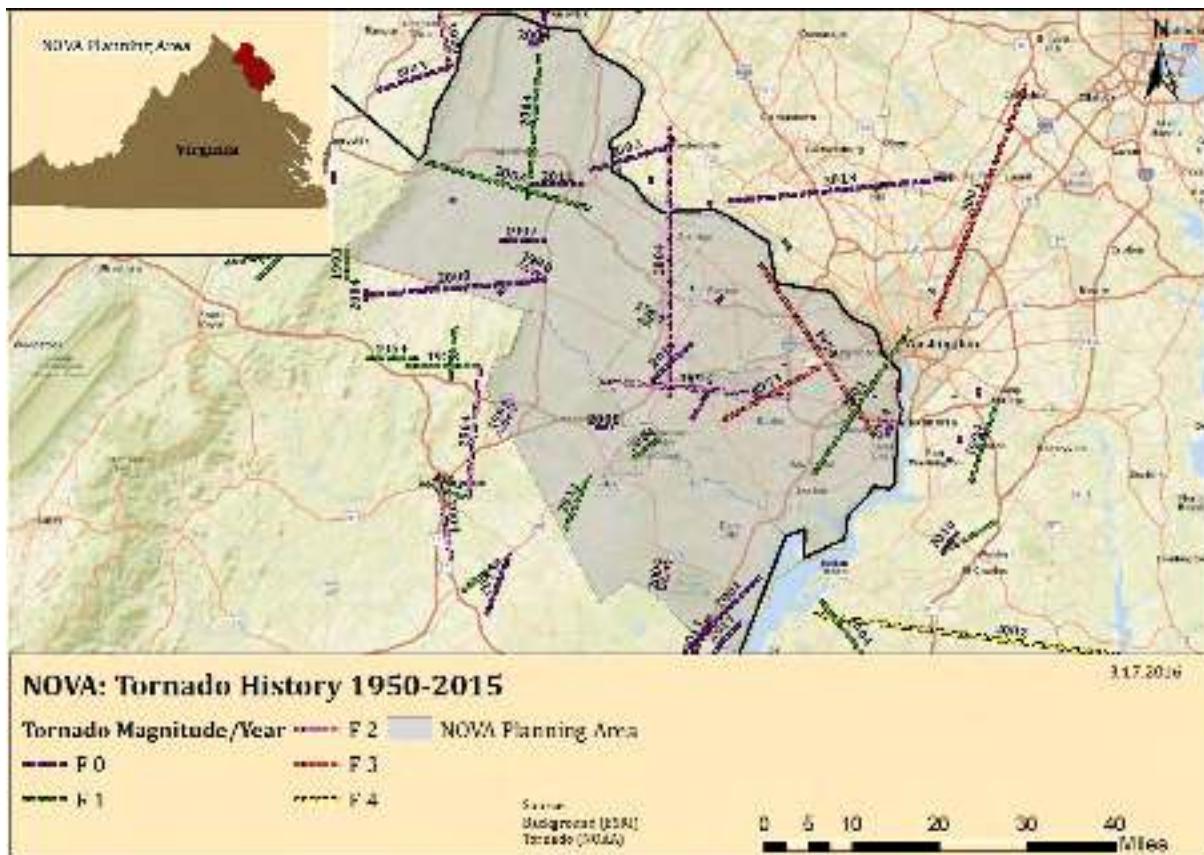


Figure 4.33. Historic Tornado Tracks, 1950 to 2015.

In total, these tornado events are reported to have caused approximately four fatalities, 12 injuries and approximately \$13.6 million in property and crop damages as summarized by jurisdiction in Table 4.89. More detailed information on each of these historical tornado events can be obtained through the NCDC Storm Event database.

**Table 4.89. NCDC Tornado Events in the Northern Virginia Region, 1950–2015, Based on NCDC Data.****Tornado Events in Northern Virginia**

<i>Years of Record: 1950 - 2015</i>	Annualized Property and Crop Damage	Total Property and Crop Damage	Injuries	Fatalities	Number of Events
Arlington County	\$16,923	\$1,100,000	0	2	2
Fairfax County	0	0	0	0	0
Loudoun County	\$78,200	\$5,083,000	2	0	25
Prince William County	\$60,185	\$3,912,000	0	1	17
City of Alexandria	0	0	0	0	0
City of Fairfax**	0	0	0	0	0
City of Falls Church	\$38,462	\$2,500,000	0	0	1
City of Manassas*	\$0	\$0	0	0	2
City of Manassas Park*	\$0	\$0	0	0	1
Town of Clifton	\$0	\$0	0	0	0
Town of Dumfries	\$0	\$0	0	0	2
Town of Haymarket	\$0	\$0	0	0	0
Town of Herndon	\$0	\$0	0	0	0
Town of Leesburg	\$6,215	\$404,000	0	0	5
Town of Lovettsville	\$9,054	\$588,500	0	0	6
Town of Middleburg	\$123	\$8,000	0	0	3
Town of Occoquan	\$0	\$0	0	0	0
Town of Purcellville	\$0	\$0	0	0	0
Town of Quantico	\$385	\$25,000	10	1	3
Town of Round Hill	\$0	\$0	0	0	1
Town of Vienna	\$0	\$0	0	0	0
Total	\$209,662	\$13,628,000	12	4	70

*NCDC database does not contain damage data for the September 17, 2004 tornado events that impacted Manassas and Manassas Park

**NCDC has no record of any tornado events having impacted the City of Fairfax since 1950; this conflicts with other sources indicating that tornadoes did impact the City, causing damage on September 5, 1979 as a result of Hurricane David.



4. Previous Occurrences

Supplemental to the previous occurrences recorded by NCDC (shown in Table 4.89), the following events are notable within the planning area.

On June 20, 2015, an EF-0 tornado produced a 2.1-mile path of damage that was approximately 100 yards wide. The bulk of the damage occurred at the Broad Run golf training center in Prince William County, where about a half-dozen softwood trees between 12 and 18 inches in diameter were snapped approximately 4 feet above the ground. The damage at the baseball fields at the intersection of Route 28 and Godwin Road included a scoreboard secured by 4x4s being snapped, along with baseball dugout roofs lifted and blown away. The damage was sporadic along the 2.1-mile path.

On October 15, 2014, severe thunderstorms produced a confirmed EF-0 tornado near Belle Haven in Eastern Fairfax County. The tornado created a path of vegetative damage for approximately 1.5 miles. The tornado continued north across the Belle Haven Country Club where larger tree limbs were snapped. The tornado then briefly moved into the City of Alexandria, likely lifting across Interstate 495 at the intersection of George Washington Parkway, where large tree branches were also downed. Several large tree branches were snapped in the immediate adjacent neighborhood to the north before the radar couplet signature weakened after 12:26 pm. Estimated maximum winds were 55-65 mph.

On May 16, 2014, a tornado touched down near Sunny Bank in Loudoun County. A large tree was uprooted, and other trees and large branches were found uprooted and collapsed in different directions, along with branches snapped or twisted at various points along Light Horse Court.

On April 27, 2011, an EF-1 tornado snapped numerous trees along Carriage Ford Road, Aden Road and Garman Drive in Prince William County. Siding and shingles were removed from several homes in the area. Horse run-ins and sheds were also damaged. Garage doors were blown in on a detached garage. A fence was also damaged along with some signs and small trees in the parking lot of a shopping center. A few trees were snapped along Linton Hall Road before the tornado lifted.

On October 13, 2011, thunderstorms developed that contained strong aloft winds. Thunderstorms developed behind the front produced damaging wind gusts. Rapidly changing winds in both direction and speed caused some of the stronger thunderstorms to produce tornadoes near the warm front. Trees were sporadically uprooted and snapped for about a three-mile path, starting near Clifton to just west of Fairfax City.

On July 23, 2008, a weak tornado touched down in Prince William County in an industrial park near Wellington at 6:43PM. The tornado produced siding and roof damage to homes and toppled trees. The twister damaged the roof of a retail home center in Sudley Towne Plaza before lifting after crossing Sudley Road near Route 234.

On June 4, 2008, strong upper level thunderstorms developed over the area, resulting in several severe thunderstorms. An EF-1 tornado crossed into south central Loudoun County, producing a damage path near the town of Aldie.



On July 4, 2007, a funnel cloud was spotted near Pickett Road in Fairfax by Department of Public Works and Environmental Services. Severe weather in the area caused the need for sheltering those attending Fourth of July celebrations. No reports of damage or injuries were received as a result of this particular funnel cloud, but a man was killed when a tree fell onto his car in Annandale during storms earlier in the afternoon.

On September 17, 2004, a tornadic thunderstorm entered western Fairfax County from Prince William County. The storm had a path of approximately seven miles. Beginning on Old Centerville Road, the storm produced scattered tree damage and minor roof damage in the Loudoun Town area. A line of damage was carved from Lee Highway northward into the Centerville and Chantilly areas. The tornado destroyed one estate and damaged approximately 50 other structures, and was responsible for downed trees and powerlines. The parent thunderstorm produced another tornado on the east side of the City of Manassas causing structural and tree damage before continuing on into Manassas Park where several dwellings were damaged in the Yorkshire subdivision. At its strongest, this tornado produced F2 damage estimated at approximately \$1 million.

On September 24, 2001, five tornadoes touched down in Northern Virginia during the afternoon and early evening of the 24th. A tornado, which remained on the ground for 15 miles, passed through densely populated areas of Eastern Fairfax County, the western portion of the City of Alexandria, and Arlington County causing minor injuries and significant damage to trees, residences, and businesses. Its strength varied between F0 and F1 as it crossed the Interstates three times during rush hour traffic. Cars were hit with flying debris and some windows were blown out. Hundreds of homes and numerous parked vehicles were also damaged. Most of the damage was minor to the exterior and roofs of homes. A few homes suffered more significant damage, mainly in the Shirlington area of Arlington County. Total damages were estimated at \$1 million. Only two people are known to have been injured. Before the tornado moved into Washington, DC, it passed right by the Pentagon City Mall and the Pentagon itself. Numerous recovery workers at the Pentagon in the aftermath of the 9-11 attack had to take cover from the tornado in underground tunnels. One of the tornadoes touched down in Prince William County where it downed some trees in Prince William Forest Park area. The tornado moved north into the Lake Montclair community where it took down a few trees, broke branches, and bent siding up on homes. The weak tornado lifted shortly after.

On May 25, 1997, a small, brief tornado, packing winds up to 70 miles per hour, knocked down between 75 and 100 trees and limbs, some of which fell onto residences, vehicles, and other property in South Arlington. Scattered structural damage included aluminum siding, gutters, shingles, and plastic fascia.

On June 24, 1996, a tornado, associated with the mesocyclone of a heavy-precipitation super cell, touched down in extreme southeastern Loudoun County near the Bull Run, then proceeded east-southeast for 20 miles knocking down over 1,000 trees and causing substantial property damage, especially in western Fairfax County, before lifting along the Capital Beltway at the Braddock Road interchange less than two miles west of Annandale. The most significant damage occurred along Tree Line Drive, where 11 of 17 homes incurred moderate to major



damage. The combined effort of several agencies produced property damage estimates along the track (not including flora) totaling \$2.9 million. Included in that total are 323 homes which sustained minor damage. An estimated 80,000 homes lost power along the track of the tornado in Fairfax County, with some homes not receiving power until several days after the event.

On April 16, 1993, a tornado touched down approximately a 0.5 mile southwest of Saint Louis in the southern part of Loudoun County, and moved east northeast for about 1.7 miles. The storm knocked down and damaged hundreds of trees. Roofs of two barns were blown off, windows were blown out, and fences were ripped up.

On September 5, 1979, Hurricane David spawned six tornadoes across Virginia. A strong F3 tornado struck Fairfax County tracking 18 miles, killing one and injuring six people. It struck the same school hit by a tornado on April 1, 1973, this time causing \$150,000 damage. Numerous cars were demolished, 90 homes were damaged, and trees and debris blocked roads. Damages in Fairfax County reached \$2.5 million dollars.

On April 1, 1973, a strong F3 tornado struck a populated area of Northern Virginia. It touched down in Prince William County and traveled 15 miles northeast through Fairfax and into Falls Church. Extensive damage occurred along a six-mile stretch in Fairfax. A high school, two shopping centers, an apartment complex, and 226 homes were damaged. Thirty-seven people were injured. It could have been much worse, but it was Sunday and "Blue Laws" were still in effect--the normally busy shopping center which had extensive damage was closed and school was not in session. Damage totaled an estimated \$14 million.

On May 2, 1929, on a day known as "Virginia's Deadliest Tornado Outbreak," the town of Hamilton in Loudoun County (six miles northwest of Leesburg) experienced one of the five tornadoes that caused widespread destruction across the state. The tornado path was reportedly 200 yards across and two miles long. It destroyed a house, barn, and some smaller buildings at one farm. It caused several injuries but no deaths. Other nearby farms were damaged, as well as a brick church.

On November 17, 1927, a tornado touched down in a rural part of Fairfax County and moved northeast across the western part of Alexandria, across the Potomac River and Washington, DC, and into Maryland. Over 100 people were injured in Alexandria and over 200 homes were unroofed and torn apart.

B. Risk Assessment

1. Probability of Future Occurrences

The probability of future occurrences of tornadoes was examined through analysis of the NCDC historical data and in consideration of data developed for the 2013 Commonwealth of Virginia Hazard Mitigation Plan. For the Commonwealth's plan, an extensive frequency analysis was performed on the historical tornado record (including touchdown points and tornado tracks) using GIS techniques. Results of this analysis (see Figure 4.34) pinpoint areas that have experienced slightly higher frequency of tornadoes based on past occurrences. It should be noted that what is determined to be 'High' in the figure is relative to tornado frequency in the entire



Commonwealth of Virginia. This ‘High’ designation is still low in comparison with frequencies experienced in ‘tornado alley’ and throughout the southern States. An examination of the NCDC data shows that Loudoun County has experienced 25 tornado events since 1950, more than any other jurisdiction in Northern Virginia. Prince William County is not too far behind having recorded 17 such events during that same period of time.

Based on this analysis, it is likely that the Northern Virginia region will continue to experience weak to moderately intense tornadoes. It is unlikely that very strong tornadoes (F4 or F5) will strike the area, though it does remain a possibility. Climate change is projected to increase the frequency and intensity of extreme weather events¹⁵, including severe thunderstorms. At this time, it remains uncertain if this might also translate into an increased frequency of tornadoes.

2. Impact & Vulnerability

Tornadoes are high-impact, low-probability hazards. A tornado’s impact is dependent on its intensity and the vulnerability of development in its path. Qualification of tornado impact has not been performed for this analysis. Future plan updates might investigate the feasibility of methods for doing so. Tornado vulnerability is based on building construction and standards, the availability of shelters or safe rooms, and advanced warning capabilities. Even well-constructed buildings are vulnerable to the effects of a stronger (generally EF2 or higher) tornado.

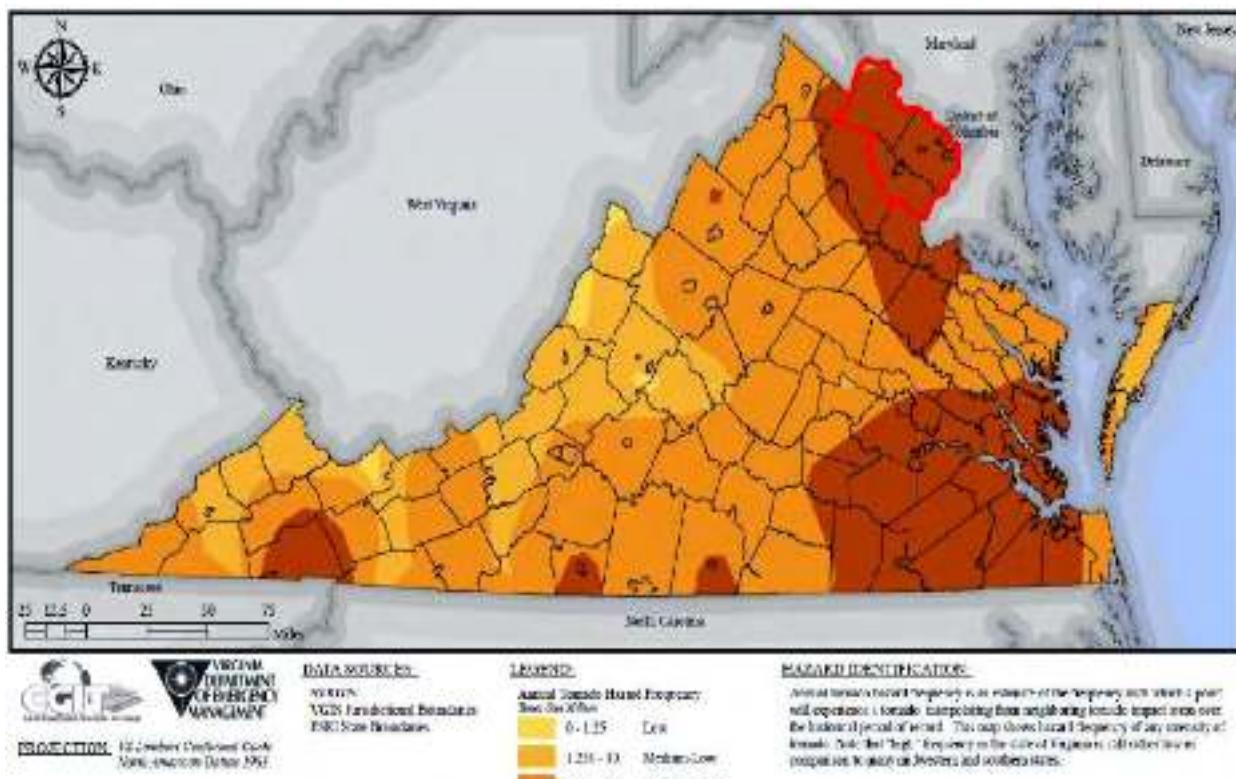


Figure 4.34 Tornado Hazard Frequency. Source: Commonwealth of Virginia Hazard Mitigation Plan.



3. Risk

Risk, defined as probability multiplied by impact, cannot be fully estimated for tornadoes due to the lack of intensity-damage models for this hazard. Instead, estimates of the financial impacts of tornadoes can be developed based on historical data contained within the NCDC storm event data. Examination of NCDC data shows that there were 70 tornado events in Northern Virginia between 1950 and December 2015 that caused approximately \$13.6 million in property and crop damages. Loudoun County has recorded more damage than other Northern Virginia jurisdictions due to tornadoes. NCDC data shows that the county experienced more than \$5 million in property and crop damages since 1950.

Critical Facility Risk

Quantitative assessment of critical facilities for tornado risk was completed for this update using a scenario developed for each participating jurisdiction. The track of a historic tornado in the jurisdiction or an adjacent area was relocated to insect with the participating jurisdiction. Locally-identified critical assets were mapped in relation to the tornado track. Images were created for each scenario; those images can be found in Appendix D.

Table 4.90 provides details of the critical assets that were determined to be damaged in each scenario. For the purposes of this assessment, no assumption was made as to the level of damage that the asset would sustain; therefore, the values displayed represent the entire value of the asset and its contents.

The type and age of construction plays a role in vulnerability of facilities to tornadoes. In general, concrete, brick, and steel-framed structures tend to fare better in tornadoes than older, wood-framed structures or manufactured homes. Finally, not all critical facilities have redundant power sources and may not even be wired to accept a generator. Future plan updates should consider closer examination of critical facilities risk by looking at construction type of critical facilities in jurisdictions considered to be at higher risk of tornadoes.

Table 4.90. Scenario Assessment for Tornadoes by Jurisdiction.

Jurisdiction	Number of Assets Damaged	Value of Assets	Value of Contents	Total
Arlington County	83	\$488,255,187	\$27,000,723	\$515,255,910
Fairfax County	61	\$511,768,862	\$78,281,693	\$590,050,555
Loudoun County	22	\$245,335,780	\$245,335,780	\$490,671,560
Prince William County	0	\$0	\$0	\$0
City of Alexandria	6	\$55,873,350	\$50,000,000	\$105,873,350
City of Fairfax	0	\$0	\$0	\$0
City of Falls Church	3	\$18,662,700	\$0	\$18,662,700
City of Manassas	7	\$10,191,160	\$796,050	\$10,987,210

**Table 4.90. Scenario Assessment for Tornadoes by Jurisdiction.**

Jurisdiction	Number of Assets Damaged	Value of Assets	Value of Contents	Total
City of Manassas Park	6	\$40,408,100	\$0	\$40,408,100
Town of Dumfries	0	\$0	\$0	\$0
Town of Haymarket	6	\$3,187,813	\$205,877	\$3,393,690
Town of Herndon	8	\$18,762,385	\$2,514,029	\$21,276,414
Town of Leesburg	14	\$26,397,517	\$1,517,642	\$27,915,159
Town of Lovettsville	\$0	\$0	\$0	\$0
Town of Middleburg	4	\$297,620	\$297,620	\$595,240
Town of Purcellville	2	\$28,030	\$28,030	\$56,060
Town of Quantico	0	\$0	\$0	\$0
Town of Round Hill	0	\$0	\$0	\$0
Town of Vienna	6	\$13,250,000	\$700,000	\$13,950,000

Existing Buildings and Infrastructure Risk

Risk to existing buildings and infrastructure is largely determined by building construction type including construction method, materials and roof span. As mentioned previously, concrete, brick, and steel-framed structures tend to fare better in tornadoes than older, wood-framed structures

Overall Loss Estimates and Ranking

As detailed in Table 4.89 (earlier in this section), the annualized losses due to tornadoes in Northern Virginia totals approximately \$209,662. Based on historical occurrences, tornado events in the Northern Virginia region are more common in Loudoun County, with Prince William County coming in a close second. However, it is expected that susceptibility for tornado occurrences is relatively uniform across the region. Historical data indicates that Loudoun County is by far the most vulnerable of the four counties in terms of property damages, fatalities, and injuries.

Similar to hurricane and tropical storm force-winds, the most at-risk buildings to tornadoes are assumed to include manufactured homes and older residential structures (see discussion under *Hurricanes and Tropical Storms*). Even small F1 tornadoes can cause severe damage to these buildings. For more intense tornadoes (F2 and higher), all buildings are considered at-risk with the exception of those specifically built to withstand wind speeds of more than 120-150 miles per hour (such as designated shelters, EOCs, etc.).



The Commonwealth of Virginia's 2013 Hazard Mitigation Plan ranking was based largely on the NCDC database. The update to the Northern Virginia plan used this same framework to establish a common system for evaluating and ranking hazards. In determining a score and ranking for tornadoes, the geographic extent score for each jurisdiction is based on a frequency analysis of historical tornado events completed for the 2013 Commonwealth plan.

Based on this analysis and the available data, the tornado hazard is ranked as being 'High' for all jurisdictions in Northern Virginia (See Figure 4.34). Refer to the Risk Assessment Methodology section of the HIRA for a full description of the methodology and the limitations of the data used for ranking the hazards. NCDC data, although somewhat limited, provides a comprehensive historical record of natural hazard events and damages.

For the 2016 plan update, the qualitative assessment was performed by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard. Therefore, to avoid repetition, Table 4.91 provides the results of the qualitative assessment for all participating jurisdictions, as all jurisdictions were found to have the same result.

Table 4.91. 2016 Qualitative Assessment for Tornadoes.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Critical	Moderate	0 to 12 hours	Less than one week

X. Drought

NOTE: As part of the 2016 plan update, the Drought hazard was reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4, Section IV Ranking and Analysis Methodologies. Though Drought and Extreme Heat are often interrelated hazards, they can and do occur independent of each other. Though the 2010 plan update consolidated their analysis into one section, the 2016 plan update separated them into different hazards. In addition, each section of the plan was also reformatted for improved clarity, and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

Drought is generally defined as a persistent and abnormal moisture deficiency having adverse impacts on vegetation, people, or animals. High temperatures, high winds, and low humidity can worsen drought conditions and make areas more susceptible to wildfire. Human demands and



actions can also hasten drought-related impacts. Droughts are frequently classified as one of following four types:

- Meteorological;
- Agricultural;
- Hydrological; or
- Socio-economic.

Meteorological droughts are typically defined by the level of “dryness” when compared to an average, or normal, amount of precipitation over a given period of time. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts. Emphasis tends to be placed on factors such as soil/water deficits, water needs based on differing stages of crop development, and water reservoir levels. Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socio-economic drought is the result of water shortages that limit the ability to supply water-dependent products in the marketplace.

Figure 4.35 shows the Palmer Drought Severity Index (PDSI) summary map for the United States from 1895 to 1995 with the planning area highlighted in green. The PDSI is a meteorological index that is based on temperature, precipitation, and Available Water Content of the soil data. The PDSI drought classifications are based on observed drought conditions and range from -0.5 (incipient dry spell) to -4.0 (extreme drought). As can be seen, the Eastern United States has historically not seen as many significant long-term droughts as the Central and Western regions of the country.

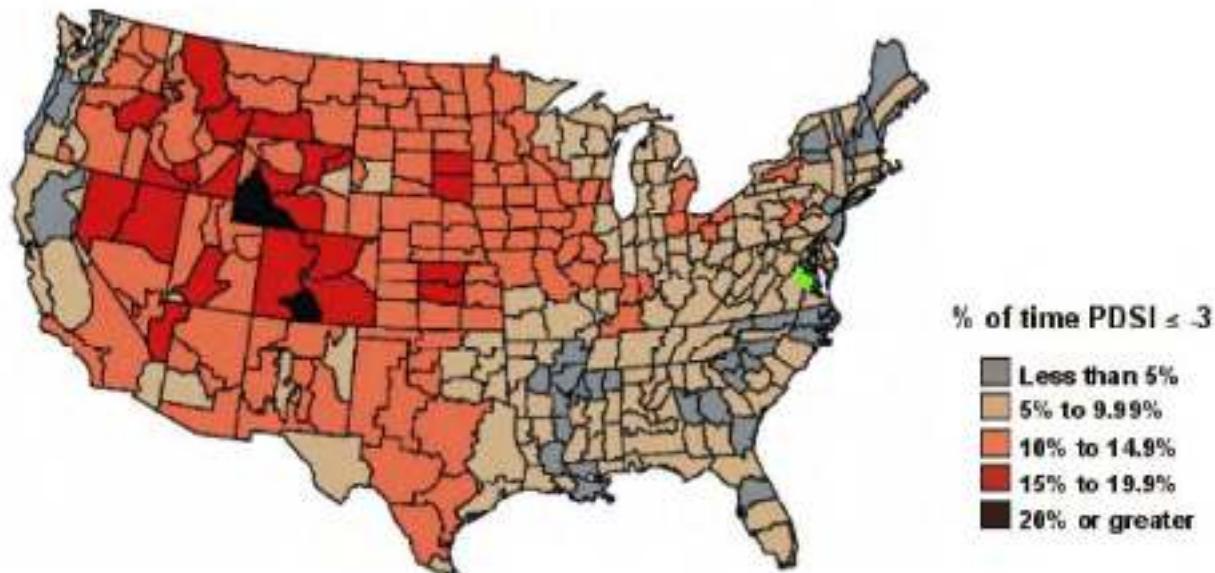


Figure 4.35. Palmer Drought Severity Index, 1895-1995 Percent of Time in Severe and Extreme Drought. *Source: National Drought Mitigation Center*

2. Geographic Location/ Extent

The Northern Virginia region is susceptible to drought conditions, although these are typically not nearly as severe as in other regions of the country. According to historical PDSI records for the years 1895 to 1995, the Northern Virginia region was in severe to extreme drought conditions for only 5 to 10 percent of the time (See Figure 4.35), as compared with areas in the western portion of the United States that experienced severe to extreme drought conditions for more than 20% of the time.

According to the U.S. Department of Commerce, Bureau of Economic Analysis, less than one percent of the Northern Virginia region's civilian workforce is involved in the farm or agriculture sector. Those that are tend to be most involved in hay production, which is grown primarily to feed livestock populations, and viticulture. Other vulnerable crops include corn, alfalfa, and soybeans. According to the USDA's Census of Agriculture, Loudoun County leads the Northern Virginia region with more than 1,400 active farms on 142,452 acres of farmland, with the average farm size being approximately 100 acres.

3. Magnitude or Severity

There are 95 records of drought events contained within the NCDC database. (See Table 4.92) Many of these instances are considered overlapping (counted twice or possibly more), as adjacent jurisdictions experiencing the same drought were considered separate instances. Data



regarding the impact or occurrence of drought on the towns is contained within the estimates for the counties. Also, unlike the very distinct beginning and end to other hazards (e.g., tornado), the period of a drought occurrence is not clear because multiple instances may be recorded for the same long-term drought. More detailed information on historical drought events can be obtained through the NCDC Storm Event Database.

Table 4.92. Annualized Property and Crop Loss Due to Drought, Based on NCDC Data.

Number of Events	151
Years of Record: 1950-2015	Annualized Property and Crop Damage
Arlington County	\$22,315
Fairfax County	\$22,315
Loudoun County	\$317,304
Prince William County	\$28,160
City of Alexandria	\$22,315
City of Fairfax	\$0
City of Falls Church	\$22,315
City of Manassas	\$28,160
City of Manassas Park	\$0
Town of Clifton	Included in Loudoun County estimate
Town of Dumfries	Included in Prince William County estimate
Town of Herndon	Included in Fairfax County estimate
Town of Haymarket	Included in Prince William County estimate
Town of Leesburg	Included in Loudoun County estimate
Town of Lovettsville	Included in Loudoun County estimate
Town of Middleburg	Included in Loudoun County estimate
Town of Occoquan	Included in Prince William County estimate
Town of Purcellville	Included in Loudoun County estimate
Town of Quantico	Included in Prince William County estimate
Town of Round Hill	Included in Loudoun County estimate
Town of Vienna	Included in Loudoun County estimate
Total	\$462,886

Lack of rainfall during drought conditions will affect water levels along the Potomac River, the main water source for the Northern Virginia region. Many of the major reservoirs serving the Northern Virginia region, including the Occoquan (Fairfax County) and the Beaverdam (Loudoun County), have experienced dangerously low levels in the past due to ongoing drought periods. During these periods, many locations are forced to begin water restrictions, which could lead to potential economic impacts for the region. The most vulnerable residents during these dry periods are those who live in the more rural areas located away from the larger cities and populated suburbs of the region (many of whom draw their water supply from wells).



4. Previous Occurrences

Because of the widespread geographic nature of the hazard, droughts typically impact large geographic areas, such as the entire Northern Virginia region. To avoid repetition, descriptions of the occurrences of drought in Northern Virginia have been consolidated to cover the entire planning area.

Planning Area

From October 1, 2007 – October 30, 2007, rainfall deficits of nearly 10 inches were common across northern Virginia at the beginning of the month. All counties and independent cities in the Commonwealth, with the exception of Arlington County and the independent cities of Alexandria and Falls Church, were declared primary disaster areas by the State. Many jurisdictions instituted water restrictions (both voluntary and mandatory) during this particularly dry stretch. Much of Northern Virginia was categorized as experiencing Extreme Drought by the National Drought Monitor during the later portions of the month. Several storm systems brought much-needed rainfall as the month ended, alleviating drought conditions.

In August 1998-August 1999, the PDSI indicated Northern Virginia was in an extreme drought. July was the 10th month in the previous 12 that precipitation was below normal. During this period, precipitation was a staggering 10 to 16 inches below average, the second driest 12 months on record.

The lack of rainfall affected water levels along the Potomac River, the main water source for the region. Many upstream tributaries also reported extremely low water levels. For the first time, water was released from the Randolph and Little Seneca reservoirs near the Potomac headwaters to help maintain a safe water level for wildlife and human consumption. By July 31st, the Randolph Reservoir was 13.8 percent below capacity and the Little Seneca Reservoir was down four inches.

Across Northern Virginia, several crops such as corn and soybeans never reached maturity, trees prematurely shed leaves and fruit in orchards, pasture land became nearly non-existent, and watering holes and irrigation sources dried up.

These instances of drought came to an end in September 1999 as the remnants of two hurricanes brought significant rainfall to the region. Following these storms, most areas recorded a major increase in water supplies and upgraded their condition from an extreme drought to a mild drought.

July 1997 was a very dry month that included one seven-day heat wave, and exacerbated drought-like conditions across much of the fertile farmland of Northern Virginia. The weather in July resulted in the failure of several crops, including corn, hay, alfalfa, and soybeans. Counties in the Northern Virginia region reported damage via local farms, though no formal declarations of Federal emergency were received from them.



B. Risk Assessment

1. Probability of Future Occurrences

The future incidence of drought is highly unpredictable and may be localized, which makes it difficult to assess the probability of drought. No sources of information on long-term historic frequency of drought or future probability were identified for inclusion in this plan. This may be a result of many different definitions resulting in spotty reporting. Based on past events, it certainly remains possible over the long-term that the Northern Virginia region will experience recurring drought conditions, the severity of which cannot be quantified.

2. Impact & Vulnerability

Short-term droughts can impact agricultural productivity, while longer term droughts are more likely to impact not only agriculture, but also water supply. Jurisdictions that have invested in water supply and distribution infrastructure are generally less vulnerable to drought. Short and long-term drought may lead to an increase in the incidence of wildfires which might in turn lead to increased potential for landslides or mudflows once rain does fall.

There is no standardized methodology for estimating vulnerability to the drought hazard. As opposed to posing a direct threat to life and property, drought impact is primarily measured by its potential and actual economic effect on the agricultural sector as well as municipal and industrial water supplies. This economic effect can also be expected to affect related sectors, such as wholesale and retail trade.

3. Risk

The risk associated with drought in Northern Virginia has not been formally quantified, due to the difficulty in assessing the rate of incidence, and the lack of complete data on drought impacts. There is low risk of human injury/death due to drought in Northern Virginia, and low risk of property damage. Crop damages due to drought are uncertain, as agricultural productivity often varies with growing conditions from year to year. However, the NCDC Storm Events database does report crop losses due to drought of approximately \$463,000 annually (see Table 4.92). Future updates to this plan should consider methods for quantifying annual drought losses in sectors outside of agriculture. This might include defining losses related to maintaining water supply, hydropower, tourism, and recreation and would require data sources outside of NCDC storm events data – including detailed local reports of both occurrences and associated damages.

Critical Facility Risk

Risk associated with drought has not been quantified in terms of geographic extent for this revision; as a result, critical facility risk has not been calculated. The majority of drought related damages do not impact buildings or infrastructure.

As discussed previously, the entire Northern Virginia region is vulnerable to drought and historically suffers drought conditions between five and 10 percent of the time. Since 1950, the region has been severely impacted by numerous instances of a long-term drought with damages totaling approximately \$25 million (most of which was attributed to agricultural losses in Loudoun and Prince William counties). Prior to this period of record, very little historical data exists on past drought events.



The Commonwealth of Virginia's 2013 HIRA ranking was based largely on the NCDC database. The update to the Northern Virginia plan used this same framework to establish a common system for evaluating and ranking hazards. No geographic extent data was available for drought probability. Based on this analysis and the available data, the drought hazard is considered to be 'Moderate' for Loudoun County, Prince William County, and the Towns of Leesburg, Lovettsville, Purcellville, Middleburg, Round Hill, Dumfries, Haymarket, Occoquan, and Quantico, and 'Low' for all other jurisdictions.

For the 2016 plan update the qualitative assessment was performed by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard. Therefore, to avoid repetition, Tables 4.93 and 4.94 provides the results of the qualitative assessment for all participating jurisdictions.

Arlington County, Fairfax County, the City of Arlington, the City of Fairfax, the City of Falls Church, the Town of Clifton, the Town of Herndon, and the Town of Vienna

Table 4.93. 2016 Qualitative Assessment for Drought.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Low	Moderate	3 to 6 months	More than one month

Loudoun County, Prince William County, the City of Manassas, the City of Manassas Park, the Town of Dumfries, the Town of Haymarket, the Town of Leesburg, the Town of Lovettsville, the Town of Middleburg, the Town of Occoquan, the Town of Purcellville, the Town of Quantico, and the Town of Round Hill

Table 4.94. 2016 Qualitative Assessment for Drought.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Moderate	Moderate	3 to 6 months	More than one month



XI. Earthquake

NOTE: As part of the 2016 plan update, the Earthquake hazard was reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4, Section IV Ranking and Analysis Methodologies. Each section of the Plan was also reformatted for improved clarity, and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of caverns. Earthquakes can affect hundreds of thousands of square miles; cause damage to property measured in the tens of billions of dollars; result in loss of life and injury to hundreds of thousands of persons; and disrupt the social and economic functioning of the affected area.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earth's outer crust. These fault planes are typically found along borders of the Earth's 10 tectonic plates. These plate borders generally follow the outlines of the continents, with the North American plate following the continental border with the Pacific Ocean in the west, but following the mid-Atlantic trench in the east. As earthquakes occurring in the mid-Atlantic trench usually pose little danger to humans, the greatest earthquake threat in North America is along the Pacific Coast.

The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength, a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

2. Geographic Location/ Extent

Figures 4.36 and 4.37 show the probability that ground motion will reach a certain level during an earthquake. The data show peak horizontal ground acceleration (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent and 2 percent probability of exceedance in 50 years, respectively. The maps were compiled by the USGS Geologic Hazards Team, which conducts global investigations of earthquake, geomagnetic, and landslide hazards.

Figure 4.38 from the Commonwealth of Virginia's Hazard Mitigation Plan shows the epicenter locations of historical earthquakes and the two main zones in Virginia that are more susceptible



to earthquakes. These zones, as mapped by the USGS, are believed to be sources of most Magnitude 6 or greater earthquakes during the past 1.6 million years around Virginia.

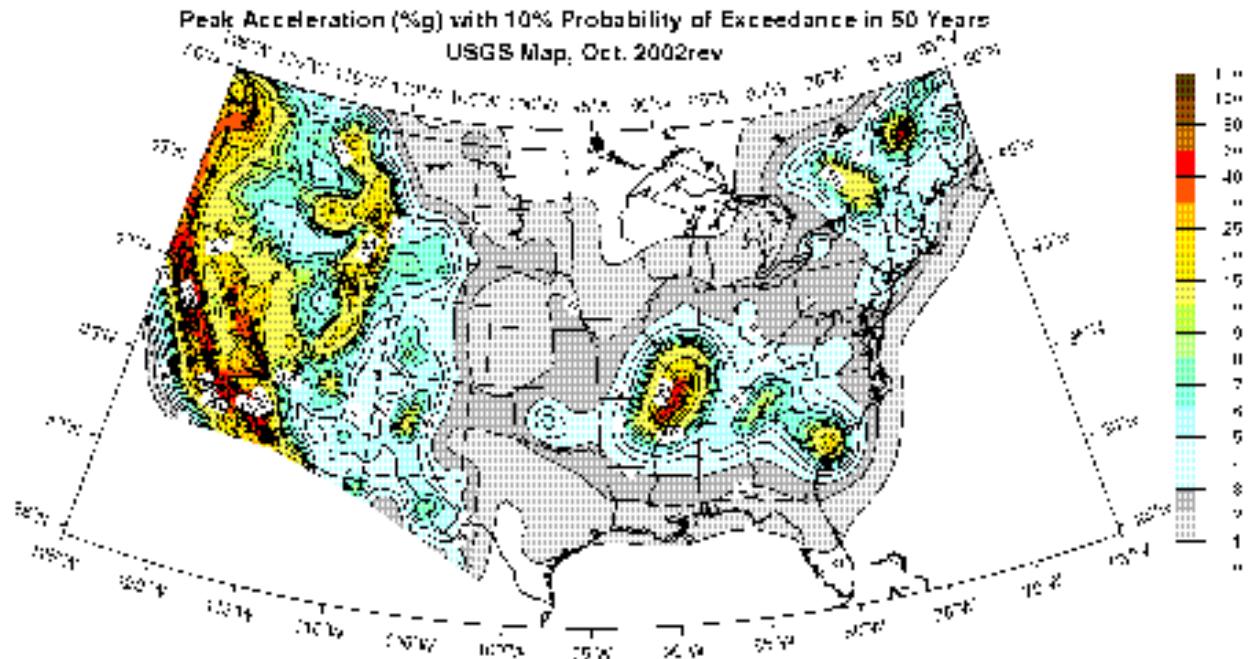


Figure 4.36. Peak Acceleration with 10 Percent Probability of Exceedance in 50 Years.

Source: USGS

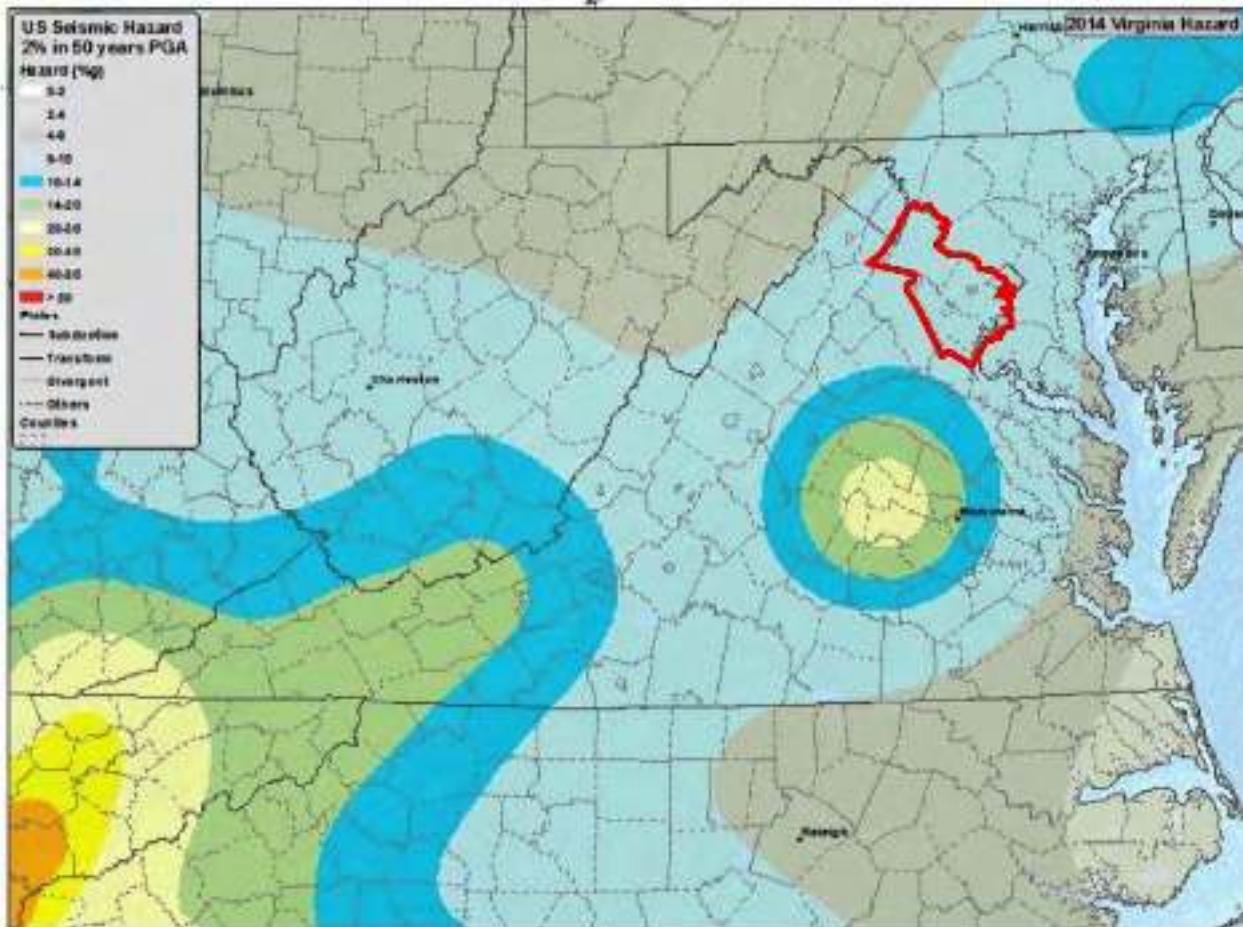


Figure 4.37. Peak Acceleration with 2 Percent Probability of Exceedance in 50 Years.

Source: USGS

3. Magnitude or Severity

Ground shaking can lead to the collapse of buildings and bridges and disrupt gas lines, electricity, and phone service. Death, injuries, and extensive property damage are possible vulnerabilities from this hazard. Some secondary hazards caused by earthquakes may include fire, hazardous material release, landslides, flash flooding, avalanches, tsunamis, and dam failure.

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses shear strength and the ability to support foundation loads. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an



earthquake through a measure of shock wave amplitude (see Table 4.95). Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). A detailed description of the MMI Scale of earthquake intensity and its correspondence to the Richter Scale is given in Table 4.96.

Table 4.95, The Richter Magnitude Scale.

Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0-7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Table 4.96. Modified Mercalli Intensity Scale for Earthquakes.

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	Instrumental	Detected only on seismographs	
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	
IV	Moderate	Felt by people walking	
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves	<5.4
VII	Very Strong	Mild Alarm; walls crack; plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<6.9

**Table 4.96. Modified Mercalli Intensity Scale for Earthquakes.**

Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>8.1

4. Previous Occurrences

The first recorded earthquake in Virginia occurred in 1774. Since then, more than 300 earthquakes have occurred in the State, with 18 having a magnitude of 4.5 or higher on the Richter Scale. The largest of these events occurred in Giles County in 1897 with a magnitude of 5.8. Most earthquake events have resulted in very little property damage, if any, and there are no historical records of any earthquake-related damages in the Northern Virginia region. Historical event information for earthquakes in Virginia occurrences is based on information made available through the USGS Earthquake Hazards Program. There have been no Federally Declared Disasters or NCDC recorded events in the Northern Virginia region for earthquakes.

According to the USGS, there have been 62 significant earthquake events to occur within 300 miles of the Northern Virginia region (including those centered outside of Virginia). The epicenter locations of these events are shown in Figure 4.38¹⁶ along with the year in which they occurred for the larger events. There are no reported casualties or significant property damages for the Northern Virginia region as a result of these events. Below is a summary of significant events that impacted the Northern Virginia region. It is assumed that these events were experienced across the planning region, though it is possible that there were no specific reports of damages in specific geographic areas.

On August 23, 2011, a magnitude 5.8 earthquake struck the Piedmont region of Virginia. Its epicenter was in Louisa County, and was one of the highest magnitude earthquakes to occur east of the Rocky Mountains. The earthquake was felt in approximately a dozen states and well into Canada. No fatalities from the event were recorded, though some injuries were reported; however, damage was widespread and estimated at hundreds of millions of dollars, much of which was uninsured. The earthquake caused the automatic shutdown of the North Anna Nuclear Power Station in Mineral, Virginia, located approximately 11 miles west-southwest of the station. In Arlington County, a pipe ruptured in the Pentagon, resulting in flooding of at least two corridors. Damage was also reported at a theater in Arlington County and several structures in the City of Arlington; the City of Manassas reported slight damage to City Hall and the Fire and Rescue Headquarters for the City. In Prince William County, the earthquake was blamed for damage to a dam and slight damage to several county facilities. A Federal Disaster Declaration was issued for the event in Virginia, though no part of the Northern Virginia planning area was included in the declaration.



On July 16, 2010, a magnitude 3.4 occurred near Gaithersburg, Maryland. The earthquake was felt in the Potomac-Shenandoah Region of Virginia. An hour after the quake, more than 5,500 people reported feeling it across Maryland, Washington, DC, West Virginia, Virginia, and Delaware¹⁷. No injuries or property damages were reported. The earthquake occurred in a part of the Eastern Seaboard that is less seismically active than central Virginia, New England, and the area surrounding New York City. Since 1980, 14 earthquakes have been felt within 80 km (about 50 miles) of the July 16th earthquake. All were smaller than this event. Other earthquakes have been reported in that area as far back as at least 1758¹⁸.

On May 6, 2008, a minor earthquake (2.0 magnitude) occurred near Annandale, Virginia. Felt reports were primarily received from people in Fairfax County, the District of Columbia, and Montgomery County, Maryland.

On December 9, 2003, an earthquake was widely felt in the Washington-Baltimore area and occurred west of Richmond, Virginia, in the Central Virginia Seismic Zone. It had a magnitude of 4.3¹⁹.

On April 9, 1918, the Shenandoah Valley region was strongly shaken by an earthquake. It was called the "most severe earthquake ever experienced" at Luray. Although little damage resulted, people in many places over the northern valley region were greatly alarmed and rushed from their houses. Broken windows were reported in Washington, DC. The tremor was noticed by President Wilson and his family at the White House; the President's secretary called a newspaper office to learn the cause of the terrifying noise. The felt area extended over 155,000 square kilometers, including parts of Maryland, Pennsylvania, and West Virginia.

On May 3, 1897, the largest historical earthquake to originate in Virginia occurred. The epicenter was in Giles County, where on May 3rd, an earlier tremor at Pulaski, Radford, and Roanoke had caused damage. Loud rumblings were heard in the epicentral region at various times between May 3rd and 31st. The shock on the latter date was felt from Georgia to Pennsylvania and from the Atlantic Coast westward to Indiana and Kentucky, an area covering about 725,000 square kilometers. It was especially strong at Pearisburg, where the walls of old brick houses were cracked and bricks were thrown from chimney tops. Springs were muddied and a few earth fissures appeared. Chimneys were shaken down in Bedford City, Houston, Pulaski, Radford, and Roanoke. Chimneys were also broken at Raleigh, North Carolina; Bristol and Knoxville, Tennessee; and Bluefield, West Virginia. Minor tremors continued in the epicentral region from time to time until June 6; other disturbances felt on June 28, September 3, and October 21 were probably aftershocks.

On August 31, 1861, the earthquake epicenter was probably in extreme southwestern Virginia or western North Carolina. At Wilkesboro, North Carolina, bricks were shaken from chimneys. The lack of Virginia reports may perhaps be ascribed to the fact that the Civil War was under way and there was rather heavy fighting in Virginia at the time. This shock affected about 775,000 square kilometers and was felt along the Atlantic coast from Washington, DC, to Charleston, South Carolina, and westward to Cincinnati, Louisville, and Gallatin, Tennessee, and southwestward to Columbus, Georgia.



On April 29, 1852, another moderately strong, widely felt shock occurred. At Buckingham and Wytheville, chimneys were damaged. The felt area extended to Washington, DC, Baltimore, and Philadelphia, and also included many points in North Carolina - approximately 420,000 square kilometers.

On August 27, 1833, the earthquake covered a broad felt area from Norfolk to Lexington and from Baltimore, Maryland, to Raleigh, North Carolina - about 135,000 square kilometers. Two miners were killed in the panic the shock caused at Brown's Coal Pits, near Dover Mills, about 30 kilometers from Richmond. At Charlottesville, Fredericksburg, Lynchburg, and Norfolk, windows rattled violently, loose objects shook, and walls of buildings were visibly agitated.

On March 9, 1828, an earthquake, apparently centered in southwestern Virginia, was reported felt over an area of about 565,000 square kilometers, from Pennsylvania to South Carolina and the Atlantic Coastal Plain to Ohio. Very few accounts of the shock were available from places in Virginia; it was reported that doors and windows rattled. President John Quincy Adams felt this tremor in Washington, DC, and provided a graphic account in his diary. He compared the sensation to the heaving of a ship at sea.

On February 21, 1774, a strong earthquake was felt over much of Virginia and southward into North Carolina. Many houses were moved considerably off their foundations at Petersburg and Blandford. The shock was described as "severe" at Richmond and "small" at Fredericksburg. However, it "terrified the inhabitants greatly." The total felt area covered about 150,000 square kilometers.

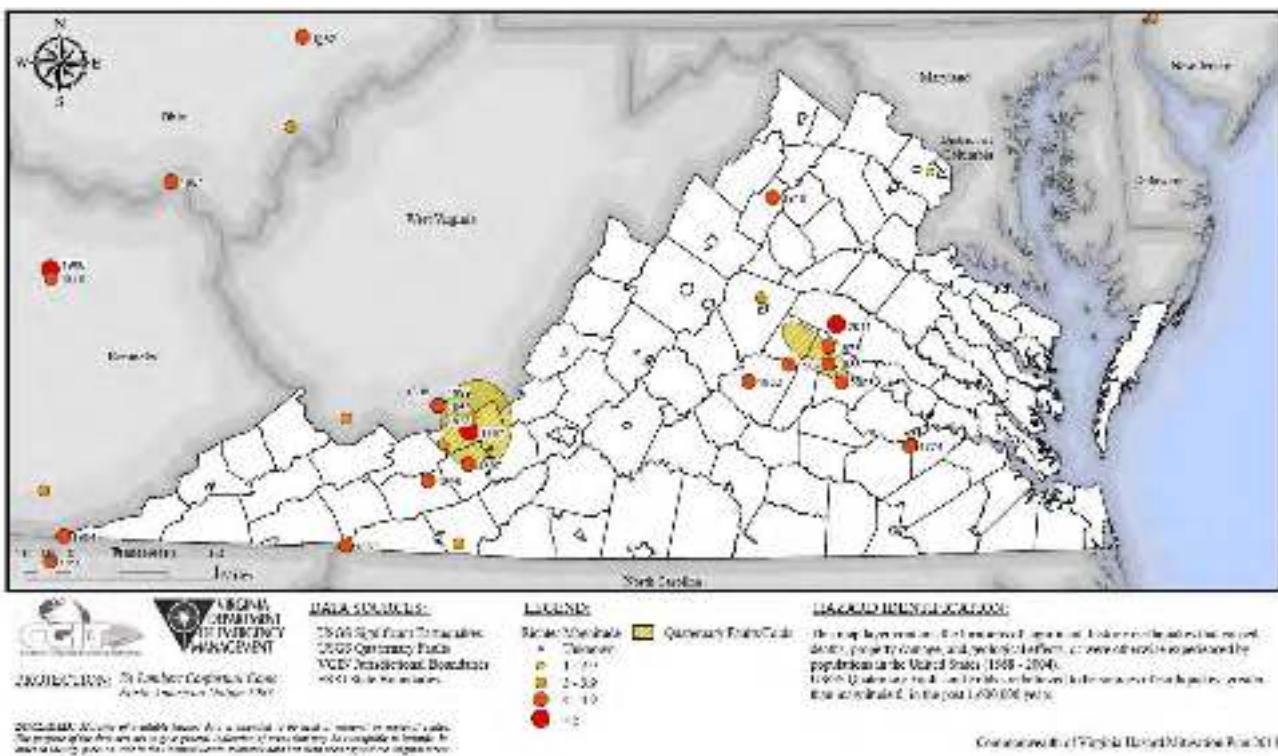




Figure 4.38. Significant Earthquakes 1568 – 2011.

B. Risk Assessment

Similar to other states on the eastern seaboard, the State of Virginia is designated as a moderate risk state for earthquake occurrence by the USGS. Earthquake events can and occasionally do occur in the State, though of much less intensity than those that occur along the west coast. The greatest seismic risk in Virginia is in the Eastern Tennessee Seismic Zone, located in the southwestern portions of the State and far from the Northern Virginia region.

1. Probability of Future Events (Chance of Occurrence)

Earthquakes are low probability, high-consequence events. Although earthquakes may occur only once in the lifetime of an asset, they can have devastating impacts. A moderate earthquake can cause serious damage to unreinforced buildings, building contents, and non-structural systems, and can cause serious disruption in building operations. Moderate and even very large earthquakes are inevitable, although very infrequent, in areas of normally low seismic activity. Consequently, in these regions buildings are seldom designed to deal with an earthquake threat; therefore, they are extremely vulnerable.

Probabilistic ground motion maps are typically used to assess the magnitude and frequency of seismic events. These maps measure the probability of exceeding a certain ground motion, expressed as percent peak ground acceleration (%PGA), over a specified period of years. The severity of earthquakes is site specific, and is influenced by proximity to the earthquake epicenter and soil type, among other factors. Figure 4.39²⁰ shows the PGA zones for the 2500-year Return Period derived from HAZUS^{MH} data developed by VDEM for the Commonwealth Hazard Mitigation Plan. The 2500-year Return period, or 0.04%-annual-chance of occurrence, is much more varied than the 100-year Return period and similar to the two USGS earthquake zones discussed in the earthquake Previous Occurrence section. Southwest and Central Virginia have an increased likelihood of experiencing a significant earthquake. The PGA zones for the 2500-year Return Period were used as the geographic extent parameter for ranking earthquakes. See the Risk Assessment and Methodology and Risk section for more details.

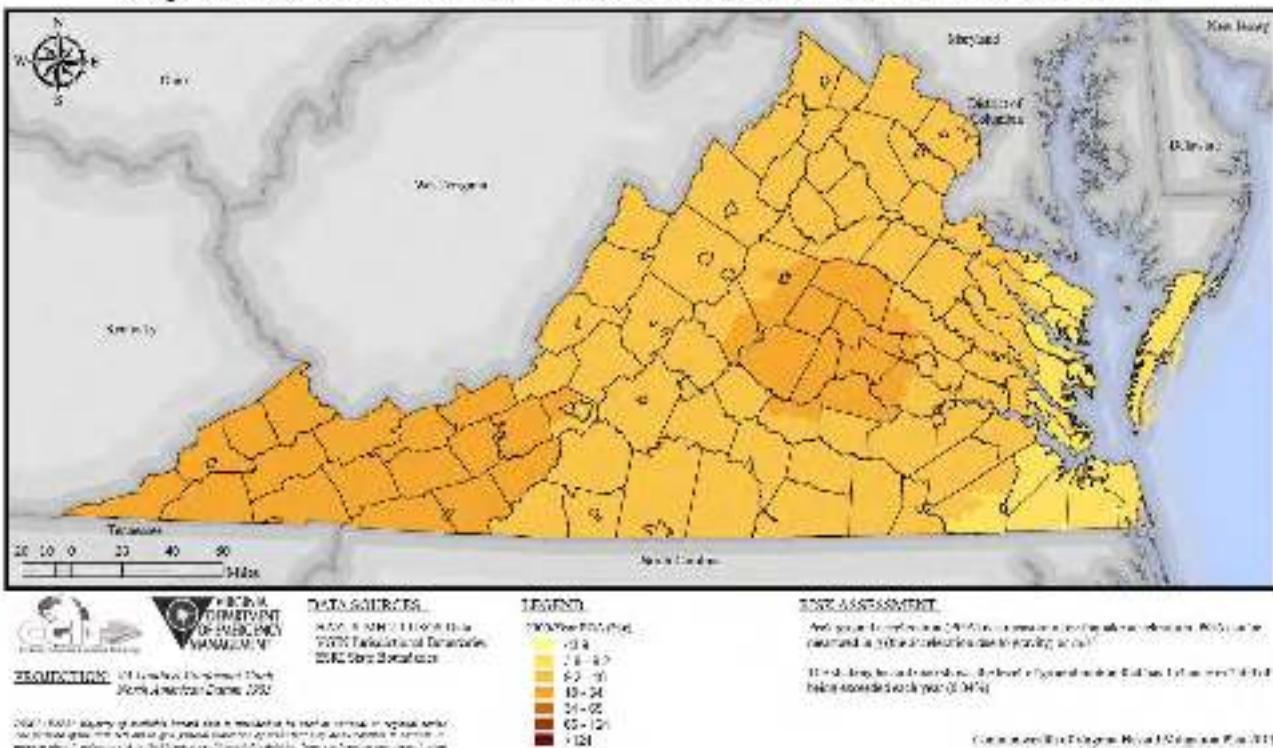


Figure 4.39. 2500-year Return Period Peak Ground Acceleration.

The recurrence interval for significant earthquake events in the Northern Virginia region is very low; however, the potential impact of a major seismic event along the Eastern Tennessee or Central Virginia seismic zone could be moderately destructive. Based on correspondence with Dr. Martin Chapman²¹, director of the Virginia Tech Seismological Observatory, the majority of continued earthquake activity takes place in Goochland County, Virginia, and therefore would be a reasonable earthquake scenario for Northern Virginia. This scenario has been modeled using HAZUS^{MH}; results are summarized below in the Risk section.

2. Impact & Vulnerability

Impacts from earthquakes can be severe and cause significant damage. Table 4.97 provides the corresponding intensity equivalents in terms of MMI, as well as perceived shaking and potential damage expected for given values. These values were used as thresholds to group State and critical facilities into different vulnerability/risk zones based on potential damage.

Table 4.97. Modified Mercalli Intensity (MMI) and PGA.

MMI	PGA (%g)	Perceived Shaking	Potential Damage
I	<0.17	Not Felt	None
II	0.17 - 1.4	Weak	None
III	0.17 - 1.4	Weak	None
IV	1.4 -3.9	Light	None
V	3.9 -9.2	Moderate	Very Light
VI	9.2 -18	Strong	Light
VII	18 -34	Very Strong	Moderate

**Table 4.97. Modified Mercalli Intensity (MMI) and PGA.**

MMI	PGA (%g)	Perceived Shaking	Potential Damage
VIII	34 - 65	Severe	Moderate to Heavy
IX	65 - 124	Violent	Heavy
X	> 124	Extreme	Very Heavy
XI	> 124	Extreme	Very Heavy
XII	> 124	Extreme	Very Heavy

The Northern Virginia planning region vulnerability and impact has been calculated in terms of total direct economic loss, as defined by HAZUS^{MH}. This includes damage to structural, non-structural, building, contents, inventory loss, relocation, income loss, rental loss, and wage loss. Additional information can be found in the Jurisdiction Risk portion of this section.

3. Risk

Moderate and even very large earthquakes are inevitable, although very infrequent, in areas of normally low seismic activity. Earthquake HAZUS^{MH} analysis was completed for the 2016 plan update, to continue the methodology used in previous plans. Below are highlights of the results.

HAZUS-MH Analysis

Due to the region's relatively low seismic risk, buildings and infrastructure throughout the region are not designed to withstand major ground shaking events. This means that if such events do occur, while unlikely, the losses would likely be substantial. HAZUS^{MH} was used to update damage and loss estimates for the probabilistic ground motions associated with each of eight return periods (100, 250, 750, 1000, 2000, and 2500 years). The building damage estimates were then used as the basis for computing direct economic losses. These include building repair costs, contents and business inventory losses, costs of relocation, capital-related, wage, and rental losses. Annualized loss was computed, in HAZUS^{MH}, by multiplying losses from the eight potential ground motions by the respective annual frequencies of occurrence, and summing the values.

Specific result reports and GIS-generated by HAZUS can be found in Appendix D.

HAZUS^{MH} can be used to evaluate a variety of hazards and associated risk to support hazard mitigation. This revision utilized a Level 1 analysis for the earthquake module. Level 1 analysis involves using the provided hazard and inventory data with no additional local data collection. This is an acceptable level of information for mitigation planning; a future version of this plan could be enhanced with Level 2 or 3 analyses. The estimates of social and economic impacts contained in this report were produced using HAZUS^{MH} loss estimation methodology software, which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

For this plan update, the probabilistic scenario in HAZUS^{MH} was run on a region-wide basis, with the assessment focusing on the 2500-year return event. Based on this analysis, the Northern



Virginia region can expect over \$1.49 million in annualized damages to transportation, utility, and building stock throughout the region. The scenario modeled a 6.5 magnitude earthquake, centered near the same location as the actual 2011 Louisa County earthquake, with a depth of 10 meters, which was the same scenario used in the 2010 update. This scenario was maintained for continuity of the assessment. As discussed above, this would be a reasonable and likely scenario for the region. The results of this magnitude earthquake would result in over \$3.74 billion dollars in damages to building stock, utility infrastructure, and transportation infrastructure. Table 4.98 summarizes the results of the region-wide analysis for the probabilistic scenario. (*Note: Town information is included the county totals.*) Building stock data includes damages to buildings, contents, inventory, and business interruption costs. Utility infrastructure includes damages to facilities and pipelines. Transportation infrastructure accounts for segments, bridges, tunnels, and facilities.

Table 4.98. HAZUS^{MH} Estimate: Damages from probabilistic scenario 2500-year return interval.

Jurisdiction	Building Stock	Transportation Infrastructure	Utility Infrastructure	Total
Arlington County	\$343,903,000	\$4,726,000	\$3,172,000	\$347,551,000
Fairfax County	\$1,794,989,000	\$12,702,000	\$20,528,000	\$1,828,219,000
Loudoun County	\$430,261,000	\$1,985,000	\$8,280,000	\$440,526,000
Prince William County	\$679,957,000	\$4,027,000	\$15,648,000	\$699,632,000
City of Alexandria	\$274,089,000	\$3,011,000	\$4,038,000	\$281,238,000
City of Fairfax	\$63,431,000	\$28,000	\$286,000	\$63,745,000
City of Falls Church	\$274,089,000	\$0	\$154,000	\$274,243,000
City of Manassas	\$74,521,000	\$854,000	\$5,412,000	\$80,787,000
City of Manassas Park	\$20,296,000	\$131,000	\$165,000	\$20,592,000
Total	\$3,708,422,000	\$27,464,000	\$57,684,000	\$3,793,570,000

Critical Facility Risk

HAZUS^{MH} estimates the region has 2,857 hospital beds available for use. Based on the scenario, on the day of the earthquake the region would have 71% of hospital beds available (functionality) for use by patients already in the hospital and those injured by the earthquake. All essential facilities would have functionality of greater than 50% on the day of the earthquake. After one week, 87% of the beds would be back in service; by 30 days after the event, 97% would be back in service.

Sheltering Needs

The model estimates 2,437 households to be displaced from the scenario. Of these, 1,283 people (out of a total population of 2,230,623) will seek temporary shelter.



Debris Generation

HAZUS^{MH} estimates the region would have to deal with a total of 1.21 million tons of debris from the scenario event. Of that amount, 69% would be made up of brick and wood debris, with the remainder being reinforced concrete and steel. If this amount of debris is converted to an estimated number of truckloads (assuming 25 tons per truckload), the scenario requires 48,520 truckloads to remove the debris generated by this scenario earthquake.

Existing Buildings and Infrastructure Risk

As discussed in the community profiles previously, there is an estimated 663,000 buildings in the region with an aggregate total building replacement value (excluding contents) of \$320,418 million dollars. The majority of the buildings in the region are associated with residential housing. Wood frame construction makes up 73.6% of the building inventory.

Based on the HAZUS^{MH} scenario, there would be about 22,807 buildings with at least moderate damage. Approximately 554 buildings would be damaged beyond repair. Table 4.99 summarizes the expected damage and number of buildings damaged, by occupancy.

Table 4.99. HAZUS^{MH} Estimate: Expected Building Damage by Occupancy.

Occupancy Type	None		Slight		Moderate	
	Count	%	Count	%	Count	%
Agriculture	1,311	0.20	219	0.34	99	0.44
Commercial	26,688	4.67	4,502	6.97	2,524	11.06
Education	1,458	0.26	237	0.37	134	0.59
Government	918	0.16	154	0.24	93	0.41
Industrial	6,281	1.10	1,072	1.66	663	2.91
Other Residential	21,475	3.76	2,924	4.53	1,482	6.50
Religious	2,920	0.51	395	0.61	203	0.89
Single Family	510,548	89.32	55,062	85.28	17,609	77.21
Sub-totals:	571,600	--	64,566	--	22,807	--
	Extensive		Complete		Totals	
	Count	%	Count	%	Count	--
Agriculture	19	0.45	2	0.29	1,650	--
Commercial	464	11.16	51	9.19	34,229	--
Education	22	0.52	3	0.53	1,854	--
Government	15	0.36	2	0.33	1,182	--
Industrial	116	2.80	12	2.25	8,144	--
Other Residential	201	4.82	18	3.29	26,100	--
Religious	41	0.99	5	0.93	3,564	--
Single Family	3,281	78.90	461	83.20	586,961	--
Sub-totals:	4,158	--	554	--	--	--



Overall Loss Estimates and Ranking

No earthquake events were recorded in the NCDC database for the Northern Virginia region; as a result, no NCDC annualized loss estimates were calculated.

The hazard ranking for earthquake is based on events reported in the NCDC Storm Events database and a generalized geographic extent. The geographic extent ranking category used the PGA values for the 2500 Return Period. This return period represents a 0.04%-annual-chance of occurrence in any given year. The Northern Virginia planning region was ranked as ‘Moderate’ for earthquakes. Figure 4.39 shows the seven parameters that were used to derive the overall risk ranking. As discussed in the risk assessment methodology section, parameters that did not have recorded events in the NCDC database were given the lowest default score (1).

For the 2016 plan update the qualitative assessment was performed by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard. Therefore, to avoid repetition, Table 4.100 provides the results of the qualitative assessment for all participating jurisdictions, as all jurisdictions were found to have the same results.

Table 4.100. 2016 Qualitative Assessment for Earthquakes.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Possible	Critical	Moderate	Less than 6 hours	Less than one week

XII. Landslides

NOTE: As part of the 2016 plan update, the Landslides hazard was reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4, Section IV Ranking and Analysis Methodologies. Each section of the plan was also reformatted for improved clarity, and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

Landslides are the downward movement of large volumes of surface materials under gravitational influences.²² Types of movement include: rotational, translational, block, falls, topples, avalanche, earth flow, creep, and lateral spreading.²³ Landslide materials in motion generally consist of fractured or weathered rock, loose or unconsolidated soils, and vegetative debris. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, volcanic eruptions, and changes in groundwater levels.



There are several types of landslides: rock falls, rock topple, slides, and flows. Rock falls are rapid movements of bedrock, which result in bouncing or rolling. A topple is a section or block of rock that rotates or tilts before falling to the slope below. Slides are movements of soil or rock along a distinct failure surface. Mudflows, sometimes referred to as mudslides, lahars, or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or ‘slurry.’ Slurry can flow rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing in size as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.

Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow resulting from the 1980 eruptions of Mount St. Helens, in the State of Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of California, Oregon, and Washington are at risk from the same types of flows during future volcanic eruptions.

2. Geographic Location/ Extent

In the United States, it is estimated that landslides cause up to \$2 billion in damages and from 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year. Figure 4.40 delineates areas where large numbers of landslides have occurred and areas that are susceptible to landslides in the conterminous United States. This map layer is provided in the USGS Professional Paper 1183, “Landslide Overview Map of the Conterminous United States.”

While mountainous areas in Virginia are the most susceptible to landslide events, landslide and subsidence hazards do exist elsewhere in the State, including the Northern Virginia region – though these events are quite rare and limited in terms of their impact on people and property. Minor landslide events are possible in localized, steep-sloped areas of the Northern Virginia region during extremely wet conditions. These areas are primarily located in western Loudoun County, as well as some areas of moderate risk in extreme eastern areas of Fairfax and Prince William counties. Figure 4.41 provides a general indication of where landslide events are most likely to occur in Virginia based on landslide incidence and susceptibility data provided by the USGS and mapped by VDEM.

Areas that are generally prone to landslide hazards include: previous landslide areas; the bases of steep slopes; the bases of drainage channels; and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include: areas that have not moved in the past; relatively flat-lying areas away from sudden changes in slope; and areas at the top or along ridges, set back from the tops of slopes.

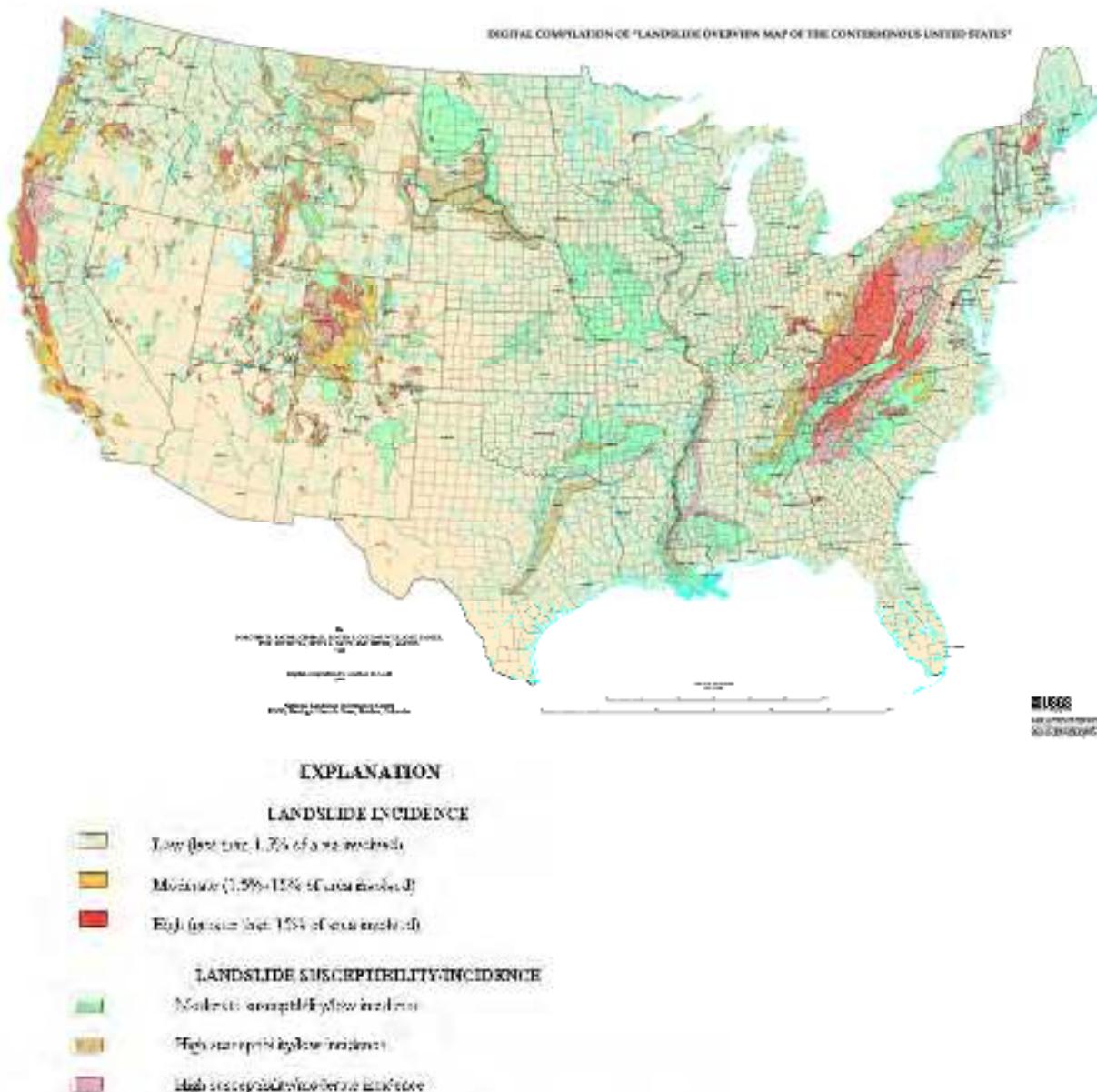


Figure 4.40. Landslide Overview Map of the Conterminous United States

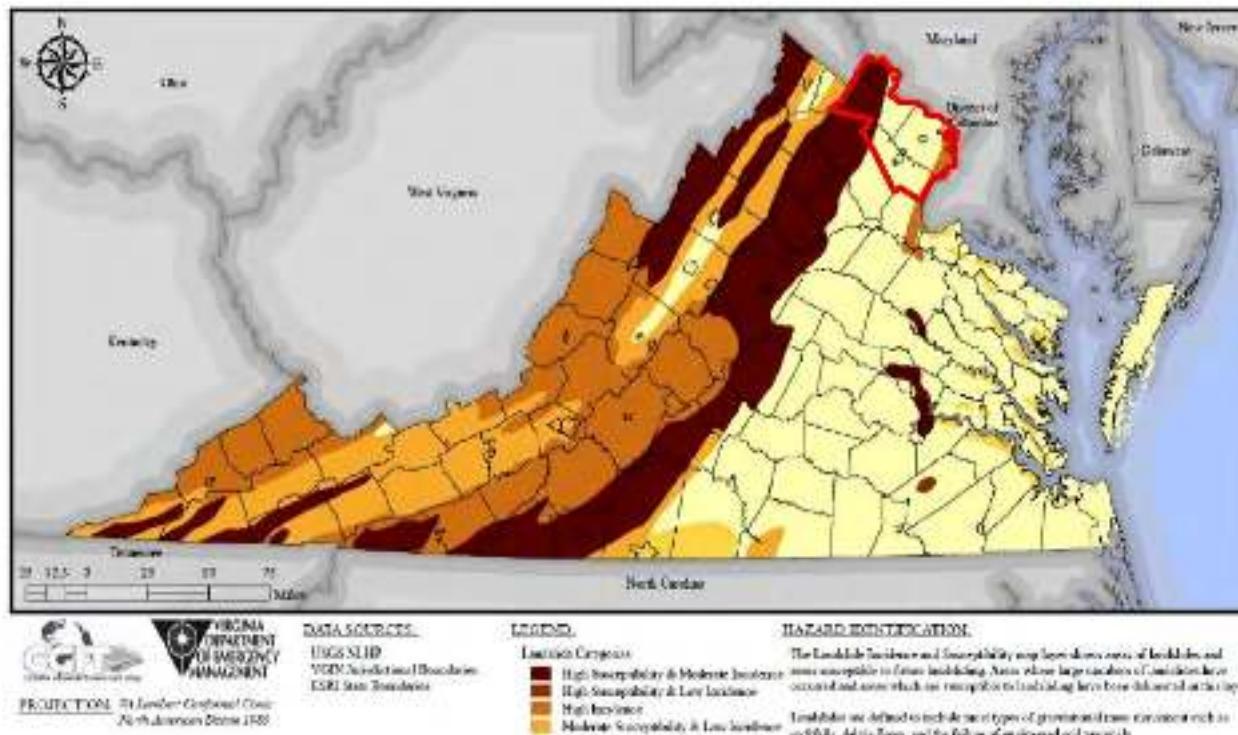


Figure 4.41. Landslide Incidence and Susceptibility.

3. Magnitude or Severity

Landslides are frequently associated with periods of heavy rainfall or rapid snow melt. Such landslides tend to worsen the effects of flooding that often accompanies these weather events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

4. Previous Occurrences

There are no historical records of major landslide events in the Northern Virginia region, as they are relatively uncommon events. No recent incidents were reported for the 2016 update to this plan. Minor landslide events are possible and have been known to occur in localized, steep-sloped areas of the region during extremely wet conditions. Though there are no documented occurrences, landslides are more likely to occur in western portions of Loudoun County than other areas of the region. Small landslides and minor subsidence issues are possible in eastern areas of Fairfax County, possibly due to the presence of marine clay, though no major damages have ever been recorded.

In June 2003, a minor landslide occurred in the Lansdowne area of Loudoun County, breaching a retaining wall, disrupting underground utility lines, and threatening 10 homes. According to local officials this was a very isolated incident brought on by heavy spring rains and should not indicate that the area is prone to recurring landslides.



B. Risk Assessment

The landslide data set shows areas in the United States where large numbers of landslides have occurred and areas that are susceptible to landslides. This data set is a digital representation of USGS Open-File Report 97-289, which is a PDF version of the 1997 USGS Digital representation of Landslide Overview Map (scale 1: 4,000,000). The report classifies the major physical subdivision of the United States and assesses the vulnerability based on subdivision characteristics. Figure 4.42 highlights the areas of increased incidence and susceptibility. The purpose of this dataset is to provide a general indication of areas that may be susceptible to sliding. It is not suitable for site selection or local planning initiatives.

As is evident from the following figure, the majority of the planning area falls within a low risk of incidence area, with small portions falling within a high risk of incidence area and the remainder within an area defined as high susceptibility/moderate incidence.

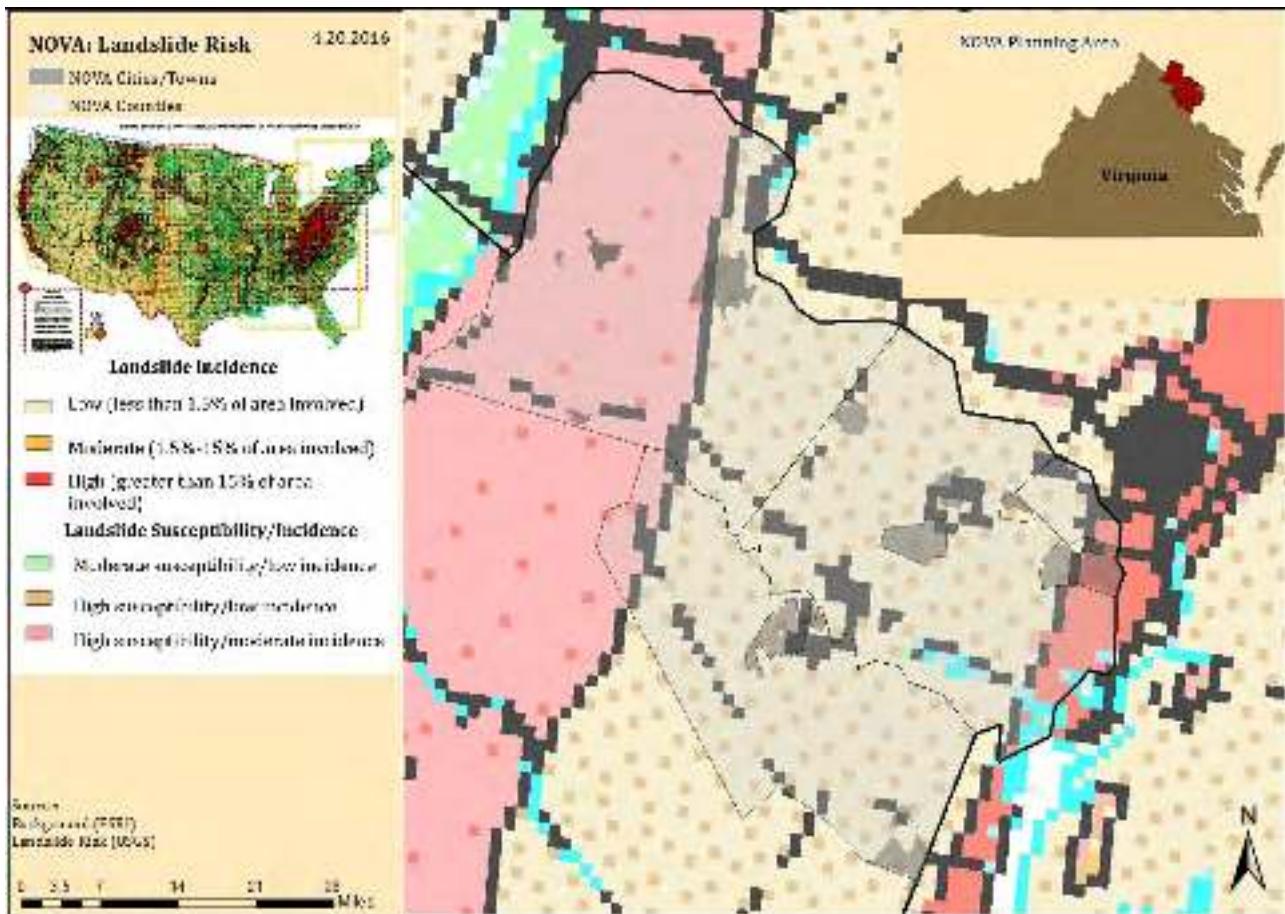


Figure 4.42. Planning Area Landslide Risk.



1. Probability of Future Occurrences

Landslide probability is highly site-specific, and cannot be accurately characterized on a statewide basis, except in the most general sense. Relative risk ranking is intended only for general comparison to the other hazards that impact the region. The magnitude of landslides is dependent on the amount of liquid and landmass in motion and the amount of development in the area. Often a landslide will be more severe in areas with higher slopes and poorly drained soils. Some areas that are generally prone to landslides include old landslide sites, the base of slopes, the base of minor drainage hollows, the base or top of old fill slope, the base or top of a steep cut slope, and developed hillsides where leach field septic systems are used.

2. Impact & Vulnerability

Landslides can cause serious damage to highways, buildings, homes, and other structures that support a wide range of economies and activities. Landslides commonly coincide with other natural disasters. Expansion of urban development contributes to greater risk of damage by landslides.

3. Risk

While some slope stability problems have been associated with marine clay in Fairfax County (marine clay becomes loose as moisture content increases, and is subject to slope creep if the natural slope is steepened during site development) the county has identified areas of marine clay and has established regulations requiring special engineering investigations and design procedures in the areas.

With future growth, various non-structural methods, such as zoning and grading ordinances, as well as structural methods, should be analyzed in terms of cost-effective alternatives. Zoning and grading ordinances to avoid building in areas of potential hazard or to regulate construction to minimize the potential for landslides is one non-structural method to reduce the likely consequences of debris flows. Loudoun County has adopted zoning ordinances preventing the development of building sites with steep slopes along the Blue Ridge (defined in the ordinance as exceeding a 15% grade, equivalent to an eight-degree slope), which substantially reduces the hazards of landslides and debris flows within that area.

Critical Facility Risk

Due to the lack of specific data regarding landslides and specific building information in the planning area, the potential risk to critical facilities and existing buildings and infrastructure was not estimated for this plan update.

Existing Buildings and Infrastructure Risk

For the purposes of this risk assessment, potentially at-risk buildings for landslides were not considered due to the fact that the landslide incidence data is highly generalized, owing to the small scale and the scarcity of precise landslide information for much of the country, and is unsuitable for local planning or actual site selection. This precaution should be noted and is applicable to the analysis completed for critical facilities in the landslide zones.



Overall Loss Estimates and Ranking

Due to the lack of any historical landslide damage data and well established occurrence probabilities, damages caused by landslides and associated dollar losses could not be estimated for the 2016 update or any previous version of this plan.

The Commonwealth of Virginia's 2013 Hazard Mitigation Plan ranking was based on the NCDC database. The update to the Northern Virginia plan used this same framework to establish a common system for evaluating and ranking hazards. While this ranking methodology makes sense for the majority of the hazards in this plan, the data is limited/non-existent for landslides.

Inputs for landslide were very limited as a result of having no landslide events available in the NCDC database. To be able to include landslide in the ranking, some general assumptions were made; geographic extent was the primary basis for establishing risk and was calculated as what percent of the jurisdiction is in the high risk zone, as defined by USGS. In lieu of probability for future occurrence, areas with high landslide risk were assumed to be at greater risk. Since there are no recorded landslide events, the lowest ranking score (1) was assigned to the jurisdictions for events, damages, deaths, and injuries to be able to compare landslide to the other hazards.

For the 2016 plan update the qualitative assessment was performed by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard. It is possible that Loudoun County may have a slightly higher level of risk to the hazard, but this cannot be determined from the available data and a single occurrence. For practical and planning purposes, the region is assumed to have a uniform qualitative risk of 'Low'. Therefore, to avoid repetition, Table 4.101 below provides the results of the qualitative assessment for all participating jurisdictions, as all jurisdictions were found to have the same results

Table 4.101. 2016 Qualitative Assessment for Landslide.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Critical	Moderate	Less than 6 hours	Less than one week

XIII. Wildfire

NOTE: As part of the 2016 plan update, the Wildfire hazard was reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4, Section IV Ranking and Analysis Methodologies. Each section of the plan was also reformatted for improved clarity and new maps and imagery, when available and appropriate, were inserted.



A. Hazard Profile

1. Description

A wildfire is any fire occurring in a wildland area (i.e., grassland, forest, brush land) except for fire under prescription. Prescription burning, or ‘controlled burn,’ undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters. Wildfires are part of the natural management of the Earth’s ecosystems, but may also be caused by natural or human factors. More than 80% of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

There are three classes of wildland fires: surface fire, ground fire, and crown fire. A surface fire is the most common of these three classes and burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. Wildland fires are usually signaled by dense smoke that fills the area for miles around.

State and local governments can impose fire safety regulations on home sites and developments to help curb wildfire. Land treatment measures such as fire access roads, water storage, helipads, safety zones, buffers, firebreaks, fuel breaks, and fuel management can be designed as part of an overall fire defense system to aid in fire control. Fuel management, prescribed burning, and cooperative land management planning can also be encouraged to reduce fire hazards.

Fire probability depends on local weather conditions; outdoor activities such as camping, debris burning, and construction; and the degree of public cooperation with fire prevention measures. Drought conditions and other natural disasters (tornadoes, hurricanes, etc.) may increase the probability of wildfires by producing fuel in both urban and rural settings. Forest damage from hurricanes and tornadoes may block interior access roads and fire breaks, pull down overhead power lines, or damage pavement and underground utilities.

Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses, and industries are located within high fire hazard areas. The increasing demand for outdoor recreation places more people in wildlands during holidays, weekends, and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for the inferno that can sweep through brush and timber and destroy property in minutes.

2. Geographic Location/ Extent

Wildfires commonly begin unnoticed and spread quickly through vegetative fuels. As discussed in the ranking methodology section, the VDOF risk assessment represents the geographic extent or locations throughout the Commonwealth that have a higher risk for wildfire. The geographic extent score for a given jurisdiction is based on the percent of the jurisdiction that falls within the “high” risk area as defined by VDOF. Fairfax and Prince William Counties have the highest percent of their land area within the high risk classifications as compared to the other jurisdictions in the planning region. Figure 4.43 reflects the VDOF risk assessment and includes the geographic extent parameter used in the hazard ranking. Several areas in Northern Virginia



are conducive to wildfires: the Conway-Robinson State Forest and Prince William Forests Park in Prince William County among them.

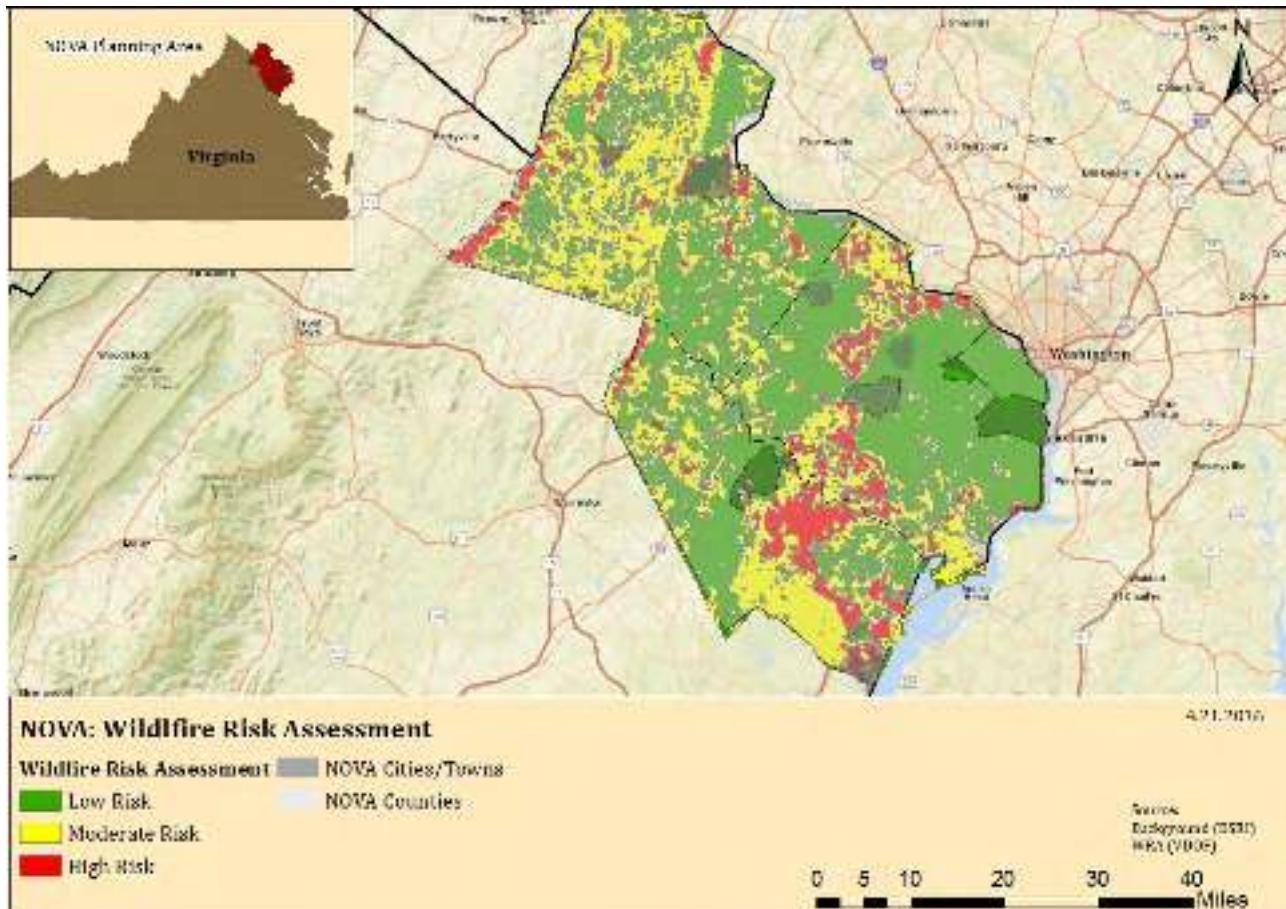


Figure 4.43. VDOF Wildfire Risk Assessment of Northern Virginia.

3. Magnitude or Severity

The Northern Virginia region is not considered as at-risk to wildfire as other areas of the State, but wildfire occurrence is certainly a hazard that does occur. According to VDOF records, there were 141 wildfire events in the Northern Virginia region between 1995 and 2013 (the latest year for which data was available). These fires burned a total of 966 acres, but fortunately caused no deaths or injuries. These fires were typically small in size, burning an average of approximately 16 acres before being suppressed. Of the 141 recorded historical incidents during this period, six fires burned an area greater than 10 acres (all in Loudoun or Prince William County). This is a significant increase in the last few years, as ten of these fires occurred between 2009 and 2013. Table 4.102 lists the number of these fire events, acres burned, and estimated damages by jurisdiction for the Northern Virginia region (where available).

4. Previous Occurrences

While the Commonwealth of Virginia rarely experiences the large, extensive wildfires typically seen in the western regions of the United States, wildfire risk remains a genuine concern. According to the VDOF, as of 2011 (the most recent year for which acreage calculations were



available), about 1,411 wildfires consume an average of 10,181 acres in the State each year. During 2011, Virginia lost more than 22,000 acres to wildfires.

Local records of wildfire occurrences do exist, though the detail recorded in them varies significantly from jurisdiction to jurisdiction. This makes determining if an incident was, in fact, a wildfire and the consequences of that incident difficult to do for comparison purposes. The majority of wildfires that do occur are contained before they grow large, and are handled by local fire resources, which means that the majority of data regarding previous occurrences is stored, in some form, at the local level.

Given the amount of wildland/urban interface acreage within the planning area, it is unsurprising that there are numerous instances where local responders are called upon to deal with wildfires – sometimes multiple times in a single day. For example, on February 19, 2011, Fairfax County responded to a 20-acre wildfire, a 2-acre wildfire, a 5-acre wildfire, and numerous other incidents – all on the same day.

Virginia's wildfire season normally occurs in the spring (March and April) and then again in the fall (October and November). During these times, the relative humidity is usually lower, winds tend to be higher, and the fuels are cured to the point where they readily ignite. Also during these times hardwood leaves are on the ground providing more fuel and allowing sunlight to directly reach the forest floor, warming and drying the surface fuels.

Fire activity fluctuates during each month and also varies from year to year based on precipitation amounts. During years of adequate rain and snow, wildfire occurrence is typically low. Lack of moisture during other years means extended periods of warm, dry, windy days and therefore increased fire activity. The damage caused by Hurricane Isabel in 2003 increased the threat of wildfires in Virginia, and creating a major threat to lives and homes in the eastern half of Virginia for several years to come. The dead and downed timber caused by the storm has had time to cure and could produce wildfires that will be larger and much harder and dangerous to suppress.

Records indicate that most of Virginia's wildfires are caused by people. According to VDOF, the majority of wildfire incidents in the State from 1995 to 2011 (the most recent year for which data was available) occurred because of debris burning – a human-caused activity. Virginia is growing more rapidly than many other States, and its population has more than doubled in the last 50 years. Further, people are moving into residential developments located within forested areas, and there is an increased use of the forests for recreational uses. All of these trends increase the risk of wildfires and require continued fire prevention and protection activities.

There have been 141 wildfire burning 966 acres during 1995 through 2013 (the most recent year for which data was available) totaling at least \$180,895 in damages. Table 4.102 shows the total number of fires, acres burned, jurisdictions that had recorded wildfire events by VDOF. Loudoun and Prince William County wildfires make up the majority of damages in Northern Virginia during the period of record (1995-2013).

**Table 4.102. Wildfire events in the Northern Virginia Region, 1995-2013, based on VDOF Data.**

Jurisdiction	Number of Fires	Total Acres
Fairfax County	2	3
Loudoun County	100	379
<i>Town of Leesburg</i>	2	2
Prince William County	36	615
<i>Town of Dumfries</i>	1	6
Total	120	368

The available data illustrates that majority of the wildfire occurrences in the Northern Virginia region were caused by debris burning and other human activities. Table 4.103 shows the leading causes of wildfires in the region based on VDOF records for the 141 historical wildfires occurring between 1995 and 2013 (the most recent year for which data was available).

Table 4.103. Leading Causes of Wildfires in the Northern Virginia Region, 1995-2013

Cause	# of Fires	% of Wildfires
Debris Burning	42	30%
Children	24	17%
Miscellaneous	31	22%
Incendiary	15	10%
Smoking	12	8%
Equipment Use	9	6%
Campfire	2	1%
Lightning	1	1%
Railroad	1	1%
Power Lines	2	1%
Prescribed Burn	1	1%
Firearms/Ammunition	1	1%

Source: VDOF

Based on the number of historical occurrences, wildfires are fairly prevalent events in the Northern Virginia region. These events, however, are usually contained to very small areas and have caused minimal damages to property due to strong fire response and suppression capabilities.

B. Risk Assessment

1. Probability of Future Events

Future wildfire incidents are difficult to predict, as the factors influencing wildfire generation vary greatly with changing weather conditions and human activities. There is currently no quantitative estimate of future wildfire probability for specific regions of the State.



While the VDOF Wildfire Risk Assessment does indicate the relative propensity for wildfires across the State, this assessment does not assign probabilities of occurrence or return intervals as is common with some of the other hazards. Based on available data from VDOF, during the years 1995 – 2011 (the most recent year for which data was available), Virginia experiences an average of 1,141 wildfires per year, affecting an average of 10,181 acres annually.

2. Impact & Vulnerability

Vulnerability to wildfire is influenced by a variety of factors, such as land cover, weather, and the effectiveness of land management techniques. Highly urbanized areas may be less vulnerable to wildfire, but suburban neighborhoods located at the urban/wildland interface are vulnerable to wildfire. The primary impacts of most wildfires are timber loss and environmental damage, although the threat to nearby buildings is always present. Secondary impacts may also include landslides and mudslides caused by the loss of groundcover which stabilizes the soil.

3. Risk

In 2002 and 2003, VDOF used GIS to develop a statewide spatial *Wildfire Risk Assessment* model that aims to: (1) identify areas where conditions are more conducive and favorable to wildfire occurrence and wildfire advancement; (2) identify areas that require closer scrutiny at larger scales; and (3) examine the spatial relationships between areas of relatively high risk and other geographic features of concern, such as woodland home communities, fire stations, and fire hydrants. This model incorporates data from several other State and Federal agencies including land cover, demographics, transportation corridors, and topography to illustrate the level of wildfire risk for all areas across the State of Virginia. The results of this model were merged and the wildfire risks were classified and scored as: 1 (low), 2 (moderate), and 3 (high). This data is presented in Table 4.104.

Prince William County has over 15% of its acreage in the high risk category, with the Town of Round Hill having almost one-third of its acreage at high risk. Fairfax County has approximately 12% of its acreage in the high risk category, with over 16% of the Town of Clifton's area in high risk. The Northern Virginia region is mostly low (48.97%) and medium (41%) risk, with a tenth of the region in the high risk category.

Table 4.104. Wildfire Risk by Jurisdiction

Jurisdiction	Low (acres)	Low % Area	Medium (acres)	Medium % Area	High (acres)	High % Area	Total Acres
Arlington County	16,064	96.30%	435	2.61%	183	1.10%	16,682
Fairfax County	143,682	57.22%	77,244	30.76%	30,174	12.02%	251,100
<i>Town of Herndon</i>	2,734	99.93%	1	0.04%	0	0.00%	2,736
<i>Town of Vienna</i>	2,795	99.25%	21	0.75%	0	0.00%	2,816
<i>Town of Clifton</i>	43	26.06%	95	57.58%	27	16.36%	165
Loudoun County	136,046	42.16%	166,511	51.60%	20,114	6.23%	322,672
<i>Town of Leesburg</i>	4,670	58.46%	2,635	32.98%	684	8.56%	7,989

**Table 4.104. Wildfire Risk by Jurisdiction**

Jurisdiction	Low (acres)	Low % Area	Medium (acres)	Medium % Area	High (acres)	High % Area	Total Acres
<i>Town of Purcellville</i>	278	13.69%	1,738	85.62%	14	0.69%	2,030
<i>Town of Middleburg</i>	219	33.08%	389	58.76%	55	8.31%	662
<i>Town of Round Hill</i>	0	0.00%	165	69.62%	71	29.96%	237
Prince William County	87,118	39.77%	98,129	44.79%	33,828	15.44%	219,076
<i>Town of Dumfries</i>	745	73.40%	255	25.12%	14	1.38%	1,015
<i>Town of Haymarket</i>	240	78.43%	66	21.57%	0	0.00%	306
<i>Town of Occoquan</i>	83	74.77%	27	24.32%	0	0.00%	111
<i>Town of Quantico</i>	44	93.62%	3	6.38%	0	0.00%	47
City of Alexandria	9,644	98.83%	114	1.17%	0	0.00%	9,758
City of Fairfax	3,801	94.65%	215	5.35%	0	0.00%	4,016
City of Falls Church	1,275	100.00%	0	0.00%	0	0.00%	1,275
City of Manassas	6,130	95.50%	287	4.47%	2	0.03%	6,419
City of Manassas Park	741	65.29%	265	23.35%	129	11.37%	1,135
TOTAL	416,352	48.97%	348,595	41.00%	85,295	10.03%	850,247

Critical Facility Risk

The US Forest Service offers a product called the Wildfire Hazard Potential (WHP) map. This product is a raster geospatial product that can help to inform evaluations of wildfire risk across large landscapes. On its own, the WHP is not an explicit map of wildfire threat or risk, but when paired with data depicting highly valued local resources and assets – such as critical facilities – it can provide approximate relative wildfire risk to those resources and assets.

The locally-provided critical and historical facilities data was intersected with the US Forest Service's wildfire hazard potential to determine which facilities were at an increased risk for wildfire, or being in the urban/wildland interface. Figure 4.44 illustrates the current estimates for wildland fire potential throughout the Northern Virginia region. Figure 4.45 illustrates the location of locally-identified critical facilities within the fire potential estimates. As can be seen in these images, the majority of the region falls within areas currently classified as having very low or low potential for wildfire, with other significant amounts of areas classified as non-burnable.

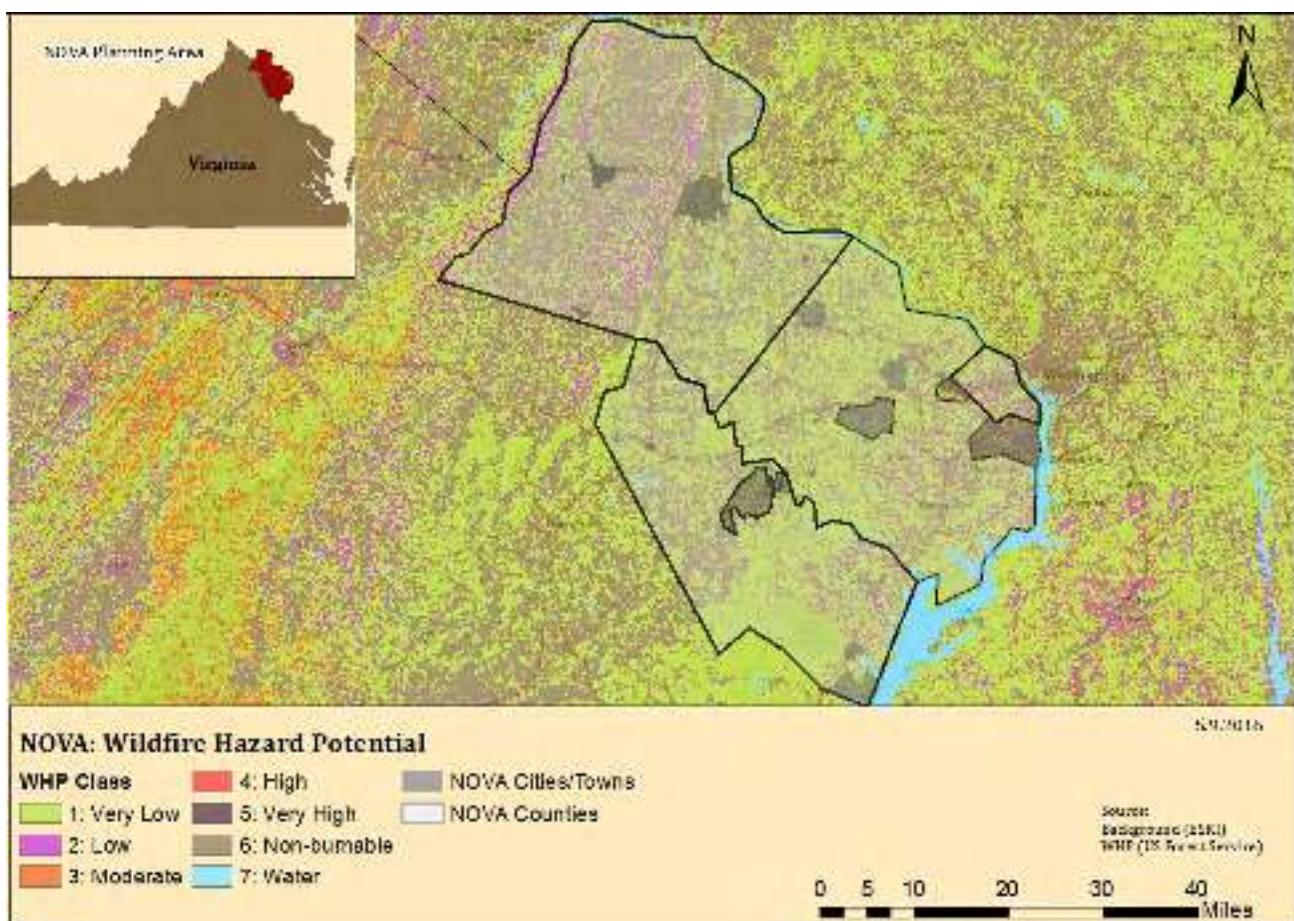


Figure 4.44. Wildfire Hazard Potential for Northern Virginia, based on USFS data.

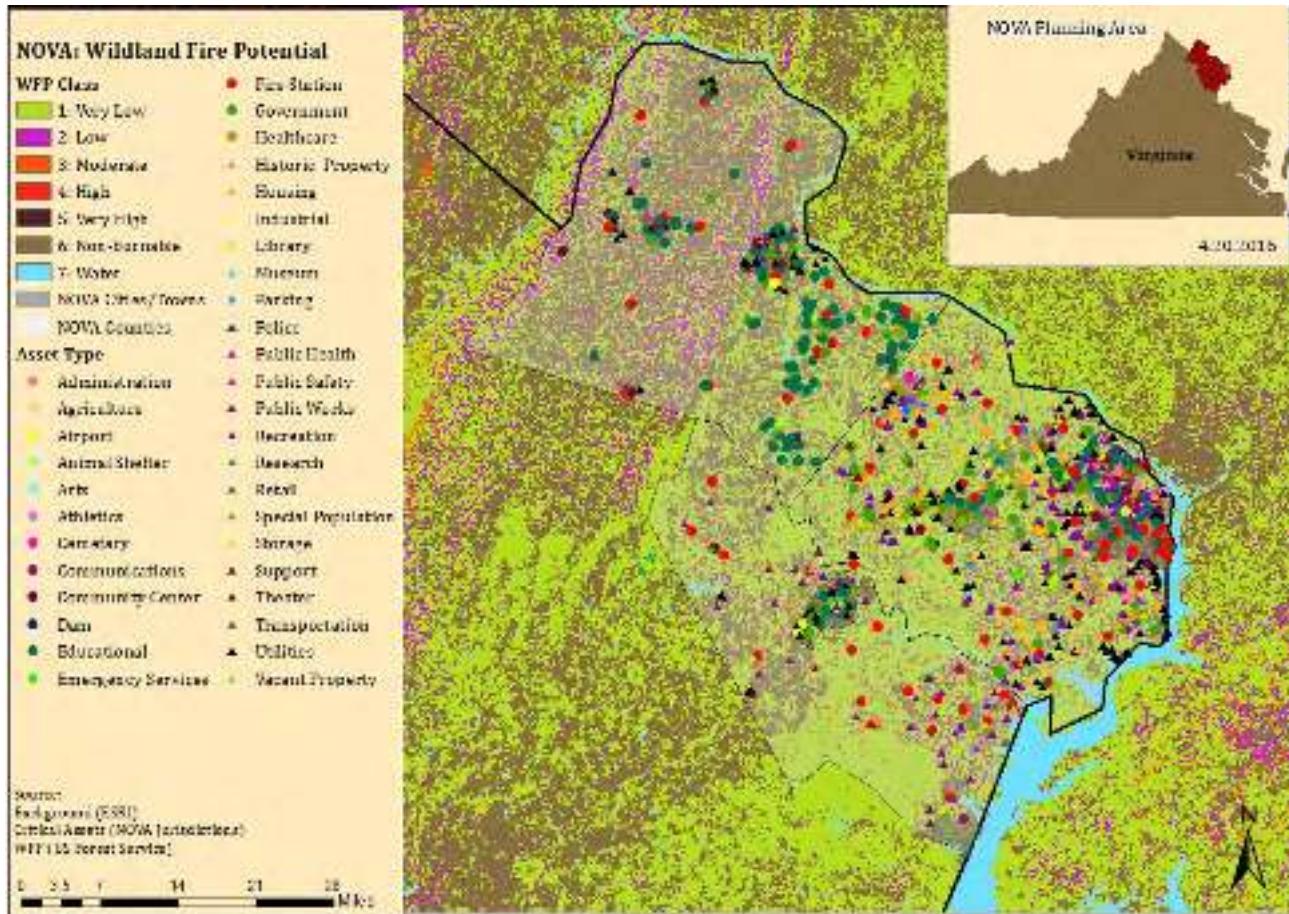


Figure 4.45. Wildfire Hazard Potential for Northern Virginia – With Critical Facilities.

Table 4.105 shows the number of critical facilities, by locality, and the corresponding wildfire potential for their location. The names and information for the local critical facilities in the wildfire risk zones are available in the Critical Facility-Risk Appendix D. Figures for each participating jurisdiction can also be found in Appendix D. The lack of wildfire probabilities and detailed infrastructure data led to the inability to calculate potential losses due to wildfire.

Table 4.105. Wildfire Hazard Class Exposure for Locally-Provided Critical and Historic Assets				
Jurisdiction	WHP Class	Asset Value	Contents Value	Total Value of Exposure
Arlington County	Non-burnable or Water	\$976,001,803	\$96,448,098	\$1,072,449,901
	Very Low	\$600,313,587	\$107,401,659	\$707,715,246
	Low	\$47,190,500	\$3,209,400	\$50,399,900
	Undefined	\$81,600	\$2,000	\$83,600
	<i>Subtotal</i>	<i>\$1,623,587,490</i>	<i>\$207,061,157</i>	<i>\$1,830,648,647</i>
Fairfax County	Non-burnable or Water	\$1,281,440,265	\$157,830,545	\$1,439,270,810
	Very Low	\$583,864,501	\$53,541,788	\$637,406,289
	Low	\$32,697,355	\$4,364,984	\$37,062,339
	Undefined	\$161,505,240	\$15,975,815	\$177,481,055

**Table 4.105. Wildfire Hazard Class Exposure for Locally-Provided Critical and Historic Assets**

Jurisdiction	WHP Class	Asset Value	Contents Value	Total Value of Exposure
	<i>Subtotal</i>	\$2,059,507,361	\$231,713,132	\$2,291,220,493
Loudoun County	Non-burnable or Water	\$1,087,409,540	\$1,087,409,540	\$2,174,819,080
	Very Low	\$1,093,424,340	\$1,093,424,340	\$2,186,848,680
	Low	\$1,141,390	\$1,141,390	\$2,282,780
	<i>Subtotal</i>	\$2,181,975,270	\$2,181,975,270	\$4,363,950,540
Prince William County	Non-burnable or Water	\$463,216,250	\$78,327,055	\$541,543,305
	Very Low	\$107,653,000	\$6,417,385	\$114,070,385
	<i>Subtotal</i>	\$570,869,250	\$84,744,440	\$655,613,690
City of Alexandria	Non-burnable or Water	\$13,455,000	\$5,000,000	\$18,455,000
	Very Low	\$257,461,735	\$59,000,000	\$316,461,723
	Low	\$25,434,825	\$0	\$25,434,825
	<i>Subtotal</i>	\$296,351,560	\$64,000,000	\$360,351,560
City of Fairfax	Non-burnable or Water	\$194,474,176	\$0	\$194,474,176
	<i>Subtotal</i>	\$194,474,176	\$0	\$194,474,176
City of Falls Church	Non-burnable or Water	\$71,530,100	\$0	\$71,530,100
	Very Low	\$1,860,200	\$0	\$1,860,200
	<i>Subtotal</i>	\$73,390,300	\$0	\$73,390,300
City of Manassas	Non-burnable or Water	\$181,079,188	\$49,562,538	\$230,641,726
	Very Low	\$175,569,875	\$24,132,350	\$199,702,225
	<i>Subtotal</i>	\$356,649,063	\$73,694,888	\$430,343,951
City of Manassas Park	Non-burnable or Water	\$38,897,500	\$0	\$38,897,500
	Very Low	\$61,770,900	\$0	\$61,770,900
	<i>Subtotal</i>	\$100,668,400	\$0	\$100,668,400
Town of Clifton	Non-burnable or Water	\$0	\$0	\$0
	Very Low	\$0	\$0	\$0
	<i>Subtotal</i>	\$0	\$0	\$0
Town of Haymarket	Non-burnable or Water	\$3,671,280	\$203,863	\$3,875,143
	Very Low	\$324,353	\$2,014	\$326,367
	<i>Subtotal</i>	\$3,995,633	\$205,877	\$4,201,510
Town of Herndon	Non-burnable or Water	\$30,010,198	\$2,780,084	\$32,790,282
	Very Low	\$17,103,282	\$2,459,867	\$19,563,149
	<i>Subtotal</i>	\$47,113,480	\$5,239,951	\$52,353,431
Town of Leesburg	Non-burnable or Water	\$91,153,261	\$28,138,520	\$119,291,781
	Very Low	\$53,707,958	\$17,131,332	\$70,839,290
	Low	\$1,783,300	\$1,997,900	\$3,781,200

**Table 4.105. Wildfire Hazard Class Exposure for Locally-Provided Critical and Historic Assets**

Jurisdiction	WHP Class	Asset Value	Contents Value	Total Value of Exposure
	<i>Subtotal</i>	\$146,644,519	\$47,267,752	\$193,912,271
Town of Lovettsville	Very Low	\$164,950	\$164,950	329,900
	<i>Subtotal</i>	\$164,950	\$164,950	329,900
Town of Middleburg	Non-burnable or Water	\$675,400	\$675,400	\$1,350,800
	Very Low	\$191,700	\$191,700	\$383,400
	Low	\$6,220	\$6,220	\$12,440
	<i>Subtotal</i>	\$873,320	\$873,320	\$1,746,646
Town of Occoquan	Non-burnable or Water	\$1,645,900	\$0	\$1,645,900
	Very Low	\$320,300	\$30,000	\$350,300
	<i>Subtotal</i>	\$1,966,200	\$30,000	\$1,006,200
Town of Purcellville	Non-burnable or Water	\$2,015,900	\$2,015,900	\$4,031,800
	Very Low	\$3,246,770	\$3,246,770	\$6,493,540
	<i>Subtotal</i>	\$5,262,670	\$5,262,670	\$10,525,340
Town of Round Hill	Non-burnable or Water	\$386,370	\$386,370	\$772,740
	<i>Subtotal</i>	\$386,370	\$386,370	\$772,740
Town of Vienna	Non-burnable or Water	\$25,875,000	\$1,945,000	\$27,820,000
	Very Low	\$6,925,000	\$750,000	\$7,675,000
	<i>Subtotal</i>	\$32,800,000	\$2,695,000	\$34,495,000
Total Exposure	Non-burnable or Water	\$4,280,937,131	\$1,510,722,913	\$5,973,660,044
	Very Low	\$2,963,902,451	\$1,368,280,525	\$4,332,182,006
	Low	\$108,253,590	\$184,537,720	\$1,480,253,006
	Undefined	\$161,586,840	\$2,398,931,432	\$5,516,919,344

Existing Buildings and Infrastructure Risk

As demonstrated above and in the critical facility analysis, most of the wildfire risk in the Northern Virginia region is located in areas of Loudoun and Prince William counties. Historically, wildfires have been larger and caused more damages in these counties mainly due to not only increased vegetative fuel loads, but also because the areas are sparsely settled and have less rapid fire response capabilities. The most at-risk properties within these areas are considered to be those structures located along the wildland-urban interface, defined by the National Wildfire Coordinating Group²⁴ as “the line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.” Structures with combustible roofs and less than 30 feet of cleared defensible space are particularly at risk.



Overall Loss Estimates and Ranking

Between 1995 and 2013 (the most recent year for which data was available), the VDOF recorded 141 wildfire events in the Northern Virginia. Table 4.106 shows the specific annualized number of fires by jurisdiction. This is based on the total VDOF reported damages divided by the number of years of record.

Table 4.106. Annual Number of Wildfires Annualized, based on VDOF data, 1993 – 2013.	
Jurisdiction	Annualized Number of Fires
Fairfax County	0.11
Loudoun County	5.55
Town of Leesburg	0.11
Prince William County	2.0
Town of Dumfries	0.05

No wildfire events were recorded in the NCDC database for the Northern Virginia region; as a result, no NCDC annualized loss estimate was calculated. The Commonwealth of Virginia's 2013 Hazard Mitigation Plan ranking was based on the VDOF data. The update to the Northern Virginia plan used this same framework to establish a common system for evaluating and ranking hazards.

For the 2016 plan update the qualitative assessment was organized by jurisdiction. Based on the data available, Prince William and Loudoun Counties and their associated participating towns were determined to have different risks than all other participating jurisdictions, that of 'Moderate', while all other participating jurisdictions were determined to be 'Low'. To avoid repetition, all other participating jurisdictions are represented below in a single table, and Loudoun and Prince William Counties (and their associated participating towns) are represented in standalone tables.

Loudoun County and the Town of Leesburg, the Town of Lovettsville, the Town of Purcellville, the Town of Middleburg, and the Town of Round Hill; Prince William County and the Town of Dumfries, the Town of Haymarket, the Town of Occoquan, and the Town of Quantico

Table 4.107. 2016 Qualitative Assessment for Wildfire

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Likely	Critical	Moderate	Less than 6 hours	Less than one week



Arlington County and the Town of Clifton, the Town of Herndon, and the Town of Vienna; Fairfax County, the City of Alexandria; the City of Fairfax; the City of Falls Church; the City of Manassas; and the City of Manassas Park.

Table 4.108. 2016 Qualitative Assessment for Wildfire

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Critical	Small	Less than 6 hours	Less than one week

XIV. Sinkholes / Karst / Land Subsidence

NOTE: As part of the 2016 plan update, the Sinkholes/Karst/Land Subsidence hazards were reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4, Section IV Ranking and Analysis Methodologies. Each section of the plan was also reformatted for improved clarity, and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

Sinkholes are a frequent occurrence in areas underlain by calcareous carbonate formations, especially limestone and dolomite. Groundwater flow through cracks, fissures, joints, and other discontinuities in the rock mass dissolves the carbonate minerals creating small voids. Over time continued water seepage and dissolution of minerals enlarges the void to form caves and caverns in the rock. As the void increases in size, so does the load supported by the void roof. If the strength of the roof layer becomes less than the weight of the material above it, the roof fails and the overburden materials collapse into the void. If the collapse manifests itself at the surface, the resulting depression is referred to as a sinkhole. Other calcareous carbonate materials include partially-cemented to well-cemented shell formations found in coastal areas of the southeastern United States.

The process of sinkhole formation depends on a complex set of variables including geologic structure, geochemistry, hydrologic conditions, and development activity. If the roof above the void is sound rock and the water level falls below the roof level, future growth of the void may not reduce the roof thickness and collapse may not occur. However, if the roof rock is fractured or otherwise cracked, shallow groundwater from above can flow into the void bringing with it eroded overburden soil. The erosion of overburdened soil into the rock void creates a similar soil void that can migrate to the surface, resulting in a collapse of the soil roof even though the underlying rock has not collapsed.



Changes in hydrologic conditions, natural or man-made, can increase the occurrence of sinkholes. An increase in the volume and/or velocity of flow through the rock provides more fresh water to dissolve soluble minerals and more energy to erode solid particles, increasing existing voids or creating new ones. Water supply and open pit mining are common reasons for pumping large volumes of water through soluble calcareous formations.

Sink holes vary in size, ranging from a few feet to a mile or more in diameter. Sink holes can reach several hundred feet below the surface. Areas of abundant sinkholes are referred to as karst topography. Karst areas have few surface streams as drainage is primarily through underground solution channels.

Sinkholes can also occur due to the impacts of constructed facilities in most geologic environments, including those not underlain by calcareous carbonate rocks. Undetected leaks in underground utility lines can result in subsurface erosion of soil from around the pipe. Left undetected, the erosion creates a void that expands upward until the soil roof cannot support the overburden load and the roof collapses.

2. Geographic Location/ Extent

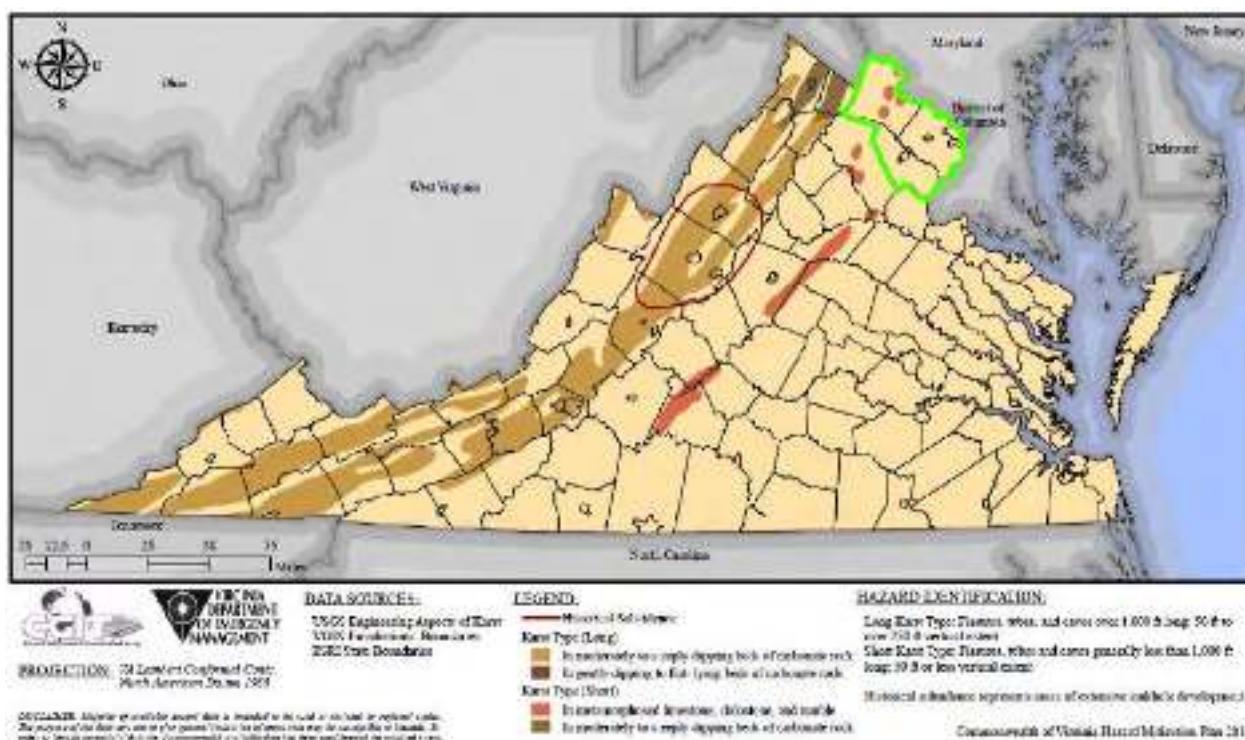
Sinkholes are prevalent in the Great Valley region of central Virginia, including karst terrains in the Shenandoah Valley where voids are formed by the natural dissolution of soluble rock such as limestone and dolomite.

According to the Virginia Department of Mines, Minerals and Energy, sinkholes are very rare in the Northern Virginia region and do not pose a significant risk. However, a band of metamorphosed limestone, dolostone, and marble located in eastern Loudoun County and the Town of Leesburg has a history of sinkhole activity. Figure 4.46 shows the karst regions and areas of historical subsidence in the Commonwealth, based on the USGS Engineering Aspects of Karst. The karst regions in Northern Virginia are considered short karst type, which include fissured, tube, and caves generally less than 1,000 feet long; and 50 feet or less in vertical extent.

Loudoun County has a region of karst geology located in an area roughly one mile on either side of State Route 15 from just south of Leesburg, north to the Potomac River Bridge. The region is bounded sharply to the west by the Bull Run Fault, which runs at the base of Catoctin Mountain through Loudoun County. Figure 4.47 shows the limestone district for Loudoun County. The Limestone Overlay District (LOD) is primarily comprised of the following geologic formations:

- Cf-Frederick Limestone;
- Ct-Tomstown Dolomite;
- JTRc-Catharpin Creek Formation;
- JTRcg-Catharpin Creek Formation Goose Creek Member;
- TRbl-Balls Bluff Siltstone Leesburg Member; and
- TRbs-Balls Bluff Siltsone Fluvial and Deltaic Sandstone Member.

1



2
3 Figure 4.46. Karst Regions and Historical Subsidence in Virginia.
4 Source: Commonwealth of Virginia Hazard Mitigation Plan



Loudoun County Limestone Area



Figure 4.47. Loudoun County limestone district.

Source: Loudoun County



3. Magnitude or Severity

Although sinkholes frequently occur without notice, there are warnings of potential sinkhole development including:

- Slumping or leaning fence posts, utility poles, trees, etc.;
- Discolored vegetation;
- Tension crack visible in the ground surface;
- Discolored well water;
- New cracks in building walls and/or; and
- Newly sagging floors or pavements.

Sinkhole formation is aggravated and accelerated by urbanization. Development increases water usage, alters drainage pathways, overloads the ground surface, and redistributes soil. According to FEMA, the number of human-induced sinkholes has doubled since 1930, costing nearly \$100 million. The increasing frequency of sinkholes could be affected by reporting biases. A paper published by the USGS, Tampa, Florida shows a significant increase in sinkhole development that corresponds to a period of drought. Changes in ground water levels increase the overburden stress on the void roof increasing the potential for roof collapse. Thus using that period as indicating a larger trend may not be appropriate, especially given the context of the initial data. Additionally, Florida data suggests that the jump in sinkhole development in the 1987 to 1991 period was caused, at least in part, by natural events. Further, the reason for the jump in insurance payouts is likely the result of naturally caused sinkholes occurring under more expensively developed real estate²⁵.

4. Previous Occurrences

Water leaking from culverts or other drainage structures can create a void beneath the drainage structure by compaction or internal scour of the soil. This reduction in support can result in displacement of the leaking structure and an increase in leakage or breakage. The void may increase in size to the extent that the soil has insufficient strength to support itself with subsequent failure, leading to the formation of a steep sided, collapsed sinkhole.

Sinkholes remain a possible occurrence in localized areas of the Northern Virginia region. To date, there have been no Federal Declared Disasters or NCDC recorded events for karst related events.

In April 2015, a sinkhole opened in the Exeter Community of Loudoun County. The hole, which measured approximately 30 by 40 feet, formed in the parking lot of a townhouse community, and caused some damages, including the sinking of the roadway and disruption of water service to approximately 65 structures in the area. Reports indicate this was the second sinkhole in this same area in the previous two decades.



Other known events, although not comprehensive, include:

- Heavy rain caused the collapse of a major thoroughfare in Loudoun County in June 2014. The collapse occurred on Dry Mill Road and exposed a 48-inch water main, and resulted in a five-mile detour for motorists.
- A sinkhole 20 feet deep and 25 feet wide closed down Dale Boulevard west of Mapledale Avenue, about four miles from Interstate 95 in Prince William County (2008).
- August 11, 2001, heavy rainfall washed out a culvert and created a sinkhole in Arlington County, though no damages were reported.

B. Risk Assessment

The Engineering Aspects of Karst data set shows areas of karst in the United States. This data set is a digital representation of USGS Open-File Report 2004-1352, which is a PDF version of the 1984 USGS Engineering Aspects of Karst map (scale 1: 7,500,000). These maps depict areas containing distinctive surficial and subterranean features, developed by solution of carbonate and other rocks and characterized by closed depressions, sinking streams, and cavern openings. Loudoun County and the Town of Leesburg are the only areas in the planning region that have been included in the USGS Engineering Aspects of Karst.

David Hubbard, geologist with the Virginia Department of Mines, Minerals, and Energy developed 1: 24,000 scale sinkhole boundary maps during 1980 and 1988 for the State. Sinkhole distribution is shown in three main regions along the Valley and Ridge province. A total of 48,807 sinkholes have been mapped over 254 standard (7.5 minute) topographic maps for an average of 192.1 sinkholes per map. The southern third of the project area represented more than half of the mapped location. There appears to be an increase in the relative degree of karstification from north to south across the State of Virginia²⁶. These maps are not currently available in digital format. Additional analysis may be able to be completed in future versions of this plan as digital data becomes available.

In May 2010, Loudoun County re-adopted and re-enacted the LOD. In February 2010 the Board of Supervisors adopted amendments to the Zoning Ordinance Zoning Map, Facilities and Standards Manual, the land Subdivision & Development Ordinance, and other county ordinances to create the LOD. The amendments will implement the County's adopted Comprehensive Plan provisions concerning limestone areas by creating and mapping a new LOD and amending Section 6-407(A) of the Zoning Ordinance to add a LOD to the list of environmental overlay districts for which the Zoning Administrator is authorized to make cartographic interpretations, and amending Article 8, Definitions, of the Zoning Ordinance to add and/or revise definitions for uses and terminology used in the proposed amendments.

1. Probability of Future Occurrences

The exact time that land subsidence will occur cannot be predicted; it can occur suddenly without warning or over an extended period of several years. However, some factors that can cause a decrease in strength are wet conditions, vibrations, and increased surface loading. Land subsidence that occurs as a result of a drawdown of the groundwater table is likely to take place over a number of years. Procedures for predicting the occurrence of land subsidence have not yet been developed.



To be able to include karst in the risk assessment some general assumptions were made. Geographical Extent, using USGS Karst Topography maps, was the primary basis for establishing risk and was calculated as a percent of the jurisdictional area. In lieu of probability of future occurrence, areas with more karst were assumed to be at greater risk.

2. Impact & Vulnerability

The potential impacts of land subsidence depend on the type of subsidence that occurs (regional or localized, gradual or sudden) and the location that the subsidence occurs. The impacts of subsidence occurring in nonurban areas are likely to be less damaging than subsidence that occurs in heavily populated locations. The amount of structural damage depends on the type of construction, the structure location and orientation with respect to the subsidence location, and the characteristics of the subsidence event (sag or pit).

Potential impacts from land subsidence could include damage to residential, commercial, and industrial structures; damage to underground and above-ground utilities; damage to transportation infrastructure, including roads, bridges, and railroad tracks; as well as damage or loss of crops. The extent and value of the potential damage cannot be assessed because the nature of the damage is site- and event-specific.

3. Risk

As discussed previously, sinkholes are relatively uncommon events in the Northern Virginia region. The existing soil types are not conducive to creating natural sinkholes, and those that do occur are related to soil piping or the dissolution of sparse carbonate rock and typically cause very little damage. There are no known sources of sinkhole probability data for the region and no record of historical incidences causing property damages.

As previously mentioned, Loudoun County has adopted a LOD in their zoning ordinance that seeks to preserve and protect the unique geologic characteristics and the quality of the groundwater in its limestone area. The ordinance is intended to regulate land use and development in areas underlain by limestone and in areas with Karst features and Karst terrain in such a manner as to²⁷:

- Protect the health, safety and welfare of the public;
- Protect groundwater and surface water resources from contamination; and
- Reduce potential for property damage resulting from subsidence or other earth movement.

Critical Facility Risk

The vulnerability of each identified critical facility was assessed using GIS analysis by comparing their physical location with the extent of known hazard areas that can be spatially defined through GIS technology. Of those critical facilities identified in the region, some were indeed determined to be in known hazard areas upon further GIS analysis and thereby determined to be ‘potentially at-risk.’

Loudoun County maintains a karst feature database (the mapped karst features in the County are the developer’s responsibility to provide necessary information to determine if all the



requirements or ordinances and provisions have been met). For applications within the LOD, all documentation and studies are outlined in Section 4-1900 of the zoning ordinance. This organization allows Loudoun County to significantly reduce risk of sinkhole development to facilities, property, and people.

Using the Limestone Layer available through Loudoun County's website, mapped critical assets in Loudoun County were viewed via the County's GIS portal. Of the mapped critical assets, which include schools, fire stations, police stations, other public safety assets, and emergency medical assets, at least one fire station was found to be located within the known limestone area of Loudoun County. Figure 4.48 provides this graphic; the area identified as limestone is indicated in pink on the image.

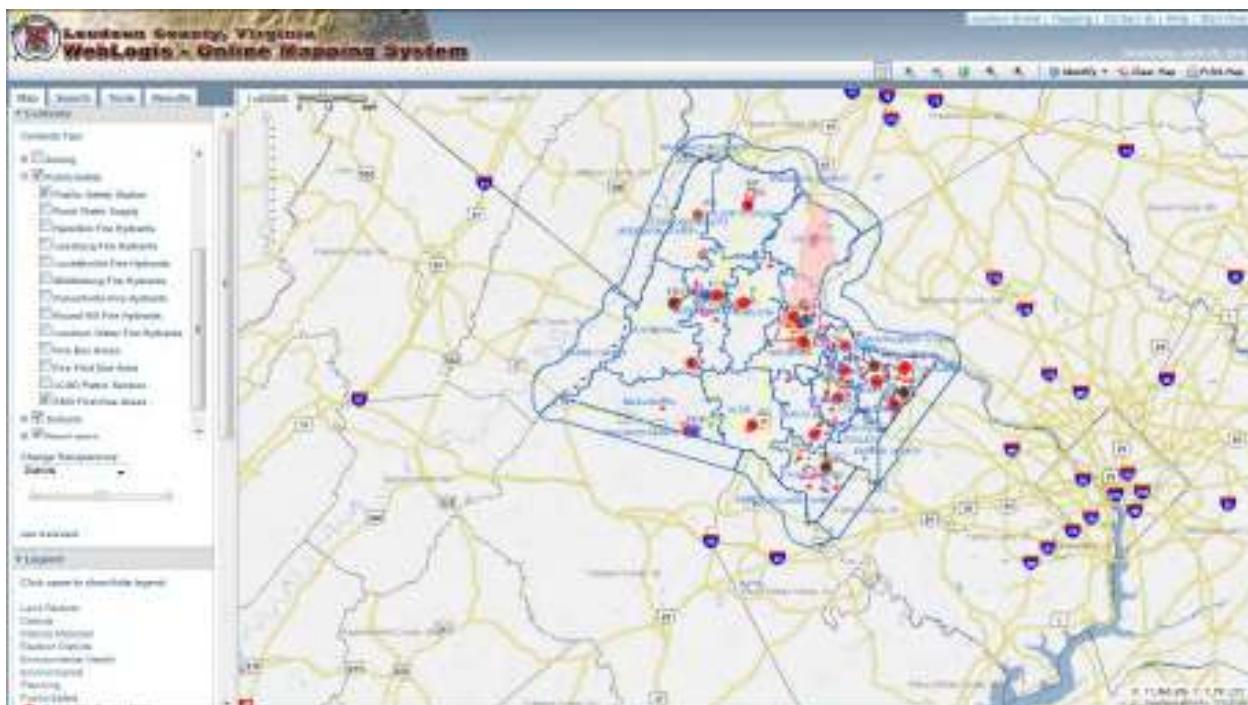


Figure 4.48. Loudoun County Limestone and Critical Assets Map.

Existing Buildings and Infrastructure Risk

Loss estimates could not be calculated for land subsidence events due to a lack of detailed and accurate information regarding structures and assets located in the previously determined hazard areas. In addition, due to the extremely localized and site specific nature of typical subsidence events, any inventory of potential at risk structures may grossly over-estimate potential losses.

Overall Loss Estimates and Ranking

As stated above, loss estimates could not be calculated for land subsidence events due to a lack of historical data causing property damages and probability of future occurrences.

There are currently no karst related records in NCDC; as a result, the lowest ranking score (1) was assigned to the annualized data for events, damages, and deaths and injuries to be able to compare karst to the other hazards, as described in Risk Assessment Methodology section. Refer



to the Risk Assessment Methodology section of the HIRA for a full description of the methodology and the limitations of the data used for ranking the hazards.

For the 2016 plan update the qualitative assessment was organized by jurisdiction. The hazard ranking for land subsidence is based on events reported and a generalized geographic extent. As previously discussed, Loudoun County and the Town of Leesburg has a slightly elevated risk due to the short karst features in the region, resulting in a vulnerability ranking of ‘Moderate’, compared to ‘Low’ for all other participating jurisdictions in the planning area. Loudoun County has ordinances in place to help mitigate their risk to this hazard.

Loudoun County and the Town of Leesburg

Table 4.109. 2016 Qualitative Assessment for Sinkholes

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Moderate	Moderate	Low	6 to 12 hours	Less than one week

All Other Jurisdictions

Table 4.110. 2016 Qualitative Assessment for Sinkholes

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Low	Moderate	Low	6 to 12 hours	Less than one week

XV. Dam Failure

NOTE: As part of the 2016 plan update, the Dam Failure hazard was reexamined and a new analysis performed. This new analysis included, but was not limited to: 1) refreshing the hazard profile; 2) updating the previous occurrences; 3) determining the number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) updating the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4, Section IV Ranking and Analysis Methodologies. Each section of the plan was also reformatted for improved clarity, and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

Worldwide interest in dam and levee safety has risen significantly in recent years. Aging infrastructure, new hydrologic information, and population growth in floodplain areas downstream from dams and near levees have resulted in an increased emphasis on safety, operation, and maintenance. The distinction between dams and levees is their purpose: dams are constructed to impound water behind them and levees are constructed to keep water out of the land behind them.



There are about 87,000 dams in the United States today, the majority of which are privately owned. Public owners include State and local authorities, and Federal agencies. The benefits of dams are numerous: they provide water for drinking, improved waterway navigation, hydroelectric power, flood control, and agricultural irrigation. Dams also provide enhanced recreation opportunities.

2. Geographic Location/ Extent

The National Inventory of Dams (NID) was developed by the U.S. Army Corps of Engineers (USACE) in cooperation with FEMA's National Dam Safety Program. The full inventory contains over 87,000 dams, and is used to track information on the country's water control infrastructure.

According to the NID, there are 11 major dams located in the Northern Virginia region and 133 non-major dams. Major dams are defined as dams being 50 feet or more in height, or with a normal storage capacity of 5,000 acre-feet or more, or with a maximum storage capacity of 25,000 acre-feet or more. The state regulatory agency for dams is the Virginia Department of Conservation and Recreation (DCR) through the Dam Safety and Floodplain Management Program. In addition to the 11 major dams discussed here, the DCR tracks and regulates a number of other smaller dams (e.g., farm pond impoundments, etc.) that present less severe hazard threats. The DCR maintains additional data on State-regulated dams in the Northern Virginia region, as well as information on the potential impact of failure. There are no major levees located in the Northern Virginia region.

Both the NID and the DCR use the same classification terminology to categorize the hazard potential of dams – high, significant, or low. This classification can change over time, as it is tied to how the failure of the dam may lead to loss of life and property downstream in the event of failure. Hazard potential is unrelated to the structural integrity of the dam; rather, it is directly related to the potential adverse downstream impacts should the dam fail. The classifications are described by the DCR as follows:

High – Dams that upon failure would cause probably loss of life or serious economic damage.

Significant – Dams that upon failure might cause loss of life or appreciable economic damage.

Low – Dams that upon failure would lead to no expected loss of life or significant economic damage. Special criteria: This classification includes dams that upon failure would cause damage only to the property of the dam owner.

Of the 11 major dams located in the region, six are classified as high hazards where failure of the dam may cause loss of human life. Another four major dams are classified as significant hazards, where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Only one of the 11 major dams is classified as a low hazard. It is important to remember that these hazard classifications are not related to the physical condition or structural integrity of the dam (nor the probability of its failure), but strictly to the potential for adverse downstream effects if the dam were to fail.



Table 4.111 lists some of the descriptive information made available for each of the 11 major dams in the Northern Virginia region.

Table 4.111. Major Dams in the Northern Virginia Region, Based on the National Inventory of Dams.

Dam Name	Hazard Class	Drainage Area (Sq. Mi.)	Primary Purpose	Owner
Upper Occoquan Dam	High	595	Water Supply	Fairfax County Water Authority
T. Nelson Elliott Dam	High	60	Water Supply	City of Manassas
Barcroft Dam	High	14.5	Recreation	Lake Barcroft Watershed Improvement District
Lake Montclair Dam	High	11.3	Recreation	Montclair Property Owners Association
Pohick Creek Dam #1	High	6.2	Flood Control	Fairfax County Board of Supervisors
Lake Thoreau Dam	High	<1	Flood Control	Reston Association
Sleeter Lake Dam	Significant	10	Irrigation	Round Hill Investors, LLC
Beaverdam Creek Dam*	Significant	5.5	Water Supply	City of Fairfax
Kingstowne Lake Dam	Significant	<1	Recreation	Kingstowne Community Association
Possum Point Ash Dam #D	Significant	< 1	Debris Control	Dominion
Horsepen Dam	Low	22.8	Water Supply	Metro-Washington Airport Authority

* This dam is now owned by Loudoun County, rather than the City of Fairfax, as reported in the NID.

3. Magnitude or Severity

Though dams have many benefits, they also can pose a risk to communities if not designed, operated, and maintained properly. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and great property damage if development exists downstream of the dam. Downstream properties may be quickly submerged in floodwaters and residents may become trapped by this rapidly rising water. The failure of dams has the potential to place large numbers of people and great amounts of property in harm's way.

4. Previous Occurrences

While dam failures are not common occurrences, there have been some notable recent events throughout Virginia. Most failures occur due to lack of maintenance of the dam in combination with major rainfall, such as hurricanes and thunderstorms. In 1995, torrential rains burst the



Timberlake Dam in Campbell County, killing two people downstream in the flooding. Following Hurricane Floyd in 1999, 13 dam failures were reported across the eastern portion of the State causing significant damages.

The Barcroft dam in Fairfax County failed during heavy rains associated with Hurricane Agnes (June 1972). Although it caused no loss of life, the dam failure resulted in damage to the Holmes Run area, most notably the destruction of an overpass at Van Dorn Street and Holmes Run (\$300,000 plus an additional \$200,000 to clear away 29 acres of trees and debris from the stream). The dam, which had originally been built in 1913, also suffered major damage and had to be rebuilt in order to restore Lake Barcroft, a recreational area for community residents.

No additional occurrences were reported for the 2016 plan update.

B. Risk Assessment

1. Probability of Future Occurrences

Predicting the probability of flooding due to dam failure requires a detailed, site-specific engineering analysis for each dam in question. Failure may result from hydrologic and hydraulic design limitations, or from geotechnical or operational factors.

Dam failure remains an unlikely occurrence for all major and non-regulated dams in the Northern Virginia region. The DCR is tasked with monitoring the routine inspection and maintenance of those dams that present the greatest risk or are in need of structural repair.

2. Impact & Vulnerability

Failure of dams may result in catastrophic localized damages. Vulnerability to dam failure is dependent on dam operations planning and the nature of downstream development. Depending on the elevation and storage volume of the impoundment, the impact of flooding due to dam failure may include loss of human life, economic losses such as property damage and infrastructure disruption, and environmental impacts such as destruction of habitat. Evaluation of vulnerability and impact is highly dependent on site-specific conditions.

3. Risk

Dam failure is considered unlikely in the Northern Virginia region due to existing safety measures and rigorous inspection reporting programs. The DCR requires specific operation and maintenance procedures, as well as routine inspections and regularly updated emergency action plans for each of the major and State-regulated dams in the Northern Virginia region. Therefore, future damages caused by dam failure and associated dollar losses are expected to be negligible – though the danger remains real and will continue to receive critical attention through the DCR's Dam Safety and Floodplain Management Program.

Due to the lack of specific data on dam failure probability or inundation zones, the potential risk to critical facilities and existing buildings and infrastructure was not estimated for this revision of the Plan. Virginia's new Impounding Structure Regulations require dam break inundation zone mapping and additional information is available from the DCR Dam Safety Program.



There are 11 dams in the region classified as major. Ten of those are classified as significant or high hazard class. Four are located in Fairfax County, three are located in Loudoun County, three are located in Prince William County, and the remaining one is located in both Prince William and Fairfax Counties. Again, these hazard classifications are not related to the physical condition or structural integrity of the dam (nor the probability of its failure), but strictly to the potential for adverse downstream effects from failure or mis-operation of the dam or facilities. There are no dam failure inundation maps available for the Northern Virginia region that can be included in this plan.

Only three of the major dams classified as high hazard have a drainage area of more than 20 square miles (the Upper Occoquan dam in Fairfax County, the T. Nelson Elliot dam in Prince William County, and the Horsepen Dam in Loudoun County), making the possibility of a catastrophic dam failure event elsewhere highly unlikely in the region. The Northern Virginia region is likely more prone to intentional water releases by dam operators immediately prior to or during major rainfall events, though in such cases the releases are coordinated with local emergency management officials to minimize potential risks to people and property.

Overall Loss Estimates and Ranking

Dam failure was not ranked with the hazards as a result of limited data available for analysis. As discussed regarding critical facilities, loss estimates were not developed due to the lack of specific data on dam failure probability or inundation zones. Fairfax County has the highest percentage of dams in the high and significant downstream hazard potentials in relation to the rest of the planning region.

For the 2016 plan update the qualitative assessment was organized by jurisdiction.

Fairfax County, Loudoun County, Prince William County, Town of Purcellville, and Town of Round Hill

Table 4.113. 2016 Qualitative Assessment for Dam Failure.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Possible	Critical	Moderate	Less than 6 hours	Less than one week

All Other Jurisdictions

Table 4.112. 2016 Qualitative Assessment for Dam Failure.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Unlikely	Critical	Moderate	Less than 6 hours	Less than one week



XVI. Extreme Temperatures

NOTE: As part of the 2016 plan update, the extreme temperatures hazard was examined and analyzed separately. This new analysis included, but was not limited to: 1) creating the hazard profile; 2) consolidating the previous occurrences; 3) determining the number of hazard events and losses by jurisdiction using NCDC and other data sources where available; 4) completing the assessment of risk by jurisdiction based on new data; and 5) ranking of the hazard by jurisdiction using the methodology described in detail in Chapter 4 Section IV Ranking and Analysis Methodologies. Each section of the plan was also reformatted for improved clarity, and new maps and imagery, when available and appropriate, were inserted.

A. Hazard Profile

1. Description

Extreme heat is defined as summertime weather that is substantially hotter and/or more humid than average for a location at that time of year. Extreme heat conditions can increase the incidence of mortality and morbidity in affected populations. People can suffer heat-related illnesses when the body is unable to compensate for the extreme heat and properly cool itself. Very high body temperatures can cause damage to the brain and other vital organs.

What is considered an excessively cold temperature varies according to the normal climate for that region. Whenever temperatures drop decidedly below normal and wind speed increases, heat leaves the human body more rapidly, increasing the possibility of negative effects of these extreme temperatures.

The greatest danger from extreme cold is to people, as prolonged exposure can cause frostbite or hypothermia, and can become life threatening. Body temperatures that are too low affect the brain, making it difficult for the victim to think clearly or move well. This makes hypothermia particularly dangerous for those suffering from it, as they may not understand what is happening to them or what to do about it.

2. Geographic Location/ Extent

Extreme temperature is not a hazard with a defined geographic boundary. All areas of the Northern Virginia area are subject to experience the hazard.

The National Weather Service (NWS) issues a range of watches and warnings associated with extreme heat, as illustrated below:

- Excessive Heat Outlook: when the potential exists for an excessive heat event in the next 3 to 7 days. An outlook is used to indicate that a heat event may develop. It is intended to provide information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management and public health officials.
- Excessive Heat Watch: when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. It is intended to provide enough lead time so



those who need to set their plans in motion can do so, such as established individual city excessive heat event mitigation plans.

- Excessive Heat Warning/Advisory: when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurrence. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

The NWS also developed the Heat Index (HI). The HI is sometimes referred to as the "apparent temperature". The HI, given in degrees F, is a measure of how hot it really feels when relative humidity (RH) is added to the actual air temperature. To find the HI, NWS uses the Heat Index Chart, found following in Figure 4.49. As an example, if the air temperature is 96 degrees Fahrenheit (found on the top of the table) and the RH is 65% (found on the left of the table), the HI - or how hot it really feels - is 121 degrees Fahrenheit. This is at the intersection of the 96-degree column and the 65% row.

Since HI values were devised for shady, light wind conditions, exposure to full sunshine can increase HI values by up to 15 degrees Fahrenheit. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous. Note the shaded zone above 105 degrees Fahrenheit on the Heat Index Chart. This corresponds to a level of HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

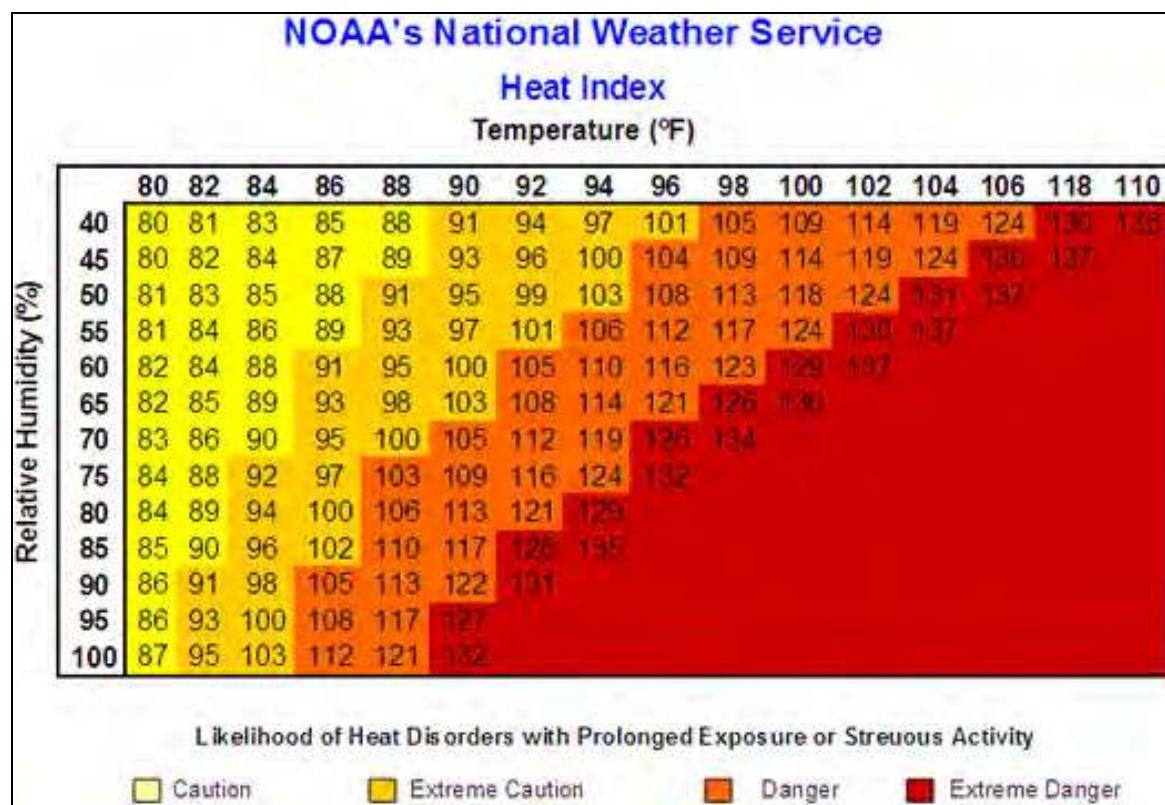


Figure 4.49. NOAA's National Weather Service Heat Index.



When extreme heat occurs or is forecast to occur, the NWS issues heat advisories based on heat indices; these advisories are issued through the media and the Emergency Alert System. The NWS provides assistance to state and local health officials in preparing civil emergency messages for severe heat waves, in addition to preparing special weather statements that define who is most at risk, safety rules, and the expected severity of the situation. The NWS also aids state and local authorities with issuing warnings and survival tips.

Extreme cold has a wide range of extent and severity markers and characteristics. The National Weather Service issues Extreme Cold Warnings when the temperature feels like it is -30 degrees Fahrenheit or colder across a wide area for a period of at least several hours. When possible, these advisories are issued a day or two in advance of the onset of the conditions.

Perhaps the most common extent/severity marker for extreme cold is the Wind Chill scale. Figure 4.50 depicts the National Weather Service's methodology for determining wind chill, using wind speed and actual temperature. While wind chill is not necessarily related to extreme cold as a single cause, the advisory system that the NWS currently uses relies on wind chill to relay warning and advisory information to the public. Extreme cold severity is a function of wind chill and other factors, such as precipitation amount (rain, sleet, ice, and/or snow).

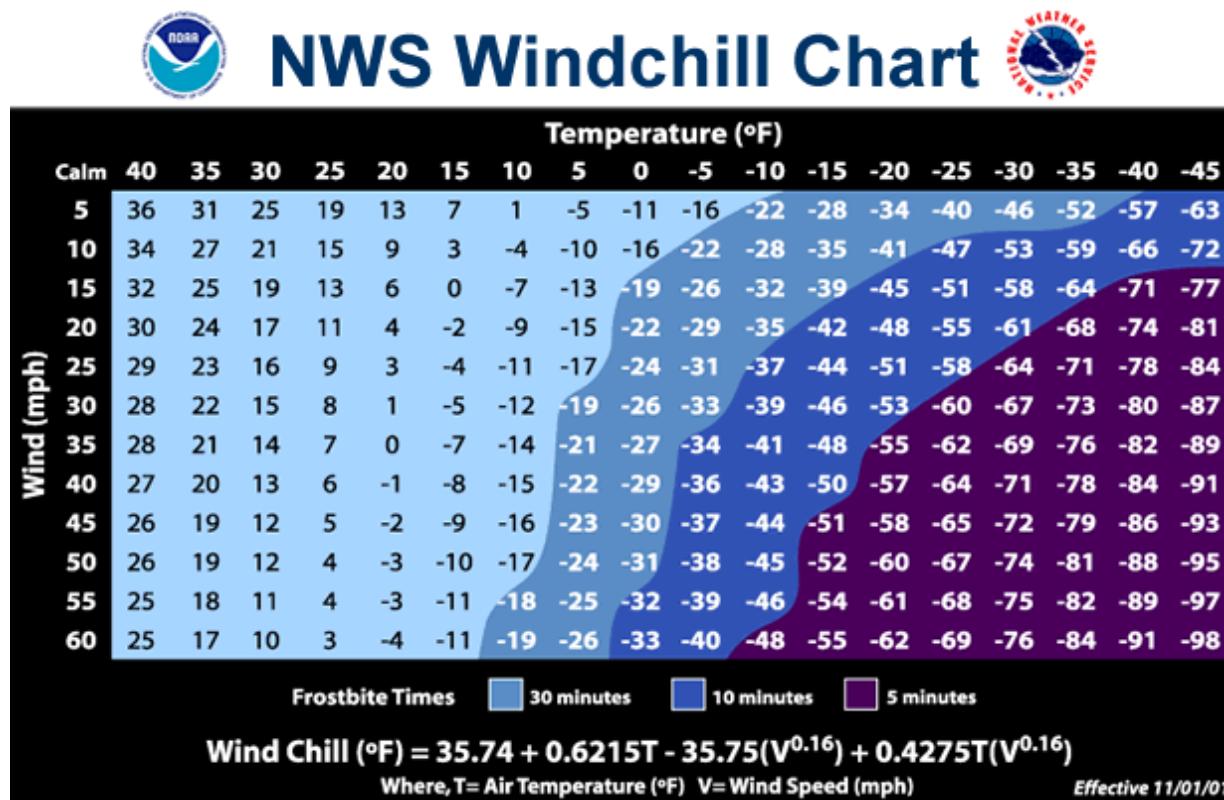


Figure 4.50 NWS Windchill Chart.

3. Magnitude or Severity

Health risks from extreme heat include sunburn, dehydration, heat cramps, heat exhaustion, and heat stroke. Heat disorders generally result from a reduction or collapse of the body's ability to cool itself by circulatory changes and sweating, or a chemical (salt) imbalance caused by too



much sweating. When the body cannot cool itself, or when it cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise, and heat-related illness may develop. All other factors being equal, the severity of heat disorders tends to increase with age. Heat cramps in a 17-year-old may be heat exhaustion in someone who is 40, and heat stroke in a person over 60. Table 4.133 provides the potential health hazards associated with heat, by category.

Table 4.133. Health Hazards Associated with Heat.

Category	Heat Index	Health Hazards
Extreme Danger	130 degrees Fahrenheit and Higher	Heat stroke/ sunstroke is likely with continued exposure.
Danger	105 degrees Fahrenheit to 129 degrees Fahrenheit	Sunstroke, muscle cramps, and/or heat exhaustion with prolonged exposure and/or physical activity.
Extreme Caution	90 degrees Fahrenheit to 105 degrees Fahrenheit	Sunstroke, muscle cramps, and/or heat exhaustion with prolonged exposure and/or physical activity.
Caution	80 degrees Fahrenheit to 90 degrees Fahrenheit	Fatigue possible with prolonged exposure and/or physical activity.

In addition to the effects that extreme heat can have on people, there are also potential effects to assets from extreme heat. Northern Virginia is home to a significant human population. Increases in the exterior temperature mean that the utilities and processes by which interior spaces are controlled and conditioned must work harder to regulate those interior temperatures. This places an additional strain on existing utility systems, which can fail under the increased workload. Failure of cooling mechanisms places research, patients, and people at risk from prolonged exposure to extreme heat.

Extreme cold can also have significant impacts on people. Hypothermia is most likely at very cold temperatures, but can occur at higher temperatures (above 40 degrees Fahrenheit) if the person exposed is also wet from rain, sweat, or submersion. Warning signs of hypothermia include shivering, exhaustion, confusion, fumbling hands, memory loss, slurred speech, or drowsiness. In infants, symptoms include bright red and cold skin and very low energy. A person with hypothermia should receive medical attention as soon as possible, as delays in medical treatment may result in death.

In addition to the threat posed to humans, extreme cold weather poses a significant threat to utility production, which in turn threatens facilities and operations that rely on utilities, specifically climate stabilization. As temperatures drop and stay low, increased demand for heating places a strain on the electrical grid, which can lead to temporary outages. These outages can impact operations throughout the campus, which can result in interruptions and delays in services. Broken pipes may cause flooding in buildings, causing property damage and loss of utility service.



4. Previous Occurrences

In 1996, the NCDC began keeping records of occurrences of extreme temperatures. Because of the widespread spatial nature of the hazard, the most reliable records are found at the county-level. The independent cities of Northern Virginia have their own reports, of course, but they are largely identical to those provided for the geographically adjacent counties, with the exception of the City of Falls Church. The towns in Northern Virginia are included in the reports for the counties. To account for this method of reporting, and to limit overestimation of occurrences and damages where possible, the records for the four counties and for the City of Falls Church are included in this assessment. All other records are excluded as duplications.

From 1996 to 2015, there have been at least 275 extreme temperature event reports recorded by the NCDC for the Northern Virginia region. Approximately \$75,000 in crop damages in Prince William County were recorded for these events, though other damages have undoubtedly occurred as an indirect result of the hazard. In addition, there were three fatalities and 102 injuries recorded.

The following occurrences, taken from NCDC records, impacted large portions of the planning area:

July 18, 2013 (Extreme Heat)

High pressure was located over much of the eastern United States and light southerly flow persisted all week. This led to above normal temperatures throughout the region and dew points in the mid-70s. Heat indices were approximately 105 to 107 degrees Fahrenheit at Quantico, 105 degrees Fahrenheit at Dulles International Airport, and 105 to 107 degrees Fahrenheit at Reagan National Airport.

July 21-22, 2011 (Extreme Heat)

Upper level high pressure caused excessive heat conditions throughout the planning area. Surface pressure over the Atlantic caused moist air to move into the region from the south. The combination of heat and humidity caused heat indices in excess of 100 degrees Fahrenheit in some locations, and up to 110-112 degrees Fahrenheit in other parts of the region. Heat indices of up to 116 degrees Fahrenheit at Dulles International Airport and 118 degrees Fahrenheit at Quantico were recorded during this period.

June 8, 2008 (Extreme Heat)

A strong ridge of high pressure over the eastern United States set the stage for a period of hot weather and high humidity in Northern Virginia. One person died due to heat-related complications in Alexandria as temperatures on this day reached into the mid to upper 90s combining with dew points in the lower 70s to produce heat indices that approached 105 degrees Fahrenheit.

December 7, 2002 (Extreme Cold)

Record-breaking cold settled into northern Virginia on this day as low temperatures reached 1 degree above zero at Dulles International Airport. Temperatures fell to -1 degrees Fahrenheit in Lincoln in Loudoun County and -4 degrees Fahrenheit at the NWS Forecast Office in Sterling.

*January 27, 2000 (Extreme Cold)*

High pressure was located directly over the Mid-Atlantic region between the 27th and 29th. The combination of clear skies, calm winds, and a snowpack led to extremely cold temperatures that fell to below zero degrees Fahrenheit. On the 27th, a 59-year-old woman was found dead in the parking lot of a shopping center in Fairfax, an apparent victim of hypothermia.

July 4–7, 1999 (Extreme Heat)

High pressure sat off the Mid-Atlantic coast, drawing extremely warm and humid air into Northern Virginia. Temperatures on the 4th through the 7th were oppressively hot, and extremely humid conditions added to the misery. Temperatures soared into the upper 90s to lower 100s during the period, and dew points were in the lower to middle 70s, creating heat indices between 100 and 115 degrees Fahrenheit. Overnight lows only dipped into the 70s and heat index values ranged from the upper 70s to upper 80s. The heat index only dropped to 90 degrees Fahrenheit at National Airport in the Washington, DC, suburbs on the morning of the 6th. Record highs were broken at Washington National Airport on the 5th and 6th. The record high at Dulles International Airport was broken on the 4th and tied on the 5th.

August 16–17, 1997 (Extreme Heat)

West winds circulating around a "Bermuda High" pressure system allowed temperatures to soar over the weekend of the 16th and 17th. Maximum temperatures surpassed the century mark across most of Northern Virginia (except in the higher elevations) both days. Heat index values ranged from 105 to 110 degrees Fahrenheit each day, but aside from a few heat exhaustion cases, it appeared that at-risk residents remained in air conditioned locations. No heat-related deaths were reported by Virginia medical authorities. A record high was achieved at Dulles International Airport on the 16th with a new maximum of 100 degrees Fahrenheit. That temperature was matched on the 17th, before strong to severe thunderstorms moved through.

April 10, 1997 (Extreme Cold)

A record cold arctic air mass overspread the Northern Virginia piedmont and the Shenandoah Valley overnight on the 9th and 10th, dropping temperatures into the upper teens to lower 20s across the entire area. These temperatures arrived on the heels of an above normal winter season, especially pronounced in late March, when peach and apple blossoms reached critical bloom stage up to 2 weeks ahead of schedule. This accelerated growth led to high kill percentages across the region, with estimates showing at least a 70 to 90 percent kill of the peach crop, and similar kills among the Red Delicious apple crop.

July 1995 (Extreme Heat)

A 38-hour period of extremely hot and humid weather in mid-July took its toll on humans and animals. The heat was caused by strengthening of a Bermuda High, extending from the surface to the upper levels of the atmosphere. The most life-threatening period of the heat wave occurred during the afternoon of the 15th, when temperatures ranged from 98 to 103 degrees Fahrenheit, with heat indices between 115 and 129 degrees Fahrenheit. On this day, an all-time record for power usage was established in Northern Virginia, with 13,512 megawatts recorded (mostly from air conditioning usage). Five thousand customers were without power in the same general area. In Alexandria, a National Park Service bicycle patrol ranger collapsed near Daingerfield Island, then later died from complications resulting from hyperthermia.



There were several additional instances of heat exhaustion during the remainder of the month, concentrated during the middle two weeks. Alexandria hospitals reported about 80 persons requiring treatment between the 14th and 23rd. The heat wave returned twice in late July, from the 21st through the 25th and again from the 29th through the 31st. However, temperatures were not as oppressive, ranging from 90 to 97 degrees Fahrenheit. Daytime heat indices ranged from 105 to 115 degrees Fahrenheit, but fell below 90 each night. No deaths or injuries were directly attributed to either episode.

B. Risk Assessment

1. Probability of Future Occurrences

The future incidence of extreme temperatures is highly unpredictable and may be localized, which makes it difficult to assess the probability of a future occurrence. Some form of extreme temperature typically impacts the Northern Virginia region annually. As a result, while the future probability of some type of extreme temperature may be estimated as High, the exact severity or manifestation of the hazard cannot be quantified at this time.

2. Impact & Vulnerability

While this hazard occurs with some regularity, it is not one with a significant history of causing damages or losses to property in the Northern Virginia region. The risk of exposure and negative health impacts to people, animal, and agriculture are the greatest risk, with the risk to the loss of utility service (particularly electrical) also a consideration. Humans and animals can be injured or die from exposure to both extreme cold and extreme heat; agriculture can be damaged or destroyed by extremes in temperature, rendering crops unusable. Utility systems may fail under strains of demand, resulting in increases in exposure of humans and animals to extreme temperatures, as facilities cannot provide regulated temperatures and climate.

3. Risk

Estimates of the financial impacts or losses from extreme temperatures can be developed based on NCDC data that runs from January 1996 to December 2015. Examination of NCDC data shows that there were approximately 275 extreme temperature events in the database.

Risk to People

NCDC reports describe three fatalities and 102 injuries for the 19-year period of record. This equates to annualized rates of .15 fatalities per year and 5.3 injuries per year for the period of record. It is people that are at the greatest risk from extreme temperatures, and people that must be protected from this hazard.

Critical Facility and Infrastructure Risk

Quantitative assessment of critical facilities for the extreme temperature risk was not feasible for this update. Even so, it is apparent that the infrastructure that supports critical facilities are at risk from extreme temperatures, as demands on generation and distribution networks may overtax the system and result in failure. Finally, not all critical facilities have redundant power sources and may not even be wired to accept a generator for auxiliary heat or cooling. Future plan updates should consider including a more comprehensive examination of critical facility vulnerability to



extreme temperatures, including those that have emergency heating or cooling equipment and those that may be wired to receive portable equipment.

Overall Loss Estimates and Ranking

In keeping with other assessments updated or validated for this plan, the assessment for extreme temperatures is based on NCDC data.

For the 2016 plan update the qualitative assessment was performed by jurisdiction. Given the widespread nature of the hazard, however, all counties, cities, and towns were determined to have the same qualitative risk to the hazard, that of ‘High’. Therefore, to avoid repetition, Table 4.134 below provides the results of the qualitative assessment for all participating jurisdictions, as all jurisdictions were found to have the same results.

Table 4.134. 2016 Qualitative Assessment for Extreme Temperatures.

	Probability	Impact	Spatial Extent	Warning Time	Duration
Risk Level	Highly Likely	Minor	Large	More than 24 hours	Less than one week

Endnotes

¹ NCDC’s Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.

² National Water Service Instruction 10-1605. Operations and Services Performance: Storm Data Preparation Guide. August 17, 2007. Available at: <http://www.nws.noaa.gov/directives/sym/pd01016005curr.pdf>

³ Commonwealth of Virginia Emergency Operations Plan Annex 3 (Volume II)

⁴ IPCC. (2007). Climate Change 2007: The Physical Science Basis. Intergovernmental Panel on Climate Change.

⁵ Pfeffer, W., Harper, J., & O’Neil, S. (2008). Kinematic Constraints on Glacier Contributions to 21st-Century Sea-Level Rise. *Science*, 321, 1340-1343.

⁶ NFIP repetitive loss data is protected under the federal Privacy Act of 1974 (5 U.S.C. 552a) which prohibits personal identifiers (i.e., owner names, addresses, etc.) from being published in local mitigation plans.

⁷ National Flood Insurance Program

⁸ HAZUS-MH Flood User Manual

⁹ Global Climate Change Impacts in the United States, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.). Cambridge University Press, 2009.

¹⁰ Changes in severe thunderstorm environment frequency during the 21st century caused by anthropogenically enhanced global radiative forcing; Robert J. Trapp*†, Noah S. Diffenbaugh*, Harold E. Brooks‡, Michael E. Baldwin*, Eric D. Robinson*, and Jeremy S. Pal; PNAS December 11, 2007, vol. 104, no. 50.

¹¹ IPCC Special Report on Emissions Scenarios, 2000

¹² Modeled Impact of Anthropogenic Warming on the Frequency of intense Atlantic Hurricanes, Morris A. Bender, Thomas R. Knutson, Robert E. Tuleya, Joseph J. Sirutis, Gabriel A. Vecchi, Stephen T. Garner, Isaac M. Held

¹³ HAZUS Hurricane Manual

¹⁴ Whole Building Design Guide (WBDG) Wind Safety of the Building Envelop by Tom Smith 5/26/2008

¹⁵ Gutowski, W.J., G.C. Hegerl, G.J. Holland, T.R. Knutson, L.O. Mearns, R.J. Stouffer, P.J. Webster, M.F. Wehner, and F.W. Zwiers, 2008: Causes of observed changes in extremes and projections of future changes. In: *Weather and Climate Extremes in a Changing Climate: Regions of Focus: North America, Hawaii, Caribbean, and U.S. Pacific Islands* [Karl, T.R., G.A. Meehl, C.D. Miller, S.J. Hassol, A.M. Waple, and W.L. Murray (eds.)]. Synthesis and Assessment Product 3.3. U.S. Climate Change Science Program, Washington, DC, pp. 81-116.

¹⁶ Significant Earthquakes figure is from the 2013 Commonwealth of Virginia’s Hazard Mitigation Plan. Earthquake Section 3.13, Figure 3.13-1.

¹⁷ The Daily News Spot July 16, 2010 interview with Amy Vaughan, geophysicist USGS National Earthquake Information Center.



¹⁸Recent Earthquakes from NEIC Earthquake Bulletin: Magnitude 3.4-Potomac-Shenandoan Region. USGS July 16, 2010. <http://earthquake.usgs.gov/earthquakes/recenteqlww/Quakes/us2010yua6.php>

¹⁹Recent Earthquakes from NEIC Earthquake Bulletin: Magnitude 3.4-Potomac-Shenandoan Region. USGS July 16, 2010. <http://earthquake.usgs.gov/earthquakes/recenteqlww/Quakes/us2010yua6.php>

²⁰ 2500-year Return Period Peak Ground Acceleration (PGA) figure is from the 2013 Commonwealth of Virginia's Hazard Mitigation Plan. Earthquake Section 3.13, Figure 3.13-3.

²¹ Telephone and Email correspondence with Dr. Martin Chapman. June 3, 2010.

²² Smith, K., *Environmental Hazards, Assessing Risk and Reducing Disaster*, Third Edition, Rutledge Press, New York 1991

²³ USGS Fact Sheet 2004-3072

²⁴ The National Wildfire Coordinating Group (NWCG) is made up of the USDA Forest Service; four Department of the Interior agencies: Bureau of Land Management (BLM), National Park Service (NPS), Bureau of Indian Affairs (BIA), and the Fish and Wildlife Service (FWS); and State forestry agencies through the National Association of State Foresters. The purpose of NWCG is to coordinate programs of the participating wildfire management agencies so as to avoid wasteful duplication and to provide a means of constructively working together.

²⁵ Tihansky, B, Ann. U.S Geological Survey, Tampa, Florida. Sinkholes, West-Central Florida: A link between surface water and ground water.

²⁶ Hubbard, D. A. "Sinkhole Distribution of the Valley and Ridge Province, Virginia." Geotechnical and Environmental Applications of Karst Geology and Hydrology, (April 2001): 33–36.

²⁷ Loudoun County Zoning Ordinance Section 4-1900 Limestone Overlay District. May 6, 2010.



Chapter 5: Capability Assessment

I. Introduction

This portion of the plan assesses the current capacity of the communities of Northern Virginia to mitigate the effects of the natural hazards identified in Chapter 4 of the plan.

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a comprehensive mitigation strategy, and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs or projects.¹ As in any planning process, it is important to try to establish which goals, objectives, and/or actions are feasible, based on an understanding of the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical and likely to be implemented over time given a local government's planning and regulatory framework, level of administrative and technical support, amount of fiscal resources, and current political climate.

A capability assessment has two primary components: an inventory of a local jurisdiction's relevant plans, ordinances, or programs already in place; and an analysis of its capacity to carry them out. Careful examination of local capabilities will detect any existing gaps, shortfalls, or weaknesses with ongoing government activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. A capability assessment also highlights the positive mitigation measures already in place or being implemented at the local government level, which should continue to be supported and enhanced through future mitigation efforts.

For the 2016 update, each participating jurisdiction was given an opportunity to update their capability assessment information presented in the 2010 plan. This effort included updating a Plans, Ordinances, and Programs table, Relevant Fiscal Resources table, and Relevant Staff and Personnel Resources table. Additionally, updates to the information presented below were conducted to better reflect the capabilities within the region as of 2016.

II. Conducting the Capability Assessment

In order to facilitate an update of the 2010 inventory and analysis of local government capabilities throughout the Northern Virginia region, specific tables and components of the previous plan were distributed to the communities. These tables, which were completed by appropriate local government officials, requested information on a variety of "capability indicators" such as existing local plans, policies, programs, or ordinances that contribute to or

¹ While the Interim Final Rule for implementing the Disaster Mitigation Act of 2000 does not require a local capability assessment to be completed for local hazard mitigation plans, it is a critical step in developing a mitigation strategy that meets the needs of each jurisdiction while taking into account their own unique abilities. The Rule does state that a community's mitigation strategy should be "based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools" (44 CFR, Part 201.6(c)(3)).



hinder the community's ability to implement hazard mitigation actions. Other indicators included information related to each jurisdiction's fiscal, administrative, and technical capabilities, such as access to local budgetary and personnel resources for mitigation purposes.

At a minimum, the updates to the 2010 information provided an extensive inventory of existing local plans, ordinances, programs, and resources in place or under development, in addition to their overall effect on hazard loss reduction. The update thereby not only helps to accurately assess each jurisdiction's degree of local capability, but also serves as a good source of introspection for those jurisdictions that want to improve their capabilities as identified gaps, weaknesses, or conflicts can be recast as opportunities for specific actions to be proposed as part of the community's mitigation strategy.

III. Capability Assessment Findings

The findings of the capability assessment are summarized in this Plan to provide insight into the relevant capacity of participating jurisdictions to implement hazard mitigation activities. All information is based upon the input provided by local government officials through the Mitigation Advisory Committee.

A. Administrative and Technical Capability

1. Administrative

The ability of a local government to develop and implement mitigation projects, policies, and programs is directly tied to its ability to direct staff time and resources for that purpose. Administrative capability can be evaluated by determining how mitigation-related activities are assigned to local departments and if there are adequate personnel resources to complete these activities. The degree of intergovernmental coordination among departments will also affect administrative capability for the implementation and success of proposed mitigation activities.

The following table, originally developed under the 2006 Northern Virginia Hazard Mitigation plan, was updated as part of the 2016 planning process. A (Y) indicates that the given local staff member(s) is maintained through each particular jurisdiction's local government resources. A (Y*) indicates that this capability is new as of the 2016 update.

Table 5.1. Administrative and Technical Capabilities

Jurisdiction	Planners with knowledge of land development and land management practices	Engineers or professionals trained in construction practices related to buildings and/or infrastructure	Planners or engineers with an understanding of natural and/or human-caused hazards	Emergency manager	Floodplain manager	Land surveyors	Scientist familiar with the hazards of the community	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in Geographic Information Systems (GIS) and/or HAZUS ^{MH}	Resource development staff or grant writers
Alexandria, City of	Y	Y	Y	Y	Y	Y		Y	Y	Y
Arlington County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dumfries, Town of	Y	Y	Y	Y						Y
Fairfax County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fairfax, City of	Y	Y	Y	Y	Y	Y		Y	Y	Y*
Falls Church, City of	Y	Y	Y	Y	Y	N	N	Y	Y	Y
Haymarket, Town of	Y*	Y*	Y	Y	Y	N	N	Y	N	Y
Herndon, Town of	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
Leesburg, Town of	Y	Y	Y*	Y*	Y*	Y*		Y*	Y*	Y*
Loudoun County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lovettsville, Town of	Y	Y	Y	Y	N	N	N	Y	Y	N
Manassas Park, City of	Y	Y	Y	Y	Y	Y	N*	Y	N*	Y
Manassas, City of	Y	Y	Y	Y*	Y	Y		Y	Y	
Middleburg, Town of	Y	Y	Y		Y				Y	
Occoquan, Town of										
Prince William County	Y	Y	Y	Y	Y	Y		Y	Y	Y
Purcellville, Town of	Y	Y	Y	Y	Y	Y		Y	Y	Y
Round Hill, Town of	Y	Y	Y	N	Y	Y	N	N	Y	Y
Vienna, Town of	Y		Y	Y	Y	Y*		Y*	Y	Y*



As described previously, the planning area is comprised of four counties, five cities, and 12 towns. All of the counties in the planning area, Arlington County, Fairfax County, Loudoun County, and Prince William County, operate under a Board of Supervisors - County Administrator/Executive system. In this form of government, the elected board of supervisors appoints a county administrator who oversees daily operations of the county.

The Cities of Alexandria, Falls Church, Fairfax, Manassas, and Manassas Park operate under the City Council – City Manager system. The City Council is elected and it, in turn, appoints a City Manager who acts as the chief administrative officer and oversees daily business operations of the City.

The Towns of Clifton, Dumfries, Occoquan, and Round Hill operate under the Town Council – Mayor system; and the Towns of Haymarket, Herndon, Leesburg, Lovettsville, Middleburg, Purcellville, and Vienna operate under a Town Council – Town Manager system, where the council appoints the Town Manager to act as the administrative officer.

Under the County Administrator, City, and Town Manager systems, each jurisdiction (with the exception of the Town of Quantico) has departments, councils, and boards that are responsible for the various functions of local government. The following table highlights the departments in each jurisdiction that could facilitate the implementation of this hazard mitigation plan.

Table 5.2. Departments that could facilitate mitigation action implementation

Jurisdiction	Departments
Alexandria, City of	Office of Code Administration Fire Department Fire Planning and Zoning Transportation and Environmental Services
Arlington County	Community Planning, Housing and Development Fire Department Environmental Services Office of Emergency Management
Clifton, Town of	Planning Commission
Dumfries, Town of	Department of Public Works Community Development Department Police Department
Fairfax County	Office of Emergency Management Fire and Rescue Planning and Zoning Public Works and Environmental Services Water Authority
Fairfax, City of	Community Development and Planning Fire Department Public Works Police Department

**Table 5.2. Departments that could facilitate mitigation action implementation**

Jurisdiction	Departments
Falls Church, City of	Development Services, Public Works, Emergency Management, Police
Haymarket, Town of	Planning Commission Police Department Engineer
Herndon, Town of	Community Development Police Department Department of Public Works
Leesburg, Town of	Planning and Zoning Police Department
Loudoun County	Emergency Management Fire and Rescue Public Works Sheriff's Office Building and Development Planning & Zoning
Manassas Park, City of	Fire and Rescue Department of Community Development Police Public Works
Manassas, City of	Emergency Preparedness Fire and Rescue Police Department Public Works Community Development Utilities and Engineering
Middleburg, Town of	Zoning and Planning Police Department Utilities Department Engineering
Occoquan, Town of	Town Council
Prince William County	Department of Fire and Rescue Planning Office Police Department Department of Public Works Department of Development Services
Purcellville, Town of	Town Manager Planning Department Police Department Public Works
Quantico, Town of	None
Round Hill, Town of	Planning Department
Vienna, Town of	Planning and Zoning

**Table 5.2. Departments that could facilitate mitigation action implementation**

Jurisdiction	Departments
	Public Works Police

While exact responsibilities differ from jurisdiction to jurisdiction, the general duties of the departments highlighted in the table are described below.

The emergency management offices are responsible for the mitigation, preparedness, response, and recovery operations that deal with both natural and man-made disaster events. Fire/EMS departments provide medical aid and fire suppression at the scene of accidents and emergencies. These departments are often responsible for responding to hazardous materials incidents.

The planning agency addresses land use planning. This department, depending on the jurisdiction, may enforce the NFIP requirements and other applicable local codes. Zoning also may be managed by the planning agency or it may be a separate office.

In some jurisdictions, the utilities department oversees community water facilities or natural gas provisions. In others, the Public Works Department oversees the maintenance of infrastructure including roadways, sewer and stormwater facilities and the community's water treatment facilities. This department also may review new development plans, ensure compliance with environmental regulations, and work with the Virginia Department of Transportation on road issues. Depending on the jurisdiction, the public works agency may enforce the NFIP requirements.

2. Technical Capability

Mitigation cuts across many disciplines. For a successful mitigation program, it is necessary to have a broad range of people involved with diverse backgrounds. These people include planners, engineers, building inspectors, emergency managers, floodplain managers, people familiar with GIS, and grant writers. Technical capability can generally be evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in using GIS to analyze and assess community hazard vulnerability.

GIS systems can best be described as a set of tools (hardware, software, and people) used to collect, manage, analyze, and display spatially-referenced data. Many local governments are now incorporating GIS systems into their existing planning and management operations. GIS is invaluable in identifying areas vulnerable to hazards. Access to the Internet can facilitate plan development, public outreach, and project implementation.

The table below summarizes the technical capabilities of the jurisdictions. When provided, the specific department that has the technical capability is identified.

5.3. Technical Capabilities of each Jurisdiction								
Jurisdiction	Land Use Planners	Civil or Building Engineers	Emergency manager	Floodplain manager	Staff familiar with hazards	GIS staff	Grant writers	Internet access?
Alexandria, City of	Planning & Zoning	Transportation & Environmental Services	Fire Department – Office of Emergency Management	Transportation & Environmental Services	Fire Department – Office of Emergency Management	Planning & Zoning	Planning & Zoning, City Administration	Yes
Arlington County	Community Planning	Environmental Services	Office of Emergency Management	Community Planning	Office of Emergency Management	Environmental Services	Office of Emergency Management, Police Department, Fire Department	Yes
Dumfries, Town of	Community Development	Public Works	Town Manager	Town Council	Police Department		Community Services	Yes
Fairfax County	Planning & Zoning	Public Works	Emergency Management	Planning and Zoning	Emergency Management	Information Technology	County Administration	Yes
Fairfax, City of	Community Development & Planning	Public Works	Office of Emergency Management	Community Development & Planning	Community Development & Planning, Office of Public Safety	Information Technology	City Administration	Yes
Falls Church, City of	Development Services	Public Works	OEM – Fire Marshal	Public Works	Police, Public Works	Public Works	Public Works	Yes
Haymarket, Town of	Planning Commission	Town Engineer	Police Department	Town Engineer	Town Engineer, Police Department	Contracted as needed	Town Clerk, Town Engineer	Yes
Herndon, Town of	Community Development	Public Works	Police Department	Public Works	Public Works, Police Department	Information Technology	Community Development, Public Works, Police	Yes

5.3. Technical Capabilities of each Jurisdiction								
Jurisdiction	Land Use Planners	Civil or Building Engineers	Emergency manager	Floodplain manager	Staff familiar with hazards	GIS staff	Grant writers	Internet access?
Leesburg, Town of	Planning & Zoning	Planning & Zoning	Police Department	Planning & Zoning	Police Department	Police Department	Town Council	Yes
Loudoun County	Planning Department Zoning Building & Development	Building & Development Public Works	Emergency Management	Building & Development	Emergency Management Building & Development Fire and Rescue Sheriff's Office	Department of GIS, Fire and Rescue, Emergency Management	All departments	Yes
Manassas Park, City of	Community Development	Public Works	Fire and Rescue	Community Development	Police, Fire & Rescue		Fire and Rescue, City Administration	Yes
Manassas, City of	Community Development	Public Works	Fire and Rescue, Prevention and Preparedness Division	Engineering Department	Public Safety	Information Technology	Community Development	Yes
Lovettsville, Town of	Zoning & Planning	Engineering	Police Department	Zoning & Planning	Public Safety	Information Technology	Zoning & Planning	Yes
Middleburg, Town of	Zoning & Planning	Engineering	Police Department	Zoning & Planning	Police Department	Police Department	Zoning & Planning	Yes
Occoquan, Town of	Town Council	Town Council	Town Council	Town Council	Town Council	Town Council	Town Council	Yes
Prince William County	Planning Office	Department of Public Works	Department of Fire & Rescue, Police Department	Planning Office	Department of Fire & Rescue, Police Department	Department of Fire & Rescue, Police Department	Planning Office	Yes
Purcellville, Town of	Planning Office	Public Works	Town Manager, Police Department	Planning Office	Police Department	Police Department	Town Manager, Planning Office	Yes

5.3. Technical Capabilities of each Jurisdiction								
Jurisdiction	Land Use Planners	Civil or Building Engineers	Emergency manager	Floodplain manager	Staff familiar with hazards	GIS staff	Grant writers	Internet access?
Round Hill, Town of	Planning and Zoning	Utility Department	Community Policing	Planning and Zoning	Town Council	Planning and Zoning	Planning and Zoning	Yes
Vienna, Town of	Planning & Zoning	Public Works	Police	Planning & Zoning	Police	Police	Planning & Zoning	Yes



B. Planning and Regulatory Capability

Planning and regulatory capability is based on the implementation of plans, ordinances, and programs that demonstrate a jurisdiction's commitment to guiding and managing growth, development, and redevelopment in a responsible manner, while maintaining the general welfare of the community. It includes emergency operations and mitigation planning, comprehensive land use planning, and transportation planning, in addition to the enforcement of zoning or subdivision ordinances and building codes that regulate how land is developed and structures are built, as well as protecting environmental, historic, and cultural resources in the community. Although some conflicts can arise, these planning initiatives generally present significant opportunities to integrate hazard mitigation principles and practices into the local decision making process.

The Planning and Regulatory capability assessment is designed to provide a general overview of the key planning and regulatory tools or programs in place or under development, along with their potential effect on loss reduction. This information helps identify opportunities to address existing planning and programmatic gaps, weaknesses, or conflicts with other initiatives, in addition to integrating the implementation of this plan with existing planning mechanisms where appropriate.

The table below provides an update to the 2010 Northern Virginia Hazard Mitigation Plan. It summarizes relevant local plans, ordinances, and programs already in place or under development for participating jurisdictions. A (Y) indicates that the given item is currently in place and being implemented by the local jurisdiction (or in some cases by the County on behalf of that jurisdiction), or that it is currently being developed for future implementation. A (Y*) indicates that capability is new as of the 2016 update.

**Table 5.4. Local plans, ordinances and programs**

Jurisdiction	Hazard Mitigation Plan	Comprehensive Land Use Plan	Floodplain Management Plan**	Open Space Management Plan	Stormwater Management Plan	Flood Response Plan	Emergency Operations Plan	SARA Title III Plan	Radiological Emergency Plan	Continuity of Operations Plan	Evac Plan	Disaster Recovery Plan
Alexandria, City of	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Arlington County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dumfries, Town of	Y	Y	Y		Y		Y					
Fairfax County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fairfax, City of	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Falls Church, City of	Y	Y	Y	Y	Y	Y	Y	See Arlington	See Arlington	Y	Y	N
Haymarket, Town of	Y	Y	N	N	N	N	Y	Y	N*	N*	N*	N*
Herndon, Town of	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Leesburg, Town of	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loudoun County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Manassas Park, City of	Y	Y	N*	Y	Y	N*	Y	Y	N*	Y	N*	N*
Manassas, City of	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lovettsville, Town of	Y	Y	N	Y	N	N	Y	N	N	N	N	N
Middleburg, Town of	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y
Occoquan, Town of	Y											
Prince William County	Y	Y	Y				Y	Y	Y	Y	Y	Y*
Purcellville, Town of	Y	Y	Y	Y	Y	Y	Y	Y	Y*	Y*	Y	Y
Round Hill, Town of	Y	Y	N	N	N	N	Y	N	N	N	N	N
Vienna, Town of	Y	Y	Y*	Y	Y	Y*	Y	Y	Y	Y	Y	Y*

** To view how each jurisdiction manages their day to day floodplain management see APPENDIX G



Table 5.4. Local plans, ordinances and programs

Jurisdiction	Capital Improvements Plan	Economic Development Plan	Historic Preservation Plan	Flood Damage Prevention Ordinance	Zoning Ordinance	Subdivision Ordinance	Post-disaster Red/Rec. Ordinance	Building Code	Fire Code	National Flood Insurance Program	NFIP Community Rating System
Alexandria, City of	Y			Y	Y	Y		Y	Y	Y	Y
Arlington County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dumfries, Town of	Y	Y		Y	Y	Y		Y	Y	Y	
Fairfax County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fairfax, City of	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Falls Church, City of	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Haymarket, Town of	Y*				Y*	Y*				Y*	
Herndon, Town of	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Leesburg, Town of	Y	Y	Y	Y	Y	Y		Y	Y	Y	
Loudoun County	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y
Lovettsville, Town of	Y	Y	Y		Y	Y		Y	Y	Y	
Manassas Park, City of	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Manassas, City of	Y	Y	Y	Y	Y	Y		Y	Y	Y	
Middleburg, Town of											Y
Occoquan, Town of											Y
Prince William County	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y
Purcellville, Town of	Y	Y	Y	Y	Y	Y		Y	Y	Y	
Round Hill, Town of	Y*				Y*	Y*			Y*	Y*	
Vienna, Town of	Y	Y*	Y*	Y	Y	Y	Y*	Y	Y	Y	Y



A more detailed discussion on each jurisdiction's planning and regulatory capability follows.

Emergency Management

Hazard mitigation is widely recognized as one of the five primary phases of emergency management. The three other phases include preparedness, response, and recovery. In reality each phase is interconnected with hazard mitigation as Figure 5.1 suggests. Opportunities to reduce potential losses through mitigation practices are most often implemented before disaster strikes, such as elevation of flood prone structures or through the continuous enforcement of policies that prevent and regulate development that is vulnerable to hazards because of its location, design, or other characteristics. Mitigation opportunities will also be presented during immediate preparedness or response activities (such as installing storm shutters in advance of a hurricane), and certainly during the long-term recovery and redevelopment process following a hazard event.

Figure 5.1
The Four Phases of Emergency Management



Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions.

Hazard Mitigation Plan: A hazard mitigation plan represents a community's blueprint for how it intends to reduce the impact of natural and human-caused hazards on people and the built environment. The essential elements of a hazard mitigation plan include a risk assessment, capability assessment, and mitigation strategy.

Disaster Recovery Plan: A disaster recovery plan serves to guide the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment policies and ordinances to be enacted following a hazard event.



- Twelve out of 19 jurisdictions have or are developing Disaster Recovery Plans, although some jurisdictions indicate that other plans include this topic, e.g., an emergency operations plan, and there is no separate disaster recovery plan that addresses long-term recovery issues.

Emergency Operations Plan: All of the Cities and Counties in Virginia are required to have an Emergency Operations Plan which also applies to the towns within their boundaries. Several of the Towns have also written Emergency Operations Plans to guide their emergency response activities.

Continuity of Operation Plan: A continuity of operations plan establishes a chain of command, line of succession, and plans for backup or alternate emergency facilities in case of an extreme emergency or disaster event.

- Survey results indicate that five jurisdictions do not have continuity of operations plans in place.

Radiological Emergency Plan: A radiological emergency plan delineates roles and responsibilities for assigned personnel and the means to deploy resources in the event of a radiological accident.

- Thirteen jurisdictions have a plan to address radiological emergencies.

SARA Title III Emergency Response Plan: A Superfund Amendments and Re-authorization Act (SARA) Title III Emergency Response Plan outlines the procedures to be followed in the event of a chemical emergency such as the accidental release of toxic substances. These plans are required by federal law under Title III of the SARA, also known as the Emergency Planning and Community Right-to-Know Act.

- Fifteen jurisdictions have an Emergency Response Plan for chemical emergencies.

General Planning

The implementation of hazard mitigation activities often involves agencies and individuals beyond the emergency management profession. Stakeholders may include local planners, public works officials, economic development specialists, and others. In many instances, concurrent local planning efforts will help to achieve or complement hazard mitigation goals even though they are not designed as such. Therefore, the *Capability Assessment Survey* also asked questions regarding each jurisdiction's general planning capabilities and the degree to which hazard mitigation is integrated into other on-going planning efforts.

Comprehensive Land Use Plan: A comprehensive land use plan establishes the overall vision for what a community wants to be and serves as a guide to future governmental decision making. Typically a comprehensive plan contains sections on demographic conditions, land use, transportation elements, and community facilities. Given the broad nature of the plan and its regulatory standing in many communities, the integration of hazard mitigation measures into the comprehensive plan can enhance the likelihood of achieving risk reduction goals, objectives, and actions.

- Survey results indicate that 19 jurisdictions have a comprehensive land use plan. All the jurisdictions indicated that their land use plans either strongly support or help facilitate



hazard loss reduction. Some jurisdictions indicated that although hazard mitigation is not specifically addressed in the plan, some elements of the plan might be relevant to hazard mitigation (e.g., environmental protection).

Capital Improvements Plan: A capital improvement plan guides the scheduling of spending on public improvements. A capital improvements plan can serve as an important mechanism for guiding future development away from identified hazard areas. Limiting public spending in hazardous areas is one of the most effective long-term mitigation actions available to local governments.

- Survey results indicate that all jurisdictions have a capital improvements plan in place or under development. Most of these are five-year plans that are updated annually, and all survey respondents indicated they either support or facilitate loss reduction efforts in their community.

Historic Preservation Plan: A historic preservation plan is intended to preserve historic structures or districts within a community. An often overlooked aspect of the historic preservation plan is the assessment of buildings and sites located in areas subject to natural hazards, and the identification of ways to reduce future damages.¹ This may involve retrofitting or relocation techniques that account for the need to protect buildings that do not meet current building standards, or are within a historic district that cannot easily be relocated out of harm's way.

- In 2010, survey results indicate that 13 out of 19 jurisdictions have a historic preservation plan for their communities. The Town of Dumfries, and the Town of Vienna indicated that they do not have any plans that address historic preservation. In 2016, this information was not changed.

Zoning Ordinances: Zoning represents the primary means by which land use is controlled by local governments. As part of a community's police power, zoning is used to protect the health, safety, and welfare of those in a given jurisdiction that maintains zoning authority. A zoning ordinance is the mechanism through which zoning is typically implemented. Since zoning regulations enable municipal governments to limit the type and density of development, it can serve as a powerful tool when applied in identified hazard areas.

- Survey results indicate that all jurisdictions in the Northern Virginia region have adopted and enforce a zoning ordinance. All jurisdictions indicated that their zoning ordinance either strongly supports or helps facilitate hazard loss reduction.

Subdivision Ordinances: A subdivision ordinance is intended to regulate the development of housing, commercial, industrial, or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Subdivision design that accounts for natural hazards can dramatically reduce the exposure of future development.²

- As of the 2010 survey results indicate that all jurisdictions in the Northern Virginia region, except Arlington County, have adopted and enforce a subdivision ordinance. By the 2016 survey Arlington County, has adopted and enforces a subdivision ordinance.

² For additional information regarding the use of subdivision regulations in reducing flood hazard risk, see Subdivision Design in Flood Hazard Areas. 1997. Morris, Marya. Planning Advisory Service Report Number 473. American Planning Association: Washington, D.C.



The jurisdictions indicated that their ordinance either strongly supports or helps facilitate hazard loss reduction.

Building Codes, Permitting and Inspections: Building Codes regulate construction standards. In many communities permits are issued for, and inspections of work take place on, new construction. Decisions regarding the adoption of building codes (that account for hazard risk), the type of permitting process required both before and after a disaster, and the enforcement of inspection protocols all affect the level of hazard risk faced by a community.

- The Virginia Uniform Statewide Building Code (USBC) is a State regulation promulgated by the Virginia Board of Housing and Community Development for the purpose of establishing minimum regulations to govern the construction and maintenance of buildings and structures. As of October 1, 2003, the 2000 version of the International Building Code and International Fire Code were adopted by the Commonwealth of Virginia.
- As provided in the USBC Law, the USBC supersedes the building codes and regulations of the counties, municipalities, and other political subdivisions and state agencies.

The adoption and enforcement of building codes by local jurisdictions is routinely assessed through the Building Code Effectiveness Grading Schedule (BCEGS) program developed by the Insurance Services Office, Inc. (ISO).³ Under the BCEGS program, ISO assesses the building codes in effect in a particular community and how the community enforces its building codes, *with special emphasis on mitigation of losses from natural hazards*. The results of BCEGS assessments are routinely provided to ISO's member private insurance companies, which in turn may offer ratings credits for new buildings constructed in communities with strong BCEGS classifications. The concept is that communities with well-enforced, up-to-date codes should experience fewer disaster-related losses, and as a result should have lower insurance rates.

In conducting the assessment, ISO collects information related to personnel qualification and continuing education, as well as number of inspections performed per day. This type of information combined with local building codes is used to determine a grade for that jurisdiction. Table 5.5 shows the BCEGS rating for the jurisdictions in the Northern Virginia region. The grades range from 1 to 10, with the lower grade being better. A BCEGS grade of 1 represents exemplary commitment to building code enforcement, and a grade of 10 indicates less than minimum recognized protection.

³ Participation in BCEGS is voluntary and may be declined by local governments if they do not wish to have their local building codes evaluated.



Table 5.5. BCEGS Rating for the Northern Virginia Region		
Jurisdiction	Year of Evaluation	BCEGS Rating
Arlington County	2000	3
Fairfax County	2015	3-Residential, 2- Commercial
Loudoun County	1997	3
Prince William County	1997	4
Alexandria, City of	1998	3
Fairfax, City of	2016	3
Falls Church, City of	2014	3-Residential, 2-Commercial
Manassas, City of	1997	4
Manassas Park, City of	2000	3
Dumfries, Town of	1997	5
Herndon, Town of	2014	3 for 1&2 Family Residential
Leesburg, Town of	1997	3
Purcellville, Town of	1997	3
Vienna, Town of	N/A	N/A

Source: Insurance Services Office, Inc. (ISO)

1. NFIP participation

Communities that regulate development in floodplains are able to participate in the NFIP. In return, the NFIP makes federally-backed flood insurance policies available for eligible properties in the community. All of the participating jurisdictions included in this planning initiative participate in the NFIP. The table below shows when each of the jurisdictions began participating in the NFIP. The table also provides the date of the FIRM in effect in each community. These maps were developed by FEMA or its predecessor and show the boundaries of the 100-year and 500-year floods. As the table shows, 13 of the maps are over 15 years old. Parts of the planning area have experienced dramatic growth over the past decade that is not reflected in the FIRM. This difference may mean that the actual floodplain varies from that depicted on the map.

Table 5.6. Communities participating in the NFIP.

Community Name	Init FHBM Identified	Init FIRM Identified	Current Effective Map Date	Reg-Emer Date	DFIRM/Q3
Arlington County	Not Listed	10/1/1969	8/9/2013	12/31/1976	DFIRM
Fairfax County	5/5/1970	3/5/1990	9/17/2010	1/7/1972	DFIRM
Town of Herndon	6/14/1974	8/1/1979	9/17/2010	8/1/1979	
Town of Vienna	8/2/1974	2/3/1982	9/17/2010	2/3/1982	
Town of Clifton	3/28/1975	5/2/1977	9/17/2010	5/2/1977	

**Table 5.6. Communities participating in the NFIP.**

Community Name	Init FHBM Identified	Init FIRM Identified	Current Effective Map Date	Reg-Emer Date	DFIRM/Q3
Loudoun County	4/25/1975	1/5/1978	7/5/2001	1/5/1978	DFIRM
Town of Leesburg	8/3/1974	9/30/1982	7/5/2001	9/30/1982	
Town of Purcellville	7/11/1975	11/15/1989	7/5/2001	11/15/1989	
Town of Middleburg		7/5/2001	7/5/2001	7/31/2001	
Town of Round Hill	5/13/1977	7/5/2001	7/5/2001	1/10/2006	
Prince William County	1/10/1976	12/1/1981	8/3/2015	12/1/1981	DFIRM
Town of Haymarket	8/9/1974	1/17/1990	1/5/1995	1/31/1990	
Town of Occoquan	7/19/1974	9/1/1978	1/5/1995	9/1/1978	
City of Alexandria	8/22/1969	8/22/1969	6/16/2011	5/8/1970	
City of Fairfax	5/5/1970	12/23/1971	6/2/2006	12/17/1971	DFIRM
City of Falls Church	9/6/1974	2/3/1982	7/16/2004	2/3/1982	DFIRM
City of Manassas	5/31/1974	1/3/1979	1/5/1995	1/3/1979	DFIRM
City of Manassas Park	3/11/1977	9/29/1978	1/5/1995	9/29/1978	DFIRM

as of 1/30/2017 <http://www.fema.gov/cis/VA.html>

C. Fiscal Capability

For Fiscal Year 2016, the budgets of the participating jurisdictions range from \$4.9 Million (Town of Middleburg) to \$3.8 Billion (Fairfax County). The table below shows the total budget amounts for each jurisdiction in addition to the amount budgeted for public safety, public works and their respective planning and zoning departments. The counties, cities, and towns receive most of their revenue through real estate taxes, State and local sales tax, local services, and through restricted intergovernmental contributions (Federal and State pass through dollars).

**Table 5.7. 2016 budgets by jurisdiction**

Jurisdiction	FY 2016 Budget (\$)	Public Works Budget (\$)	Public Safety Budget (\$)	Planning Budget (\$)
Alexandria, City of	649.2M	51.7M	146.6M	6.1M
Arlington County	943M	85M	180M	11.9M
Clifton, Town of	<i>Not Available for Review</i>			
Dumfries, Town of	5M	1.3M	1.3M	0.25M
Fairfax County	3.8B	72.6M	453.3M	10.7M
Fairfax, City of	130M	11.4M	25.2M	2.3M
Falls Church, City of	83M	5.8M	9.9M	2M
Haymarket, Town of	2.3M	0.2M	0.8M	.06M
Herndon, Town of	55.5M	10.5M	9.7M	1.9M
Leesburg, Town of	45.1M	10.9M	10.9M	1.58M
Loudoun County	2.2B	<i>3.1M</i>	155M	6.5M
Lovettsville, Town of	3M	<i>.3M</i>	.017M	.13M
Manassas Park, City of	<i>39M</i>	<i>1.8M</i>	<i>6.6M</i>	<i>650K</i>
Manassas, City of	370.7M	8.7M	29.9M	388K
Middleburg, Town of	4.9M	<i>.99M</i>	0.72M	0.23M
Occoquan, Town of	<i>Not Available for Review</i>			
Prince William County	2.7B	74.6M	289.7M	5.2M
Purcellville, Town of	17.4M	3.4M	2.1M	0.458M
Quantico, Town of	<i>Not Available for Review</i>			
Round Hill, Town of	2.7 M	1.4 M	<i>Not Available for Review</i>	<i>Not Available for Review</i>
Vienna, Town of	20.8M	6.7M	5.6M	.746M

The following table is an update to the 2010 Northern Virginia Hazard Mitigation Plan. The table highlights each jurisdiction's fiscal capability through the identification of locally available financial resources. A (Y) indicates that the given fiscal resource is locally available for hazard



mitigation purposes (including match funds for State and Federal mitigation grant funds). A (Y*) indicates that capability is new as of the 2016 update.

5.8. Fiscal capabilities by jurisdiction

Jurisdiction	Capital Improvement Programming	Community Development Block Grants	Special Purpose Taxes	Gas / Electric Utility Fees	Water / Sewer Fees	Stormwater Utility Fees	Development Impact Fees	General Obligation Bonds / Revenue Bonds / Special Tax Bonds	Partnering Arrangements or Intergovernmental Agreements
Alexandria, City of	Y	Y	Y	N	Y	N	Y	Y	Y
Arlington County	Y	Y	Y*	Y	Y	Y	Y*	Y	Y
Dumfries, Town of	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fairfax County	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fairfax, City of	Y		Y		N*				
Falls Church, City of	Y	Y	Y	Y(Gas)	Y (sewer)	Y	Y	Y	Y
Haymarket, Town of	Y*	N	N	N	N	N	Y	N	N
Herndon, Town of	Y	N	Y	Y	Y	Y	Y	Y	Y
Leesburg, Town of	Y		Y*	Y	Y			Y	Y
Loudoun County	Y	Y	Y	N	N	N		Y	Y
Lovettsville, Town of	Y	Y	N	N	Y	N	N	Y	Y
Manassas Park, City of	Y	N*	N*	N*	Y	Y	Y*	Y	Y
Manassas, City of	Y	Y	Y	Y	Y	Y		Y	Y
Middleburg, Town of	Y*	Y*			Y*			Y*	Y*
Occoquan, Town of									
Prince William County	Y	Y	Y		Y	Y	Y	Y	Y
Purcellville, Town of	Y	Y	Y		Y			Y	Y
Round Hill, Town of	Y	N	N	N	Y	N	N	Y	Y
Vienna, Town of	Y	Y*	Y*	Y*	Y*	Y*	Y*	Y*	Y*

¹ See Protecting the Past from Natural Disasters. 1989. Nelson, Carl. National Trust for Historic Preservation: Washington, D.C.



Chapter 6: Mitigation Strategies

This section of the Plan describes the most challenging part of any such planning effort – the development of a Mitigation Strategy. It is a process of:

1. Setting mitigation goals;
2. Considering mitigation alternatives;
3. Identifying objectives and strategies; and
4. Developing a mitigation action plan.

In being comprehensive, the development of the strategy included a thorough review of all natural hazards and identified far-reaching policies and projects intended to not only reduce the future impacts of hazards, but also to assist counties and municipalities to achieve compatible economic, environmental, and social goals. In being strategic, the development of the strategy ensures that all policies and projects are linked to established priorities and assigned to specific departments or individuals responsible for their implementation with target completion deadlines. When necessary, funding sources are identified that can be used to assist in project implementation.

For the 2016 update, the regional goals, objectives, and strategies were re-examined by the committee and jurisdictions and new goals and strategies were included in this section of the plan update. Local jurisdiction strategies are included in Chapter 7.

I. Planning Process for Setting Mitigation Goals

The hazard mitigation planning process conducted by the MAC is a typical problem-solving methodology:

- Describe the problem (Hazard Identification);
- Estimate the impacts the problem could cause (Vulnerability Assessment);
- Assess what safeguards exist that might already or could potentially lessen those impacts (Capability Assessment); and
- Using this information, determine what, if anything, can be done, and select those actions that are appropriate for the community in question (Develop an Action Plan).

When a community decides that certain risks are unacceptable and that certain mitigation actions may be achievable, the development of *goals* and *objectives* takes place. Goals and objectives help to describe what actions should occur, using increasingly narrow descriptors. Initially, long-term and general statements known as broad-based goals are developed. Goals then are accomplished by meeting objectives, which are specific and achievable in a finite time period. In most cases there is a third level, called *strategies*, which are detailed and specific methods to meet the objectives.

The MAC discussed regional goals and objectives for this plan at the May 10, 2016 committee meeting. The committee discussed the results of the HIRAs and reaffirmed the regional mitigation strategy. This strategy was broad and applicable to the region and the committee felt



that in general, it is still applicable to the 2016 plan update. During this same meeting, the committee made the decision to remove the regional mitigation actions. Each individual jurisdiction will incorporate these actions in their jurisdictional section of the plan as appropriate.

Following the development of the regional strategy, jurisdictional meetings were conducted during the months of May, June and July 2016. During these separate jurisdictional meetings, the HIRA was presented to the attendees, and then strategies, or actions, were developed specific to each jurisdiction.

Data collection supports the goals and recommended actions in two ways. First, the HIRA data identifies areas exposed to hazards, at-risk critical facilities, and future development at risk. Second, the Capability Assessment data identifies areas for integration of hazard mitigation into existing policies and plans.

The MAC members used the results of the data collection efforts to develop goals and prioritize actions for their jurisdiction. The priorities differ somewhat from jurisdiction to jurisdiction. Each jurisdiction's priorities were developed using a ranking of the STAPLE/E criteria.

II. Considering Mitigation Alternatives

Each jurisdiction was responsible for the development of their own mitigation actions. In general, they held separate jurisdictional meetings that occurred between May and July 2016. Members of each jurisdiction were presented with the HIRA findings. Discussions held during the meeting resulted in the generation of a range of potential mitigation goals and actions to address the hazards. A range of alternatives were then identified and prioritized by each jurisdiction. These alternatives are presented in Chapter 7.

A. Identification and Analysis of Mitigation Techniques

In formulating Northern Virginia's mitigation strategy, a wide range of activities were considered in order to help achieve the general regional goals in addition to the specific hazard concerns of each participating jurisdiction. This includes the following activities as recommended by the Emergency Management Accreditation Program¹ (EMAP):

- 1) The use of applicable building construction standards;
- 2) Hazard avoidance through appropriate land-use practices;
- 3) Relocation, retrofitting, or removal of structures at risk;
- 4) Removal or elimination of the hazard;
- 5) Reduction or limitation of the amount or size of the hazard;
- 6) Segregation of the hazard from that which is to be protected;
- 7) Modification of the basic characteristics of the hazard;
- 8) Control of the rate of release of the hazard;
- 9) Provision of protective systems or equipment for both cyber or physical risks;
- 10) Establishment of hazard warning and communication procedures; and
- 11) Redundancy or duplication of essential personnel, critical systems, equipment, and information materials.



All activities considered by the MAC can be classified under one of the following six (6) broad categories of mitigation techniques:

Prevention

Preventative activities are intended to keep hazard problems from getting worse, and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning;
- Building codes;
- Open space preservation;
- Floodplain regulations;
- Stormwater management regulations;
- Drainage system maintenance;
- Capital improvements programming; and
- Shoreline / riverine / fault zone setbacks.

Property Protection

Property protection measures involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition;
- Relocation;
- Building elevation;
- Safe rooms;
- Critical facilities protection;
- Retrofitting (e.g., windproofing, floodproofing, seismic design techniques, etc.);
- Safe rooms, shutters, shatter-resistant glass; and
- Insurance.

Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, steep slopes, and sand dunes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection;
- Watershed management;
- Beach and dune preservation;
- Riparian buffers;
- Forest/vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.);
- Erosion and sediment control;
- Wetland preservation and restoration;
- Habitat preservation; and
- Slope stabilization,



Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs;
- Dams / levees / dikes / floodwalls / seawalls;
- Diversions / detention / retention;
- Channel modification;
- Beach nourishment; and
- Storm sewers.

Emergency Services

Although not typically considered a “mitigation” technique, emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems;
- Evacuation planning and management;
- Emergency response training and exercises;
- Sandbagging for flood protection; and

Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects;
- Speaker series / demonstration events;
- Hazard map information;
- Real estate disclosure;
- Library materials;
- School children educational programs; and
- Hazard expositions.

B. Prioritizing Alternatives

Through discussion and self-analysis, each jurisdiction used the STAPLE/E (Social, Technical, Administrative, Political, Legal, Economic, and Environmental) Criteria when considering and prioritizing the most appropriate mitigation actions. This methodology requires that social, technical, administrative, political, legal, economic, and environmental considerations be taken into account when reviewing potential actions for the area’s jurisdictions to undertake. This process was used to help ensure that the most equitable and feasible actions would be undertaken based on a jurisdiction’s capabilities.

Table 6.1, below, provides information regarding the review and selection criteria for alternatives.

**Table 6.1. STAPLE/E Review and Selection Criteria for Alternatives**

Social
<ul style="list-style-type: none">▪ Is the proposed action socially acceptable to the community(s)?▪ Are there equity issues involved that would mean that one segment of a community is treated unfairly?▪ Will the action cause social disruption?
Technical
<ul style="list-style-type: none">▪ Will the proposed action work?▪ Will it create more problems than it solves?▪ Does it solve a problem or only a symptom?▪ Is it the most useful action in light of other community(s) goals?
Administrative
<ul style="list-style-type: none">▪ Can the community(s) implement the action?▪ Is there someone to coordinate and lead the effort?▪ Is there sufficient funding, staff, and technical support available?▪ Are there ongoing administrative requirements that need to be met?
Political
<ul style="list-style-type: none">▪ Is the action politically acceptable?▪ Is there public support both to implement and to maintain the project?
Legal
<ul style="list-style-type: none">▪ Is the community(s) authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity?▪ Are there legal side effects? Could the activity be construed as a taking?▪ Is the proposed action allowed by a comprehensive plan, or must a comprehensive plan be amended to allow the proposed action?▪ Will the community(s) be liable for action or lack of action?▪ Will the activity be challenged?
Economic
<ul style="list-style-type: none">▪ What are the costs and benefits of this action?▪ Do the benefits exceed the costs?▪ Are initial, maintenance, and administrative costs taken into account?▪ Has funding been secured for the proposed action? If not, what are the potential funding sources (public, non-profit, and private)?▪ How will this action affect the fiscal capability of the community(s)?▪ What burden will this action place on the tax base or local economy?▪ What are the budget and revenue effects of this activity?▪ Does the action contribute to other community goals, such as capital improvements or economic development?▪ What benefits will the action provide?
Environmental
<ul style="list-style-type: none">▪ How will the action affect the environment?• Will the action need environmental regulatory approvals?• Will it meet local and state regulatory requirements?

**Table 6.1. STAPLE/E Review and Selection Criteria for Alternatives**

- | |
|---|
| • Are endangered or threatened species likely to be affected? |
|---|

Ranking was completed in order of relative priority based on the STAPLE/E criteria, as well as the strategy's potential to reduce vulnerability to natural hazards.

III. Identifying Objectives and Strategies

A. Goals and Strategies

Through a series of jurisdictional meetings, the following goals and strategies for the region were accepted by the MAC. The goals and strategies form the basis for the development of a Mitigation Action Plan and specific mitigation projects to be considered for the Region. The process consisted of 1) setting goals, 2) considering mitigation alternatives, 3) identifying strategies, and 4) developing an action plan resulting in a mitigation strategy.

Community officials should consider the goals that follow before making community policies, public investment programs, economic development programs, or community development decisions for their communities. In addition, Regional strategies have been developed for each goal. These strategies state a more specific outcome that the jurisdictions of the Northern Virginia region expect to accomplish over the next five years. The strategies will outline the specific steps necessary to achieve that end.

Regional Goals and Strategies

- Goal 1: Improve the quality and utilization of best available data for conducting detailed hazard risk assessments and preparing meaningful mitigation action plans.
- Goal 2: Increase the capability of the Northern Virginia jurisdictions to successfully mitigate hazards to include participation in grant programs, revision of codes, and expansion of programs such as the Community Rating System, and continuation or expansion of outreach programs.
- Goal 3: Develop and maintain specific plans to minimize the effects of known hazards in the region.
- Goal 4: Improve existing local policies, codes, and regulations to reduce or eliminate the impacts of known hazards. This includes maintaining continued compliance with the NFIP for all participating jurisdictions.
- Goal 5: Investigate and implement a range of structural and non-structural projects that will reduce the effects of hazards on public and private property throughout the region.
- Goal 6: Increase the public's awareness of hazard risks in the Northern Virginia region, while also educating residents and businesses on the mitigation measures available to minimize those risks.

The previous regional strategy from the 2010 plan has been removed and mitigation actions found within it have been incorporated into local action plans found in Chapter 7 where appropriate.



Local Mitigation Strategies

In formulating a mitigation strategy, a wide range of activities were considered in order to help achieve the goals and to lessen the vulnerability of the Northern Virginia jurisdictions to the effects of the natural hazards identified in this plan. Through a series of jurisdictional meetings, conference calls, and e-mail exchanges, all of the jurisdictions (county, cities, and towns) participated in the development and review of the local mitigation strategy.

Strategies were ranked by each community. Ranking was completed in order of relative priority based on the STAPLE/E criteria, as well as the strategy's potential to reduce vulnerability to natural hazards. Actions were given a ranking of high, medium, or low, with the following meanings:

- High (H) – actions should be implemented in the short-term
- Medium (M) – actions should be implemented in the long-term
- Low (L) – actions should be implemented only as funding becomes available

When deciding on which strategies should receive priority in implementation, the communities considered:

- Time – Can the strategy be implemented quickly?
- Ease to implement – How easy is the strategy to implement? Will it require many financial or staff resources?
- Effectiveness – Will the strategy be highly effective in reducing risk?
- Lifespan – How long will the effects of the strategy be in place?
- Hazards – Does the strategy address a high priority hazard or does it address multiple hazards?
- Post-disaster implementation – Is this strategy easier to implement in a post-disaster environment?

In addition, the anticipated level of cost effectiveness of each measure was a primary consideration when developing mitigation actions. Because mitigation is an investment to reduce future damages, it is important to select measures for which the reduced damages over the life of the measure are likely to be greater than the project cost. For structural measures, the level of cost effectiveness is primarily based on the likelihood of damages occurring in the future, the severity of the damages when they occur, and the level of effectiveness of the selected measure. Although detailed analysis was not conducted during the mitigation action development process, these factors were of primary concern when selecting measures. For those measures that do not result in a quantifiable reduction of damages, such as public education and outreach, the relationship of the probable future benefits and the cost of each measure was considered when developing the mitigation actions. Each jurisdiction's mitigation strategy can be found in Chapter 7 and the status of 2010 mitigation strategies can be found in Appendix E. Where a strategy's status is blank, updates were unable to be retrieved from the jurisdiction's representative.

Each of the strategies are numbered in the action plans and listed in order of their prioritization (High, Medium, or Low). The strategies that were brought forward from the 2010 plan are listed first in the table under their original strategy number, combined with the year that they were



developed. The new strategies for this new planning cycle start at 1 again. The year column found in the 2010 plan has been removed and the year a strategy was developed was incorporated into the action number.

¹ The EMAP Standard is based on the [NFPA 1600](#) Standard on Disaster/Emergency Management and Business Continuity Programs, 2004 Edition.



Chapter 7: Jurisdiction Executive Summaries

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 139,966 in 2010.



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 NCDC¹. 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
Ranking	High	High	High	High	Med-High	Med	Low	Med-Low	Med-Low

A. Alexandria Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind\Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-6	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										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	Promotion of mitigation is included as part of the City's annual outreach program associated with FEMA's Community Rating System (CRS) annual recertification.
2010-3	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.	Transportation and Environmental Services	X	X										Internal funding	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	Included as part of the City's annual outreach program associated with FEMA's Community Rating System (CRS) annual recertification.
2010-4	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										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the	Medium	Submitted HMPG for generators

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind\Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
																structural review.		
2010-5	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Transportation and Environmental Services	X	X										Local program	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	The City's floodplain ordinance was revised in April 2011 to comply with NFIP minimum standards. The City conducted a Repetitive Loss Area Analysis in 2012. Annual report updates are published as part of the annual CRS recertification.
2010-7	Re-grade section of lower King Street, Union Street and The Strand to improve drainage and minimize flooding.	Transportation and Environmental Services	X	X										Alexandria Capital Improvement Project funding	2015	Integrate into capital improvement budgets; complete design and permitting.	Low	Engineering Feasibility Study completed in 2013. Project now part of the Water Front Plan Implementation.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind\Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-8	Construct an elevated walkway along Potomac riverfront to elevation 6.0 feet (NAVD88) to mitigate flooding.	Transportation and Environmental Services	X	X										Alexandria Capital Improvement Project funding and developer contributions	2020	Integrate into capital improvement budgets; complete design and permitting.	Low	Part of the Waterfront Plan Implementation . Design contract in place February 2016.
2017-1	Build permanent standalone EOC	Emergency Management	X	X	X	X	X	X	X	X	X	X	X	CIP	December 2018	Entering Phase 2 of construction process	High	No
2017-2	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	Internal funding	Ongoing	3,000 new subscribers to e-News for receipt of emergency alerts by end of 2018.	High	No
2017-3	Four Mile Run Stream Restoration	Transportation and Environmental Services	X		X									Internal funding	November 2018	Complete final adoption public review as prescribed by NFIP.	High	No
2017-4	Litter control infrastructure, to provide a capture area for debris before it flows into the Potomac River.	Transportation and Environmental Services	X											Alexandria Capital Improvement Project funding with matching funds from	November 2018		Medium	Approved FY 2017 - FY 2026 CIP. Page 126

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind\Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
														Arlington County				
2017-5	Excavate sediment from channel bed of Cameron Run - I495 bridge to upstream, as needed.	Transportation and Environmental Services	X											City of Alexandria CIP	Ongoing	Secure funding for project by March 2011	High	The City does excavate sediment from Cameron Run starting at the I495 bridge to upstream as needed.

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 NCDC¹. 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 7.2: 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	

A. Arlington Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\ Sinkholes	Funding Source	Target Compl. Date	Interim Measure of Success	Priority (Critical , High, Medium , Low)	Comments
2006-1	Upgrade county EOC to modern standards.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	Not Determined	Dec. 2018	Funding sources identified/se cured by June 2016. EOC upgrade plan completed	High	Currently seeking leased space. Funding stream remains unclear after project was removed from County CIP
2006-7	Continue training for employees and partners on the Incident Command System.	Office of Emergency Management	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	Ongoing program
2010-1	Enhance the ability of patrol officers, through increased training and additional equipment, to respond to active shooter and/or terrorist attacks	Police Department												Bureau of Justice Administration DHS funding	Continual	Funding Secured Training in progress Equipment upgrades ongoing	Critical	Completed 2012 and ongoing
2010-6	Secure additional special needs supplies to support the special needs population.	Arlington Red Cross	X	X	X	X		X	X	X	X	X	X	UASI	Continual	Secure funding and storage and order supplies by January 2011.	High	Completed regionally in 2016

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\ Sinkholes	Funding Source	Target Compl etion Date	Interim Measure of Success	Priority (Critical , High, Medium , Low)	Comments
2010-10	Coordinate regionally to integrate multiple evacuation plans.	VDEM/Arlingt on County Office of Emergency Management	X	X	X	X		X	X		X	X	X	State and Federal funding sources	Continual	Regional evacuation plan developed by August 2011.	High	Complete
2010-11	Secure prisoner transportation resources in the event of a jail evacuation.	Sheriff's Office	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
2010-12	Identify building(s) to house the Courts, if the Courthouse is compromised.	Sheriff's Office/ Department of Environmental Services	X	X	X	X			X			X	X	County Funding	June 2011	Determine capacity and resource requirements to house the Courts by February 2011.	High	Yes
2010-15	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									FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	Complete

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\ Sinkholes	Funding Source	Target Compl etion Date	Interim Measure of Success	Priority (Critical , High, Medium , Low)	Comments
2010-16	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									FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	Ongoing– not more than 2-3 such structures exist.
2010-17	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									FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	Ongoing
2010-18	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Office of Emergency Management	X		X									County funding.	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	Ongoing
2010-19	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	County funding	Continual	Create a partnering committee with at least 5 members of the	Medium	Complete – Significant retirement will require training.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\ Sinkholes	Funding Source	Target Compl etion Date	Interim Measure of Success	Priority (Critical , High, Medium , Low)	Comments
																private industry to assist in developing the plan by January 2012.		
2010-20	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	County funding	Continual	Establish parameters of analysis (i.e. determine what areas need to be analyzed specifically) by April 2011.	Medium	Completed- Departmental Safety Officer Staffing increased significantly in 2010
2010-21	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	County funding	Continual	Schedule a meeting between County and academic partners to discuss opportunities by January 2011.	Medium	Ongoing – Currently have two OEM staff working on a weekly basis.
2010-22	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	Arlington Red Cross	Continual	Schedule the first presentation by April 2011.	Medium	Ongoing
2010-26	Acquire the ability to have remote access to medical records.	Sheriff's Office	X	X	X	X	X	X	X	X	X	X	X	County Funding	January 2018	Secure funding by January	Medium	In Progress

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\ Sinkholes	Funding Source	Target Compl. Date	Interim Measure of Success	Priority (Critical , High, Medium , Low)	Comments
																2012		
2010-27	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	FEMA Unified Hazard Mitigation Assistance Grants	Continual	Improve situational awareness to enhance public outreach and notification by April 2011.	Medium	Ongoing
2010-28	Identify effective means of communicating with special populations, e.g., <ul style="list-style-type: none"> - Non-English speakers - Special needs - Tourists Non-digital	Office of Communications	X	X	X	X	X	X	X	X	X	X	X	FEMA Unified Hazard Mitigation Assistance Grants	Continual	Planning underway	Medium	Ongoing
2010-29	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	FEMA Unified Hazard Mitigation Assistance Grants	Continual	Hold discussions with Arlington Public Schools and set-up process	Medium	Ongoing
2017-01	Acquire additional Snow Melting equipment	Department of Environmental Service (ESF3)		X										County Operational Funds	Dec 2017	Identify the right type of equipment.	Low	
2017-02	Develop and adopt Threat & Hazard Identification and Assessment Plan for County	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	County Funding	December 2017	Draft ready by June 2017	High	

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 2010 census population estimate for the county is 1,081,685 an approximately 5.6% increase during the past decade. Based on the 2005-2009 American Community Survey, the county population was comprised of 62.7% white, 9.2% black or African American, 0.6% Native American, 0.1% Pacific Islander, 17.5% Asian, 4.8% from other races, and 4.1% bi-racial. Hispanic or Latino of any race were 15.6% 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 2015 – 2016 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 NCDC¹. 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 7.3: Hazard Ranking for Fairfax County

Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst	Extreme Temp.	Dam Failure
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med	Med-Low	Med-Low	Med-Low

A. Fairfax County Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-2	Continue to develop and implement flood proofing solutions for structures analyzing flood causes and responsibilities.	DPWES - Stormwater	X	X	X					X				County Funding	Ongoing	Initiate service request within 48 hours of receiving the request	High	These projects are completed when the county attorney we are responsible, and the efforts are ongoing. The language for this action has been modified slightly for the 2017 plan but the intent remains unchanged.
2006-5	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.	DPWES - Stormwater	X		X					X				Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	Ongoing	Prioritize installation of gauges within one year of substantial completion and as resources allow	High	These projects are ongoing and compete as funding becomes available.
2006-13	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	UASI funding, county funding	July 2014	Conduct generator survey to identify which facilities require a backup generator by January 2012.	Medium	This program will be completed when funding becomes available.
2006-28	Continue to implement building and development standards as required under the National Flood Insurance Program.	Land Development Services	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	This task is ongoing as updates are made to building and development standards, they are reviewed and incorporated as appropriate. All new policies and procedures are in accordance with the National Flood Insurance Program (NFIP).

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-6	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	UASI funding, DHS grants, county funding	Ongoing		High	OEM launched the new Fairfax Alerts system in the summer of 2014, and continues to look for new ways to alert residents including social media and WEA.
2010-12	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	Ongoing	Develop list of vulnerable or undersized culverts by January 2012.	High	PA has trail development strategy plan that addresses this concern.
2010-16	Upgrade the New Alexandria/Belle View pump station fuel oil storage tanks from underground to above-ground storage.	DPWES - Wastewater	X		X									County Funding	June 2018	Complete Design by June 2017	High	This project is planned to be completed. The language was changed slightly from the text in the 2010 plan, but the intent is the same.
2010-17	Continue to seek voluntary buy-outs of FEMAs repetitive loss properties within the floodplain.	DPWES - Stormwater	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	These projects are completed as funding is available.
2010-20	Collaborate with FEMA to develop risk maps for the Cameron Run Watershed and the Belle View communities.	DPWES - Stormwater	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Assistance grant funding,	Ongoing		High	Progress is controlled by FEMA's schedule.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
														County Funding				
2010-21	Develop an outreach program aimed at assisting private dam owners with proper operation and maintenance.	DPWES - Stormwater	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)	July 2017	Identify specific outreach techniques for this audience by January 2017.	High	This program will be completed when funding becomes available.
2010-23	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	County funding	July 2011	Establish metrics for review of plan by February 2011.	Medium	In 2012 Fairfax County published the Pre-Disaster Recovery Plan. The plan is scheduled to be revised in 2017. During that process gaps will be identified and addressed again.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-26	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	Ongoing	Medium	Yes
2010-27	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.	DPWES - Stormwater	X	X										Hazard Mitigation Assistance grant funding, US Army Corp of Engineers, County Funding	Ongoing		Medium	These Projects are completed as funding becomes available.
2010-29	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.	DPWES – Stormwater	X	X										County Funding	Ongoing		Medium	This action was reassigned to DPWES-Stormwater. It is performed annually as part of the CRS Program.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-30	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										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing		Medium	This is completed as funding is available.
2010-32	Encourage public and private water conservation plans, including consideration of rainwater catchment system.	Park Authority			X									County funding	Ongoing	Engage in public outreach regarding water conservation by January 2012.	Low	This is completed as funding is available.
2010-33	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	Ongoing	Establish working group by December 2011.	Low	
2017-1	Develop an Emergency Action Plan for the Huntington Levee project.	DPWES – Stormwater	X							X				Hazard Mitigation Assistance Grant	December 2018		High	
2017-2	Collaborate with other departments of Fairfax County to identify satellite locations throughout Fairfax County to build	DPWES - Stormwater	X											County Funding	June 2018	Identify and build at least two sites by November 2017	High	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	additional salt storage facilities to reduce the travel time and distance during snow/ice events.																	
2017-3	Secure funding to purchase additional equipment/trucks to enhance our current level of service to be able to dedicate one piece of equipment/truck to each police station within Fairfax County or identify other resources to accomplish this need.	DPWES – Stormwater	X											County Funding	June 2020	Secure funding to purchase at least 2 additional trucks/pieces of equipment each year for the next four years or establish a contract that would dedicate resources to each County police station by November 2017	High	
2017-4	Coordinate and support the Virginia Department of Transportation in the identification and resolution of road flooding and drainage issues related to VDOT roadways.	DPWES – Stormwater	X	X						X				VDOT Maintenance Funding	Ongoing	Prioritization and implementation of higher priorities.	High	
2017-5	Armor stream bank and construct a flood wall to prevent stream bank erosion and flooding at the Norman M. Cole, Jr. Pollution Control Plant	DPWES – Wastewater	X	X										County Funding	February 2018	Construction project management review and inspections	High	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-6	Design and construct safe rooms at critical facilities to house personnel and community members during high wind events.	Office of Emergency Management	X	X	X	X		X						Hazard Mitigation Grant Funds, County Funding	Ongoing		High	This action replaces 2010-11, and provides for storm proofing any critical facilities, not just shelter.
2017-7	Provide emergency utility capabilities for critical facilities. This includes, but is not limited to providing generator and emergency water hookups.	Office of Emergency Management	X	X	X	X		X	X	X	X	X	X	Hazard Mitigation Grant Funds, County Funding	Ongoing		High	This action replaces 2010-1
2017-8	Improve the County's Community Rating System (CRS) classification from Class 6 to Class 5 by documenting services that are currently being provided.	DPWES – Stormwater	X							X				County Funding	Ongoing		Medium	
2017-9	Provide routine inspections and maintenance of dams to ensure they are functional.	DPWES – Stormwater	X	X						X				County Funding	Ongoing	Routine Maintenance	Medium	
2017-10	Continue to implement flood mitigation projects for communities in Fairfax County that are exposed to severe flooding risk.	DPWES – Stormwater	X	X						X				Hazard Mitigation Grant Funds, County Funding	Ongoing		Medium	
2017-11	Update flood information website to include a link to the Office of	DPWES – Stormwater	X							X				County Funding	Check links at least once every year.		Low	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	Emergency Management website and the private dam owners outreach materials.																	
2017-12	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.	DPWES – Stormwater	X	X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2019	Medium	Action carried over from previous plan; still relevant and necessary

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



IV. Loudoun County

Loudoun County was established in 1757 and was formerly part of Fairfax County. It was named after John Campbell, Fourth 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 349,679 in 2013 by the U.S. Census Bureau. 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 NCDC¹. 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 7.4: 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	

A. Loudoun County Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-8	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	Department of Homeland Security grants, UASI funding, county funding	Ongoing	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).	
2010-1	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									Internal county funding, Federal Highway Administration grants Tiger Grants	Ongoing	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	Since 2010, we have met with VDOT and increased signage capability available for deployment notifying the public of road closed due to "high water". We have initiated conversation with VDOT regarding the installation of gates, but those conversations are in the infancy stage.
2010-2	Evaluate Repetitive Loss and Severe Repetitive Loss properties within the County. Support	Office of Emergency Management	X		X									FEMA Unified Hazard Mitigation Assistance Grants	Ongoing	Property owner interest and application to participate in	High	Since 2010 Loudoun County has participated in the Risk Map program and have

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	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.													Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss		FEMA grant program		preliminary discussed these options in a variety of settings. Given the results of the Risk Map project, we will need to develop and implement strategies that continue the discussions and look at ways to minimize risk.
2010-3	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that	Office of Emergency Management	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	This is part of the Risk Map project, which will yield additional requirements associated with this mitigation action.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2010-4	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								Internal county funding, Federal Highway Administration grants Tiger Grants	Ongoing	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.	Medium	Through a partnership with VDOT, we have deployed mobile variable message boards to several strategic locations to enhance the ability of public messaging. VDOT has increased the number of traffic cameras throughout the eastern portion of the County, which allows for collecting situational awareness. We are presently working through the County Attorney's Office regarding an agreement with VDOT through

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
																		the Secure Partner's initiative.
2010-5	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	Department of Homeland Security grants, UASI funding, county funding	Ongoing	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	Loudoun County implemented the County of Loudoun Evacuation Assistance Registry, which allows for the identification of those individuals at risk and needing assistance during an evacuation.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-6	Determine feasibility of developing a drought preparedness and response plan	Office of Emergency Management				X								Department of Homeland Security grants, UASI funding, Internal county funding	December 2018	Research and identify applicable funding mechanisms to develop the plan.	Medium	This initiative has not commenced as of yet and will be continued in the next planning cycle.
2017-1	Continue working with VDOT regarding the development and implementation of gates to prevent drivers from crossing known flood prone roadways.	Office of Emergency Management	X		X									Department of Homeland Security grants, TIGER grants, Transportation Grants, Commonwealth of Virginia	2018	Upon approval of the plan we will convene representatives to discuss current progress and to further develop the project concept.	High	
2017-2	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	Office of Emergency Management	X		X									FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map process.	High	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	where feasible using FEMA HMA programs where appropriate.																	
2017-3	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide	Office of Emergency Management	X		X									FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map process.	High	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	corrections if needed by filing form FEMA AW-501.																	
2017-4	Collaboration with VDOT and transportation officials to continue expanding the traffic cameras to maintain the ability for situational awareness.	Office of Emergency Management	X	X	X	X								Internal county funding, Federal Highway Administration grants Tiger Grants	2020	Upon approval of the plan convene a meeting of stakeholders to determine current status and to develop the project scope.	Medium	
2017-5	Determine feasibility of developing a drought preparedness and response plan	Office of Emergency Management					X							Department of Homeland Security grants, UASI funding, Internal county funding	2020	Research and identify applicable funding mechanisms to develop the plan.	Medium	

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 NCDC¹. 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 7.5: 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

A. Prince William County Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Dept. Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006 -07	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.	Department of Development Services, Department of Fire and Rescue, Department of Public Works	X	X	X	X			X					FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Continue adhere to building code and flood plain ordinance.	Medium	No
2010 -03	Provide outreach and educate to those citizens who are at risk of flooding.	Office Emergency Management , Department of Public Works and or Virginia Cooperative Extension	X		X									FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program – 5% initiative funds	Ongoing	NA	High	No
2010 -05	Review and update Emergency Action Plans (EAP) for Dams owned by the County and work with private dam owners on inspections, maps, and updates.	Department of Public Works, Office of Emergency Management	X		X						X			Hazard Mitigation Grant Program – 5% initiative funds Virginia Floodplain Management Fund (administered by DCR Division of Dam Safety and Floodplain Management), County Funding	Ongoing	Continue to evaluate as required.	High	Lake Jackson and Silver Lake Dams have been rehabilitated and meet all currents standards. Non-County owned dam EAP are reviewed when received from the dam owner and recommendations are made to the owner of the dam.
2010 -07	Evaluate parent notification processes at schools to include	Prince William County	X	X	X	X	X	X	X	X	X	X	X	No cost – internal County School staff	Ongoing	Continue to increase language	Medium	Numerous methods of commutations with parents and guardians.

#	Agency/Department: Mitigation Action	Lead Agency Dept. Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	language evaluation.	Schools												support		evaluation capability		Will continue to evaluate and address language evaluation.
2010 -09	Development of a storm water inventory framework/monitoring system.	Department of Public Works	X	X						X				PWC storm water management fee funds this ongoing initiative.	Ongoing	Update and maintain inventory database.	Medium	Utilize current manual system to provide flood checks before major storm events as well as annual inspection of County maintained facilities.
2010 -13	Review locality's compliance with the National Flood Insurance Program to include, an annual review of the Floodplain Ordinances and any newly permitted activities in the 100-year floodplain. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested from VDEM to ensure accuracy and conduct outreach as appropriate. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by	Department of Public Works, Office of Emergency Management	X	X										Hazard Mitigation Grant Program, County floodplain management program,	Ongoing	Annual review	Medium	No

#	Agency/Department: Mitigation Action	Lead Agency Dept. Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	filing form FEMA AW-501.																	
2010-14	Review and update County Debris Management Plan as required.	Department of Public Works	X	X	X	X					X			Internal staff; PWC Contracted services	Ongoing	Annual training and exercise on debris Management Plan	Low	Update sent to FEMA for formal review and approval by December 2016.
2017-01	Develop, test and exercise County Continuity of Operations Plan and Agency Continuity of Operations (COOP) Plans	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	PWC funding	Ongoing	Annual review of County and agency COOP Plans, and completion of annual Training and Exercise Matrix	High	N/A
2017-02	Create a Disaster Recovery program for information technology systems.	Department of Information Technology	X	X	X	X	X	X	X	X	X	X	X	County funding	Ongoing	Conduct annual contingency test on mission critical systems.	Medium	N/A
2017-03	Prince William County Flood Mitigation Assistance Pilot Grant Program to acquire Severe Repetitive Loss properties and create green space	Office of Emergency Management	X											Flood Mitigation Assistance (FMA) Grant	Grant Period of Performance ends October 2018	FEMA Grant awarded May 26, 2016	Medium	Pending evaluation of pilot program and homeowner participation.

#	Agency/Department: Mitigation Action	Lead Agency Dept. Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-04	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.	Department of Public Works	X	X										FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2019	Medium	Action carried over from previous plan; still relevant and necessary

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 22,542 as estimated by the Census Bureau in 2010 and 24,013 of 2015. Based on the 2010-2014 American Community Survey, the city population was comprised of 73.1% white, 5.4% black or African American, 0.7% Native American, 0.1% Pacific Islander, 17.2% Asian, 4.3% from other races. Hispanics or Latinos of any race were 16.8% 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 recent 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 NCDC¹. 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.

Table 7.6: Hazard Ranking for City of Fairfax

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



A. City of Fairfax Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-7	Consider becoming members of the Community Rating System.	Public Works	X		X									FEMA Unified Hazard Mitigation Assistance Grants	2019	Secure funding by January 2018.	High	Action carried over from previous plan; still relevant and necessary
2010-1	Secure funding and conduct a safety analysis of the tank farm within the City. Consider hardening the facility.	Fire Department												UASI funding, FEMA Unified Hazard Mitigation Assistance Grants Hazard Mitigation Grant Program	January 2019	Secure funding by July 2018.	High	Action carried over from previous plan; still relevant and necessary
2010-5	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	FEMA Unified Hazard Mitigation Assistance Grants	December 2018	Secure funding as available by HMPG.	Medium	Action carried over from previous plan; still relevant and necessary; some progress has been accomplished since previous, but work remains to be done.
2010-6	Consider posting permanent evacuation signs on City-operated evacuation routes.	Office of Emergency Management	X	X	X	X		X	X		X			FEMA Unified Hazard Mitigation Assistance Grants	June 2018	Identify where, and how many, signs will be needed by January 2018.	Medium	Action carried over from previous plan; still relevant and necessary
2010-10	Conduct annual outreach to each FEMA-listed repetitive loss and severe repetitive loss property	Office of Emergency Management	X		X									FEMA Unified Hazard Mitigation Assistance	Ongoing	Develop outreach materials, or identify appropriate	Medium	Action carried over from previous plan; still relevant and necessary

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	owner, providing information on mitigation programs (grant assistance, mitigation measures, flood insurance information) that can assist them in reducing their flood risk.													funding,		outreach materials for dissemination by June 2018		
2010-11	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									FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2019	Medium	Action carried over from previous plan; still relevant and necessary
2010-12	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									FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Query local government building services staffs as to effectiveness of provided information regarding the structural review.	Medium	Action carried over from previous plan; still relevant and necessary

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-13	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Public Works	X		X									City funding.	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2019	Medium	Action carried over from previous plan; still relevant and necessary
2017-1	Increase departmental awareness regarding funding opportunities for mitigation.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	City Funding	Ongoing	Conduct yearly outreach to interested parties related to FEMA hazard mitigation grant programs.	Low	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-2	Conduct a building assessment and analysis to identify vulnerability to extreme heat.	Public Works							X					City Funding	September 2019	Prioritize City building for assessment completing one every 3 month	Low	
2017-3	Develop repository for storage and access of hazard, risk and vulnerability data for all City assets.	Office of Emergency Management/ Information Technology	X	X	X	X	X	X	X	X	X	X	X	City Funding	2018	Implement a repository for needed access by City employees	Low	
2017-4	Prioritize critical facilities and complete site surveys to identify vulnerabilities.	Office of Emergency Management / Public Works	X	X	X	X	X	X	X	X	X	X	X	City Funding	Ongoing	Implement a strategy to help identify critical facilities	Medium	
2017-5	Provide grants information, planning tools, training and technical assistance to increase the number of hazard mitigation projects.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	City Funding	Ongoing	Continue support of hazard mitigation planning, project identification and implementation	Medium	
2017-6	Provide for user-friendly hazard-data accessibility for mitigation and other planning efforts and for private citizens	Information Technology	X	X	X	X	X	X	X	X	X	X	X	City Funding	September 2019	Develop a simple GIS platform, or build upon an existing platform, to maintain and analyze critical facilities inventories and information about hazards.	Low	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-7	Implement mitigation projects and programs intended to reduce risk to critical facilities and critical infrastructure	Public Works	X	X	X	X	X	X	X	X	X	X	X	Hazard Mitigation Grants	Ongoing	Monitor the need for mitigation projects	High	
2017-8	Integrate hazard mitigation and notification system training into existing employee training.	Personnel / Information Technology	X	X	X	X	X	X	X	X	X	X	X	City Funding	Ongoing	Add program to new employee orientation	Medium	
2017-9	Prioritize servers to ensure that critical data remains available during and after hazard events	Information Technology	X	X	X	X	X	X	X	X	X	X	X	City Funding	October 2017	.Identify all City owned servers by 2017	Medium	
2017-10	Determine necessary equipment / hardening to maintain administrative services during and after a hazard event.	Information Technology	X	X	X	X	X	X	X	X	X	X	X	City Funding/ HMGP	January 2018	Develop a list of services needed to be maintained	Medium	
2017-11	Ensure that all critical facilities have generators and fuel storage location, or quick connects for temporary generator use.	Public Works	X	X	X	X	X	X	X	X	X	X	X	City Funding / HMGP	2019	Identify all City owned facilities with and without generators	High	

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 12,332 as of the 2010 Census and was estimated by the Census Bureau to be 13,892 in 2015. Based on the 2010 Census survey, the city population was comprised of 79.9% white, 4.3% black or African American, 0.3% Native American, 9.4% Asian, 2.1% from other races, and 4% bi-racial. Hispanics or Latinos of any race was 9% of the total population. Falls Church has a significant Vietnamese-American commercial population.



Falls Church has a moderate climate. The average annual temperature is approximately 54 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 42 inches of rain and 19 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 6,314 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 NCDC¹. 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 7.7: Hazard Ranking for Falls Church										
Hazard	Flood	Wind	Tornado	Winter Weather	Drought	Earthquake	Landslide	Wildfire	Karst	
Ranking	High	High	High	High	Med-High	Med	Med-Low	Med-Low	Med-Low	

A. City of Falls Church Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-5	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.	Department of Public Works	X		X	X									FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Continue outreach program with educational materials.	Medium	The City has monitored the NFIP claims list and there are no repetitive loss properties in the City. We will continue to monitor for repetitive loss properties and conduct outreach if any become listed.
2010-6	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.	Department of Public Works	X		X	X									FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Ongoing identification process.	Medium	The City has identified all flood prone structures and conduct annual outreach about flood safety to those properties. We have and continue to pursue local flood control projects
2010-7	Promote structural mitigation to assure redundancy of critical facilities, to include but not limited to roof structure	Development Services	X	X	X	X	X			X					FEMA Unified Hazard Mitigation Assistance funding for qualified	Modified	Query local government building services staffs as to effectiveness	Medium	Directed to the City Building Official.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	improvement, to meet or exceed building code standards, upgrade of electrical panels to accept generators, etc.														structures.		of provided information regarding the structural review.		
2010-8	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Department of Public Works	X	X	X	X									Falls Church general funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	The City may rewrite the floodplain ordinance in the next 5-year term of the HMP to make it more clear. Review all floodplain development annually as part of our participation in FEMA's Community Rating System.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Hurricane	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	All City Departments are responsible to ensure mitigation plans; policies and procedures are developed and executed to ensure continuity of operations by their respective Department.	Falls Church Office of Emergency Management	X	X	X	X	X			X					Falls Church General Funds	2017/2018	Drafting of Departmental COOP Plans.	Medium	New Beginning 2016

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 estimated by the Census Bureau to be 41,764 in 2015. Based on the 2010-2014 American Community Survey, the city population was comprised of 46.1% white, Hispanics or Latinos, of any race, represent 31.9%, 13.5% black or African American, 0.2% Native American, 5.3% Asian, 0.2% from other races, and 3.8% bi-racial.

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 2015-2016 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 NCDC¹. 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 7.8 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



A. City of Manassas Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	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.	Public Works Emergency Management	X	X	X						X			FEMA Unified Hazard Mitigation Assistance	Ongoing	Obtain funding	High	Ongoing.
2017-2	Train required City staff on NIMS/ICS	All agencies												EMPG	1/1/2020	Annual staff certifications	Low	This is being completed as new staff are hired.
2017-3	Expand communications and notification participation through public outreach	Emergency Management; CERT volunteers; Fire and Rescue Department – Safe Around Manassas Program (SAM)	X	X	X	X	X	X	X	X	X	X	X	Staff and volunteer resources; UASI grants; and private donations	1/1/2020	Complete outreach plan Prioritize outreach efforts Implement outreach to priority stakeholder/citizen groups Development of marketing materials	Medium	SAM Program is in process with limited resources.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-4	Educate citizens on use of Manassas Alert	Emergency Management; Citizen Corps or CERT volunteers	X	X	X	X	X	X	X	X	X	X	X	Staff and volunteer resources	1/1/2020	Prioritize stakeholder groups for Manassas Alert outreach effort	Medium	Ongoing
2017-5	Cross train staff across departments to support critical functions	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	City staff resources	Ongoing	Develop a plan for cross training staff	Medium	Ongoing as new staff are hired.
2017-6	Update flood inundation maps	Department of Public Works	X							X				FEMA Risk MAP City funds	1/1/2020	Develop a plan (including schedule) for updating maps	Low	In progress.
2017-7	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.	Department of Public Works	X		X									FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination.	Medium	Ongoing
2017-8	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor	Department of Public Works	X		X									FEMA Unified Hazard Mitigation Assistance funding for qualified	Ongoing	Identify all priority flood-prone structures.	Medium	Ongoing

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.													structures.				
2017-9	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; Community Development Department	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	Ongoing
2017-10	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will	Department of Public Works	X	X										City funds	Ongoing	Establish a schedule of review and review committee (if necessary).	Medium	Ongoing

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2017-11	Conduct preparedness presentations in the community to ensure public awareness of steps the public can take to care for themselves during an emergency.	Emergency Management; CERT; Fire and Rescue Department	x	x	x	x	x	x	x	x	x	x	x	LEMPG and UASI Citizen Corps (CERT) Grant	Ongoing	Complete outreach plan. Development of outreach materials.	Low	
2017-12	Increase generator capacity at schools that function as shelters.	Manassas City Public Schools	x	x	x	x			x					Unknown	2021	Identify funding source.	Medium	
2017-13	Increase snow removal capacity at shelter sites.	Manassas City Public Schools		x										City funds	2018	Identify tools and process to increase capacity.	Low	
2017-14	Maintain GIS planimetric data.	IT; GIS	x	x	x	x						x	x	City funds	2019	Create update schedule.	Low	

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 15,726 as of the 2015 Census and was estimated by the Census Bureau to be 14,026 in 2009. Based on the 2015 United States Census Bureau information, the city population was comprised of 67.9% white, 13.0% black or African American, 0.3% Native American, 7.9% Asian, 10.5% from other races, and 7.9% bi-racial. Hispanics or Latinos, of any race, represents 34.0% 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 NCDC¹. 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 7.9: 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

A. City of Manassas Park Mitigation Actions and Action Plan



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Distribute hazard education information using different media's to include social media and webpages.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	Internal funding	June 2018	Develop distribution schedule and identify which utility mailing to include the fliers in by May 2011.	Medium	No
2017-2	Consider executing a public outreach campaign in the City's schools to educate staff about all hazards.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	No cost – internal staff support	January 2018	Develop agreement with Manassas Park Public Schools to distribute educational fliers by January 2012.	High	No
2017-3	Display and distribute educational hazard and emergency brochures at local events where information displays exist (i.e. National Night Out, Fire Prevention week and Preparedness Month).	Office of Emergency Management, Law Enforcement	X	X	X	X	X	X	X	X	X	X	X	Internal funding	June 2018	Ensure sufficient quantity of brochures for dissemination.	Medium	No
2017-4	Continue to update the City's stormwater management plan.	Department of Public Works	X	X	X									Internal funding, Possible Water Quality Improvement Act funds, revolving loan funds,	Ongoing	Review by July 2018.	High	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
														Section 319 NPS grants from DCR.				
2010-5	Exercise the Everbridge and next Gen 911 systems City-wide.	Office of Emergency Management	X	X	X	X	X	X	X	X	X	X	X	UASI funding	Ongoing	Secure funding by grant funds annually.	Medium	No
2010-6	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									FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination ongoing.	Medium	No
2010-7	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	Office of Emergency Management	X		X									FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	programs where appropriate.				X													
2010-7	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											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
2010-8	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that	Office of Emergency Management	7		X									Internal program support.	Ongoing	Establish a schedule of review and review committee.	Medium	No



#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



X. 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, Dumfriesshire, 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 NCDC¹. 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 7.10: 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

A. Town of Dumfries Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst\Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Police Radios	Police Department	X	X	X	X	X		X	X				General Fund	2019		Low	Improve communication with surrounding departments
2017-2	Public Safety Vehicle Replacement	Police Department	X	X	X	X	X		X	X				General Fund	2021	Purchase 1 vehicle in 2018	Low	Provide reliable transportation for police department
2017-3	Possum Point Drainage Improvement	Public Works	X											General Fund State/Federal Grants	2018	Initiate design 2016	Medium	In progress
2017-4	Dewey's Creek Stream Restoration	Public Works/Prince William County	X											US Fish and Wildlife Service Grant	2017	Design and permits are in place	Medium	
2017-5	Prince William Estates Drainage	Public Works	X											Stormwater Management Fees	2017		Medium	
2017-6	Orange Street Drainage	Public Works	X											VDOT Urban Maintenance/Stormwater Management Fees	2017	Design started	Medium	
2017-7	Quantico Creek Stream Restoration	Public Works	X											Stormwater Management Fees/Grants	2021		High	
2017-8	Tripoli Boulevard Stormwater Management	Public Works	X											General Fund	2019		Medium	

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



XI. 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 1,782 as of the 2010 Census and was estimated by the Census Bureau to be 1,980 in 2015.



Since the 1900s it has been popular for fox hunting and steeple chasing and is also known for its wineries. The town covers 0.5 square miles of land and is located in Prince William County. Based on the 2010-2014 American Community Survey, the town population was comprised of 66.9% white, 8.5% Hispanics or Latinos of any race, 7.4% black or African American, 0.0% American Indian or Pacific Islander, 10.6% Asian, 0.1% from other races, and 6.5% bi-racial.

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 2011-2015 winter seasons.

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 NCDC¹. 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 the Town of Haymarket. See Table 7.56 for a summary of hazard rankings.

**Table 7.11: Hazard Ranking for Town of Haymarket**

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

A. Town of Haymarket Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Assess the roadway structure at various intersections throughout the Town of Haymarket to avoid repeated flooding.	Town of Haymarket Police Department	X	X										Hazard Mitigation Assistance grant funding, County funding	December 2020	Identify funding sources by January 2017	High	No
2017-2	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	UASI funding, DHS grants, town/county funding	December 2020	Identify one new warning system to utilize by December 2017.	High	No
2017-3	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 Town Manager	X		X									FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2018.	Medium	No
2017-4	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood control projects, mitigation reconstruction and	Town of Haymarket Town Manager and Building Official	X		X									FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2016.	Medium	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	where feasible using FEMA HMA programs where appropriate.																	
2017-5	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 Town Manager and Police Department	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
2017-6	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property	Town of Haymarket Town Manager	X		X									General funds	Ongoing	Establish a schedule of review and review committee (if necessary) by June 2017.	Medium	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2017-7	Assess vacant buildings, determine historical significance, and develop a plan for restoring or demolishing the buildings vulnerable to hazards.	Town of Haymarket Town Manager and Building Official	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
2017-8	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												UASI Funding	December 2020	Identify Funding by December 2017	Low	No
2017-9	Determine feasibility of developing a drought preparedness and response plan	Town of Haymarket Town Manager					X							UASI funding, DHS grants, town/county funding	December 2018	Research and identify applicable funding mechanisms to develop the plan.	Low	No

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



XII. Town of Herndon

The Town of Herndon was originally established as a railroad depot in the late 1850s and was officially incorporated as a town in 1879. The town's population is 24,554, based on 2014 U.S. Census estimates. In 2010, also based on U.S. Census data, the town's population was comprised of 36.2% white, 33.6% Hispanic, and 17.9% Asian and 9.2% black or African American. Herndon has a well-educated population, with 45.4 percent of residents 25 and older holding bachelor's degrees or higher.



The Town of Herndon has a moderate climate due to its location on the eastern edge of the Virginia piedmont. 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, as evidenced during the 2012 Derecho event and Winter Storm Jonas in 2016. 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 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 NCDC¹. 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 7.12: 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

A. Town of Herndon Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Purchase and plan for deployment of industrial grade water pumps to mitigate flood waters in known flood prone locations to include roadways.	Public Works	X	X										FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Identify and prioritize locations for placement of pumps, identify funding	Medium	None
2017-2	Improve flood prone intersections by adding new drainage structures and systems. Two known intersections: 1)Herndon Pkwy and Van Buren Street 2)Monroe Street and Worldgate Drive	Public Works	X	X										Currently included in Town CIP budget	Ongoing	Identify construction start dates.	Medium	None
2017-3	Evaluate and assess older storm water systems in the Town to include 5 year CCTV inspections and trenchless repair methods.	Public Works	X	X										FEMA Unified Hazard Mitigation Assistance Funding	Ongoing	Create and initiate a plan and schedule for evaluation and assessment	Medium	None
2017-4	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	Public Works	X	X	X									FEMA Unified Hazard Mitigation Assistance Funding		Identify properties	Medium	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	FEMA HMA programs where appropriate.																	
2017-5	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.	Community Development/Public Works	X	X	X									General Funds	Ongoing	Establish a schedule of review	Medium	No

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



XIII. 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 NCDC¹. 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 7.13: 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	

A. Town of Leesburg Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-1	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	Coordinate with Virginia Department of Transportation (VDOT)	Undetermined at this point—based on funding availability	Identify funding	High	No
2006-2	Improve security measures as needed around critical facilities	Executive Office	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
2006-3	Provide back-up power (generators, where needed) for	Executive Office/ all depts.	X	X	X	X	X	X	X	X	X	X	X	U.S. Department of Homeland	Time schedule is dependent on	Identify funding	Moderate	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	critical facilities (i.e., fire stations, police stations, water facilities, etc.).													Security, Office of Domestic Preparedness: Homeland Security Grant Program (HSGP); Buffer Zone Protection Program (BZPP)	funding source and availability			
2010-1	Develop and test government Continuity of Operations (Coop) plans.	Town Manager / dept directors	X	X	X	X	X	X	X	X	X	X	X	Internal Town of Leesburg	Ongoing	Develop plan / train staff	High	Department Managers are reviewing respective components of the COOP.
2010-2	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	Internal town funding, U.S. Department of Homeland Security, Office of Domestic Preparedness: Homeland Security Grant Program (HSGP)	Ongoing	Develop evac and shelter in place plan for town facilities	Moderate	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-3	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	Internal town funding, Federal Highway Administration grants Tiger Grants, Department of Homeland Security grants, county funding	Ongoing	Identifying and purchasing needed equipment	Moderate	Display equipment upgraded in the TOL EOC with similar upgrades in other meeting areas for redundancy. Dedicated GIS computer has been added to the EOC and migration of data to a GIS server is in progress.
2010-4	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	Public Works – Street Department /Police dept	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	Ongoing	Identify locations	Moderate	Variable Message Boards have been purchased. Work continues on pad and dedicated power locations for expanded deployment.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	will be identified and pads prepared with power for deployment																	
2010-5	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	Internal town funding Department of Homeland Security grants, UASI funding, county funding	Ongoing	Develop exercise	High	Practical exercises have been completed for some departments as well as for the Department Directors. Continuing work on town wide training exercise.
2010-6	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	U.S. Department of Homeland Security, Office of Domestic Preparedness: Homeland Security Grant Program (HSGP)	Ongoing	Identify funding	Moderate	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-7	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	Internal town funding Department of Homeland Security grants, UASI funding, county funding	Ongoing	Develop protocols	High	Enhancements of upgraded Everbridge system have been incorporated into routine, incident, and emergency exercise alerts. Continuing work on the establishment of phone trees and review of the Town' Crisis Communication Plan.
2010-8	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									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
2010-9	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor	Public Works	X		X									FEMA Unified Hazard Mitigation Assistance funding for qualified	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	localized flood control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.													structures.				
2010-10	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										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
2010-11	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will	Public Works	X	X										General funds	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 Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2010-12	Determine feasibility of developing a drought preparedness and response plan	Public Works				X								Internal town funding Department of Homeland Security grants, UASI funding, county funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan.	Medium	No

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



XIV. Town of Lovettsville

Lovettsville, originally known as The German Settlement, is a small town with historical roots that go back to 1732. The Town was laid out in 1820 by David Lovett and served as a thriving commercial center for the surrounding farming areas for over one-hundred years. This function was eventually eclipsed during the post-World War II period by other, larger communities in Loudoun County, Northern Virginia, and nearby Maryland, which is about three miles from the Town.

Since 2005, Lovettsville has experienced a rapid increase in population and housing associated with growth of single-family detached residences. The population influx consists of people who are attracted to the traditional main street character of Lovettsville set in the larger context of the (mostly) rural northern Loudoun Valley. This beautiful setting, in which the Short Hill Mountains can be viewed from most locations in and around the Town, makes Lovettsville an attractive community to existing and would-be residents.



The Town is served by a number of public services (e.g. water, sewer, and solid waste collection) and facilities (e.g. a community center, library, and elementary school) as well as by private businesses including a convenience store, bank, dine-in restaurants, professional medical offices, and other small business establishments. The Lovettsville Elementary School, the Lovettsville Library, the Lovettsville Museum, and the Lovettsville Community Center are all located in Lovettsville. Upon completion, the Lovettsville Community Park will be a large, County-owned recreational facility partially located in Town that is master planned for a variety of active and passive recreational uses. Residents have access to places of worship both inside and outside the Town. The Town's home-based businesses, sidewalks, quiet country lanes, and overall setting create a rural feel that helps keep Lovettsville's pace of life slower and less congested than found in the more densely populated areas in the region. The Town is served by the Lovettsville Volunteer Fire and Rescue, Company 12, and a modern federal post office located on North Church Street. The Town's small brick government building, located at 6 East Pennsylvania Avenue in Lovettsville, was constructed in 1975 and has served as the office of the Town government since that time.

Lovettsville is close enough to larger urban centers and towns (Leesburg and Purcellville, Virginia; Brunswick and Frederick, Maryland; and Charles Town, West Virginia), so that residents have access to more expansive retail, cultural, and employment opportunities. The MARC train station in Brunswick, Maryland, located about three miles from Lovettsville on the Brunswick Line, provides commuter rail transportation to Montgomery County and Washington, DC for residents of the Lovettsville area.

Medical services are provided to Town residents by Loudoun Healthcare, a division of INOVA Health System and the Loudoun County Health Department. Loudoun Healthcare's INOVA Loudoun Hospital is located in Lansdowne, approximately 20 miles southeast of Lovettsville.



Loudoun Healthcare's Mobile Medical Van serves Lovettsville occasionally, providing wellness-oriented walk-in services. Loudoun Healthcare operates an Emergency Department at its Cornwall Street campus in Leesburg, approximately 15 miles southeast of Lovettsville, along with a free clinic. The Loudoun County Health Department is located in Leesburg. There are two dentists' offices and a doctor's office in Lovettsville.

Climate and Topography

The climate of Lovettsville is classified as "modified continental" by the National Weather Service and is characterized by mild winters and warm, humid summers. The average mean annual temperature is 51 degrees. Precipitation is well distributed throughout the year with the maximum occurring in June and the minimum in February. The average annual precipitation is 40 inches. The prevailing wind is from a south-to-southwest direction, with secondary winds from the north. The topography of Lovettsville is generally uniform without much slope characteristic. The Short Hill Mountains are only a few miles to the west of Lovettsville and help make the Town's setting attractive and refreshing.

Geology and Soils

The Town is underlain by saprolitic soils, typically extending to a depth of 60 feet or more and overlying metamorphic bedrock (metagranites and gneiss). The bedrock is relatively impermeable except where weathered and fractured areas occur. Groundwater occurs mainly in the weathered upper-most bedrock/soil-rock interface and in fractures in the upper 250 feet of bedrock. Well yields are generally low but can be substantially enhanced where fracturing is more prevalent. The most common soil associations in the Lovettsville area are:

Swampoodle-Lovettsville Complex (approximately 22 percent), consists of deep and very deep, well-drained clayey soils with seasonal water tables on nearly level summits. It is characterized by low strength and high frost heave potential and has a poor potential for development on central water and sewer. Adequate engineering solutions can usually offset this drawback.

Philomont-Purcellville-Swampoodle Complex (approximately 15 percent), consists of very deep, well drained loam and silt, as well as a well-drained clayey soil, which is good for development on central water and sewer and for conventional septic systems. Morrisonville-Philomont Complex (approximately 15 percent) is characterized by very deep, well-drained red silty, clayey, and brown loamy soils on undulating and rolling landscapes. It has good potential for development of central water and sewer and for conventional septic tank systems.

Approximately fifty percent of the soils underlying Lovettsville are contained within three soil type classifications, according to the detailed soils maps of Loudoun County. In general, the soils are considered fair to good for development on central water and sewer systems and on conventional septic systems.

Floodplain

Three major watersheds drain Lovettsville: Dutchman Creek, Quarter Branch, and tributaries to Catoctin Creek. The western part of Town, which constitutes the largest of the three drainage areas, flows north and west towards Dutchman Creek. The eastern portion of the Town drains south and east towards Catoctin Creek. The northern section of Town, north of Route 855 drains north towards Quarter Branch Creek. The water from these three streams eventually flows north to the Potomac River.



The Federal Emergency Management Agency (FEMA) completed an updated County floodplain map, July 5, 2001, which identifies a 100-year flood plain along Dutchman Creek within the Town limits, along the western corporate limits. This area, which encompasses approximately 16 acres within the Town, drains approximately 600 acres as the watercourse exits the Town limits to the north. This floodplain is categorized as a Special Flood Hazard Area, which can be expected to be inundated by the 100-year flood. A smaller flood hazard area is also identified within the Town limits on a tributary to Dutchman Creek running along West Broadway. Much of the floodplain in this area has been modified by engineering required for the development of the Town Center project.

Wetlands have been identified along Dutchman Creek tributaries on a portion of the Town Center project. The project has treated these areas according to the requirements of the US Army Corps of Engineers, which is the agency responsible for protecting wetlands throughout the country.

Natural Vegetation

Natural trees, shrubs, and ground cover are considered a significant environmental feature as they serve a variety of ecological functions including retaining rainwater, controlling erosion, cleansing the air of pollutants, offering visual relief from development, and providing wildlife habitat.

There is scattered tree cover throughout the Town. There is significant tree cover in and near the stream valley along the southwest boundary of the Town north of Heritage Highlands, the retirement community. There is substantial tree cover along streets and scattered on various properties in the old part of Town. Newer subdivisions have a limited amount of tree cover but much of the most recent residential development has trees that were planted as part of the development. The Town Center project has little tree save area but trees have and will be planted along all the streets.

Water Supply Protection

In an effort to further protect the Town's ground water supply, Lovettsville completed a wellhead protection plan in 2005. This plan identified the Town's geographical features and public water production resources in an effort to determine potential threats to the public water supply. This plan provided a recommended list of actions to protect the Town's source water. In 2007 and 2008 the Town received grant funding provided by the Virginia Department of Environmental Quality to identify and abandon existing non-active wells that could pose a threat to the Town's water supply. Thirteen wells were professionally sealed during this process. In 2009 the Town was awarded additional grant funds to develop zoning and subdivision regulations that would protect wells in the Town.

**Table 7.14: 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

A. Town of Lovettsville Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-1	Maintain high quality aerial photography of the Town.	Planning Department	X	X	X	X	X	X	X	X			X	Internal but will target 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.	Medium	
2017-2	Build redundancy in our Water Infrastructure by adding planned 2 nd Water Tower	Administration, Engineering, and Utility Department			X	X			X					Internal funding, but will target external Grants	2030	In Town CIP with Availability Fee Structure in place to help fund.	High	
2017-3	Provision of Information to flood plain areas about having adequate insurance and safety measures.	Administration	X		X									Internal funding, but will target external Grants	Ongoing	Begin Work	Medium	

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2017-4	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	Targeting outside funding from Department of Homeland Security grants, UASI funding, county funding	2022	Begin Work	Medium	
2017-5	Build redundancy in our Sewer Infrastructure by adding Equalization Basin.	Administration, Engineering, and Utility Department			X	X			X					Internal funding, but will target external Grants	2021	In Town CIP with Availability Fee Structure in place to help fund.	High	



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 NCDC¹. 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.

Table 7.15: Hazard Ranking for Middleburg

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



A. Town of Middleburg Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-1	Develop and test government Continuity of Operations Plan (COOP).	Town Administration	X	X	X	X	X	X	X	X	X	X	X	Internal to general fund	Ongoing	Develop the COOP and train staff.	High	In 2016 the police department updated MOU's within the Northern Virginia response area. Our dispatch center is and remains Loudoun County which has multiple back up plans. There is a standing partnership between the Police Department and the Loudoun County Sheriff for multi-agency response to critical incidents. Recently in cooperation with the Virginia State Police we have been working on predetermined assignments for evacuation and or the need to shutdown major roadways within the region. We are in the process of providing generator power to two Town facilities without a generator.
2010-2	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	Internal to general fund, DHS Grant Funding, Hazard Mitigation	Ongoing	Development of GIS system and associated data for hazard mitigation.	High	The Town in cooperation with Loudoun County Mapping has geo-located all fire hydrants. The Town is also in the process of doing an inventory of and geo-locating all water

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
														Grant Funds				infrastructure. Sewer infrastructure will be included in future years.
2010-3	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										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Develop outreach materials, or identify appropriate outreach materials for dissemination by June 2011.	Medium	There are no FEMA-listed repetitive loss or severe repetitive loss properties within the Town limits. The Town will continue to monitor and update floodplain limits in coordination with FEMA and the County.
2010-4	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										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	There are no priority flood-prone structures in the Town limits at this time, but the Town will continue monitoring the new floodplain limits and support mitigation should structures fall into flood-prone areas.
2010-5	Promote structural mitigation to assure redundancy of critical	Planning and Zoning	X	X										FEMA Unified Hazard	Ongoing	Query local government building	Medium	The Town has a new wastewater treatment facility as of October

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	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.													Mitigation Assistance funding for qualified structures.		services staffs as to effectiveness of provided information regarding the structural review.		2010 that meets all building code standards and includes a generator. All Town utility facilities include generators and, where metal roofed, include snow catchers. The Town is in the process of installing generators for the Town Office and Police Department, including upgrades to electrical panels where required.
2010-6	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that	Planning and Zoning	X	X										General funds	Completed ordinance update; In Progress on annual reviews of properties	Establish a schedule of review and review committee (if necessary) by June 2011.	Medium	Town adopted a new floodplain ordinance on 2/10/15 to comply with updated FEMA requirements. Revised FEMA floodplain maps have also been completed for the Town. There are currently no repetitive loss or severe repetitive loss properties within the Town limits, but this situation will be monitored annually.

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2010-7	Determine feasibility of developing a drought preparedness and response plan	Planning and Zoning				X								General funds	Ongoing	Research and identify applicable funding mechanisms to develop the plan.	Medium	No

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



XVI. Town of Occoquan

Derived from a Dogue Indian word meaning ‘at the end of the water,’ Occoquan was divided into lots and streets and laid out in 1804 by Nathaniel Ellicott, James Campbell and Luke Wheeler. The town is located in northeastern Prince William County along the Occoquan River bordering Fairfax County. The population of the town was 934 as of the 2010 Census and was estimated by the Census Bureau to be 1,025 in 2015. Based on the 2010-2014 American Community Survey, the town population was comprised of 80.3% white, 11.0% black or African American, 3.4% Asian, 1.4% Native Hawaiian and other Pacific Islander, 3.6% identifying two or more races, and Hispanic or Latino, of any race, represents 4.2% 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.

Due to Occoquan’s location at the Fall Line on the Occoquan River, a tributary to the Potomac River, the town 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 of concern. Occoquan is also susceptible to other natural hazards and risks, such as storm damage and winter weather, as evidenced during the 2015 - 2016 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 NCDC¹. 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 7.17: 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

A. Town of Occoquan Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-2	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	FEMA Unified Hazard Mitigation Assistance funding, US Army Corp of Engineers funding	Ongoing	Develop outreach plan and identify dissemination methods by July 2012.	Low	Completed initial public outreach campaign. Continue coordination with Fairfax Water as funding becomes available.
2010-3	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			FEMA Unified Hazard Mitigation Assistance funding	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	These projects are ongoing and completed as funding becomes available.
2010-5	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			FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Identify all priority flood-prone structures by December 2011.	High	These projects are ongoing and completed as funding becomes available.

2010-6	Determine feasibility of developing a drought preparedness and response plan.	Town Manager					X							FEMA Unified Hazard Mitigation Assistance funding	July 2018	Research and identify applicable funding mechanisms to develop the plan.	Low	This project will be completed as funding becomes available.
--------	---	--------------	--	--	--	--	---	--	--	--	--	--	--	---	-----------	--	-----	--

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



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 3.5 square miles. Craft beverages is a thriving industry in this area, with 4 breweries and 1 distillery in the Town and approximately 40 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 7,727 as of the 2000 Census and was estimated by the Census Bureau to be over 9,000 in 2016. The population density in 2016 was estimated at 2,600 persons per square mile. There were an estimated 2,400 housing units at an average density of 686 per square mile. Based on the 2010 Census, the town population was comprised of 86% white, 5.2% black or African American, 3.2% Asian, 2.2% from other races, and 3.3% bi-racial. Hispanics or Latinos of any race were 6.6% 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 NCDC¹. 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 7.17: 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

A. Town of Purcellville Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2006-4	Assess the roadway structure at various intersections throughout the Town of Purcellville to avoid repeated flooding.	Public Works	X	X										Hazard Mitigation Assistance grant funding, County funding	Ongoing	Identify funding sources by January 2012	High	No
2010-2	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										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
2010-3	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	Planning and Zoning	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 Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	appropriate.																	
2010-4	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									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
2010-5	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been	Planning and Zoning	X		X									General funds	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 Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2010-6	Determine feasibility of developing a drought preparedness and response plan	Town Manager				X								General Funds, FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Research and identify applicable funding mechanisms to develop the plan.	Medium	Mitigation strategies include mandatory water restrictions, enhanced use of alternate water sources, and continued development of water redundancy. Long-term capital improvement projects identified to support these activities.
2017-01	Update and Refine Continuity of Operations Plan for Government Operations	Town Manager	X	X	X	X			X					General Funds, FEMA Unified Hazard Mitigation Assistance funding,	July 2017	Identify key resources, most critical operations to assist in preparing the Plan.	High	No
2017-02	Determine feasibility of redundancy of internet services and direct TLS between facilities	Information Technology	X	X	X	X			X					General Funds, Rural Broadband Grants, FCC Opportunities	July 2017	Identify opportunities to gain wireless spectrum and connection to County facilities	High	No

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



XVIII. 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 NCDC¹. 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 7.18: 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

A. Town of Round Hill Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010 -1	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	Local funding, DHS funding, Hazard Mitigation Grant Programs	In Progress	Secure funding	Critical	Hired an Intern to manage project in partnership with the County
2010 -2	Implement drainage improvements in low-lying roadways.	Virginia Department of Transportation	X	X	X	X	X	X	X	X	X	X	X	DHS funding, Hazard Mitigation Grant Programs	In Progress	Secure funding	Critical	No
2010 -4	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	Local funding	In Progress	Allocate funding	Critical	No
2010 -5	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	Local funding, DHS funding, Hazard Mitigation Grant Programs	December 2018	Secure funding	Critical	This is planned for the FY2018 Budget
2010 -6	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									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

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-7	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										FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2011.	Medium	No
2010-8	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										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
2010-9	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. Additionally, Conduct	Planning Commission	X	X										General funds	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 Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2010 -9	Determine feasibility of developing a drought preparedness and response plan	Town of Round Hill / Loudoun County Office of Emergency Management				X								General Funds, FEMA Unified Hazard Mitigation Assistance funding,	Ongoing	Research and identify applicable funding mechanisms to develop the plan.	Medium	No

¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



XIX. 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 estimated by the Census Bureau to be 15,687 in 2010. Based on the 2010 Census Bureau, the town population was comprised of 75.5% white, 3.2% black or African American, 0.3% Native American, 12.1% Asian, 5.3% from other races, and 3.6% bi-racial. Hispanics or Latinos, of any race, represent 12.0% 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 NCDC¹. 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 7.19: 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

A. Town of Vienna Mitigation Actions and Action Plan

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
2010-1	Assess the roadway structure at various intersections throughout the Town of Vienna to avoid repeated flooding.	Town of Vienna Public Works	X	X										Hazard Mitigation Assistance grant funding, County funding	December 2015	Identify funding sources by January 2012	High	No
2010-2	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	UASI funding, DHS grants, town/county funding	December 2015	Identify one new warning system to utilize by December 2012.	High	No
2010-3	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									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
2010-4	Support mitigation of priority flood-prone structures through promotion of acquisition/ demolition, elevation, flood proofing, minor localized flood	Town of Vienna Police Department	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 Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	control projects, mitigation reconstruction and where feasible using FEMA HMA programs where appropriate.																	
2010-5	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									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
2010-6	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. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of	Town of Vienna Police Department	X		X									General funds	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 Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.																	
2017-1	Assess the roadway structure at various intersections throughout the Town of Vienna to avoid repeated flooding.	Town of Vienna Public Works	X		X									Hazard Mitigation Assistance grant funding, County funding	Ongoing	Identify funding sources by January 2018	High	No
2017-2	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	UASI funding, DHS grants, town/county funding	Ongoing	Identify one new warning system to utilize by December 2017.	High	No
2017-3	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	Town of Vienna Police Department	X		X									FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	In partnership with Fairfax County, seek to develop outreach materials, or identify appropriate outreach materials for dissemination by June	Medium	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	assist them in reducing their flood risk.				X											2017.		
2017-4	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									FEMA Unified Hazard Mitigation Assistance funding for qualified structures.	Ongoing	Identify all priority flood-prone structures by December 2017.	Medium	No
2017-5	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 Public Works Department	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
2017-6	Review locality's compliance with the National Flood Insurance Program with an annual review of the Floodplain Ordinances and any	Town of Vienna Police Department	X		X									General funds	Ongoing	In partnership with Fairfax County, establish a schedule of review and	Medium	No

#	Agency/Department: Mitigation Action	Lead Agency Department Organization	Flood	Winter Storm	Wind \ Severe Storm	Tornado	Drought	Wildfire	Earthquake	Extreme Temps	Dam Failure	Landslides	Karst \ Sinkholes	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments
	newly permitted activities in the 100-year floodplain. Additionally, Conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filing form FEMA AW-501.															review committee (if necessary) by June 2017.		



¹ NCDC's Storm Event database is available at <http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms>.



Chapter 8: Plan Maintenance

This section discusses how the mitigation strategies will be implemented by the Northern Virginia jurisdictions and how the overall Plan will be evaluated and enhanced over time. These aspects were reviewed and updated by the MAC for the 2016 update. This section also discusses how the public will continue to be involved in the hazard mitigation planning process. It consists of the following three subsections:

- Implementation;
- Monitoring, Evaluation and Enhancement; and
- Continued Public Involvement.

I. Implementation

Each jurisdiction participating in the Northern Virginia Hazard Mitigation Plan is responsible for implementing specific mitigation actions as prescribed in their locally adopted Mitigation Action Plan. In each Mitigation Action Plan, every proposed action is assigned to a specific local department or agency in order to assign responsibility and accountability and increase the likelihood of subsequent implementation. This approach enables individual jurisdictions to update their unique Mitigation Action Plan as needed without altering the broader focus of the Regional Plan. The separate adoption of locally-specific actions also ensures that each jurisdiction is not held responsible for monitoring and implementing the actions of other jurisdictions involved in the planning process.

In addition to the assignment of a local lead department or agency, the completion date and interim measure of success date have been assigned in order to assess whether actions are being implemented in a timely fashion. The Northern Virginia jurisdictions will seek outside funding sources to implement mitigation projects in both the pre-disaster and post-disaster environments. When applicable, potential funding sources have been identified and targeted for the proposed actions listed in the Mitigation Action Plans.

It will be the responsibility of each participating jurisdiction to determine additional implementation procedures beyond those listed within their Mitigation Action Plan. This includes integrating the requirements of the Northern Virginia Hazard Mitigation Plan into other local planning documents, processes, or mechanisms, such as comprehensive or capital improvement plans, when appropriate¹. The members of the Northern Virginia MAC will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their jurisdictions or agencies are consistent with the goals and actions of the Hazard Mitigation Plan, and will not contribute to increased hazard vulnerability in their jurisdictions or the region as a whole.

Opportunities to integrate the requirements of this Plan into other local planning mechanisms shall continue to be identified through future meetings of the Northern Virginia MAC and through the five-year review process described herein. Although it is recognized that there are many possible benefits to integrating components of this Plan into other local planning mechanisms, the development and maintenance of this stand-alone Hazard Mitigation Plan is

deemed by the Northern Virginia MAC to be the most effective and appropriate method to implement local hazard mitigation actions at this time. As such, the primary means for integrating mitigation strategies into other local planning mechanisms will be through the revision, update, and implementation of each jurisdiction's individual Mitigation Action Plan specific planning and administrative tasks (e.g., plan amendments, ordinance revisions, capital improvement projects, etc.).

The MAC will continue to coordinate with local jurisdictions in creating processes by which the requirements of this Plan will be incorporated into other local plans. During the planning process for new and updated local planning documents, such as a comprehensive plan, capital improvements plan, or emergency management plan, the MAC will provide a copy of the Plan to the appropriate parties. The MAC will continue to recommend that all goals and strategies of new and updated local planning documents be consistent with the Regional Plan and will not contribute to increased hazards in the affected jurisdiction(s).

II. Monitoring, Evaluation, and Enhancement

Periodic revisions and updates of the Northern Virginia Hazard Mitigation Plan are required to ensure that the goals of the plan are kept current, taking into account potential changes in hazard vulnerability and mitigation priorities. In addition, revisions may be necessary to ensure that the Plan is in full compliance with applicable Federal and State regulations. Periodic evaluation of the Plan will also ensure that specific mitigation actions are being reviewed and carried out according to each participating jurisdiction's individual Mitigation Action Plan.

The Northern Virginia MAC will continue to meet annually and following any disaster events warranting a reexamination of the mitigation actions being implemented or proposed by the participating jurisdictions. This will ensure that the Plan is continuously updated to reflect changing conditions and needs within the region. Additionally, they will reexamine the need to incorporate specific strategies into other planning initiatives as necessary. Each participating jurisdiction will be encouraged by the MAC to complete yearly reviews on the progress of their respective Mitigation Action Plan, and incorporate their strategies into local planning initiatives as appropriate. If determined appropriate or as requested, an annual report on the Plan will be developed by the MAC and submitted to the local governing bodies of participating jurisdictions in order to report progress on the actions identified in the Plan and to provide information on the latest legislative requirements and/or changes to those requirements.

If any participating jurisdiction no longer wishes to actively participate in the development and maintenance of the plan, they must notify the MAC in writing.

A. Five-Year Plan Review

The plan will be reviewed by the MAC every five years to determine whether there have been any significant changes in the region that may, in turn, necessitate changes in the types of mitigation actions proposed. New development in identified hazard areas, an increased exposure to hazards, the increase or decrease in capability to address hazards, and changes to Federal or State legislation are examples of factors that may affect the necessary content of the Plan.



The plan review process provides regional and community officials with an opportunity to evaluate those actions that have been successful and to explore the possibility of documenting potential losses avoided due to the implementation of specific mitigation measures. The plan review also provides the opportunity to address mitigation actions that may not have been successfully implemented as assigned. The Northern Virginia Emergency Managers will be responsible for reconvening the MAC and conducting the five-year review in coordination with the VDEM.

During the five-year plan review process, the following questions will be considered as criteria for assessing the effectiveness and appropriateness of the Plan:

- Do the regional goals address current and expected conditions?
- Has the nature or magnitude of risks changed?
- Are the current resources appropriate for implementing the Plan?
- Are there local implementation problems, such as technical, political, legal, or coordination issues with other agencies?
- Have the outcomes occurred as expected?
- Did the jurisdictions, agencies, and other partners participate in the plan implementation process as proposed?

Following the five-year review, any necessary revisions will be implemented according to the reporting procedures and plan amendment process outlined herein. Upon completion of the review and update/amendment process, the Northern Virginia Hazard Mitigation Plan will be submitted to the State Hazard Mitigation Officer for final review and approval in coordination with FEMA.

B. Disaster Declaration

Following a disaster declaration, the Northern Virginia MAC will reconvene and the Plan will be revised as necessary to reflect lessons learned, or to address specific circumstances arising from the event. It will be the responsibility of the Northern Virginia Emergency Managers to reconvene the MAC and to ensure the appropriate stakeholders are invited to participate in the plan revision and update process following declared disaster events.

C. Reporting Procedures

The results of the five-year review will be summarized by the MAC in a report that will include an evaluation of the effectiveness of the Plan and any required or recommended changes or amendments. The report will also include an evaluation of implementation progress for each of the proposed mitigation actions, identifying reasons for delays or obstacles to their completion along with recommended strategies to overcome them.

Any necessary revisions to the Regional Plan elements shall follow the plan amendment process outlined herein. For changes and updates to the individual Mitigation Action Plans, appropriate local designees will assign responsibility for completion of the task.

D. Plan Amendment Process

Local participating jurisdictions have the authority to approve/adopt changes to their own Mitigation Action Plans without approval from the MAC; however, the MAC should be advised

of all changes as a courtesy and for consideration for changes or modifications to the regional Plan. The MAC will be responsible for verifying that the proposed change will not affect the jurisdiction's compliance with current State and Federal mitigation planning requirements. Changes to either the Regional Plan or local Mitigation Action Plans will necessitate the adoption of these changes by the appropriate governing body, and ultimately or upon request the updated Plan or plan component(s) will be submitted to VDEM.

The MAC and its participating jurisdictions will forward information on any proposed change(s) to all interested parties including, but not limited to, all affected county and municipal departments, residents and businesses. When a proposed amendment may directly affect particular private individuals or properties, each jurisdiction will follow existing local, State or Federal notification requirements which may include published public notices as well as direct mailings. Information on any proposed plan amendments will also be forwarded to VDEM. This information will be disseminated in order to seek input on the proposed amendment(s) for not less than a 45-day review and comment period.

At the end of the 45-day review and comment period, the proposed amendment(s) and all comments will be forwarded to the MAC for final consideration. The committee will review the proposed amendment along with the comments received from other parties, and if acceptable, the committee will submit a recommendation for the approval and adoption of changes to the Plan to each appropriate governing body within 60 days.

In determining whether to recommend approval or denial of a plan amendment request, the following factors will be considered by the MAC:

- There are errors, inaccuracies, or omissions made in the identification of issues or needs in the Plan;
- New issues or needs have been identified which are not adequately addressed in the Plan;
- There has been a change in information, data, or assumptions from those on which the Plan is based; and
- There has been a change in local capabilities to implement proposed hazard mitigation activities.

Upon receiving the recommendation from the Northern Virginia MAC and prior to adoption of the Plan, each local governing body will hold a public hearing. The governing body will review the recommendation from the committee (including the factors listed above) and any oral or written comments received at the public hearing. Following that review, the governing body will take one of the following actions:

- Adopt the proposed amendments as presented;
- Adopt the proposed amendments with modifications;
- Refer the amendments request back to the MAC for further revision; or
- Defer the amendment request back to the MAC for further consideration and/or additional hearings.



III. Continued Public Involvement

Public participation is an integral component of the mitigation planning process and will continue to be essential as this Plan evolves over time. As described above, significant changes or amendments to the Plan may require a public hearing prior to any adoption procedures.

Additional efforts to involve the public in the maintenance, evaluation, and revision process will be made as necessary. These efforts may include:

- Advertising proposed changes to the Plan to the public;
- Utilizing the MAC and municipal or county websites to advertise any maintenance and/or periodic review activities taking place; and
- Keeping copies accessible via public Websites.

¹ A listing of each jurisdiction's local planning documents (or those under development) is provided in Section 7: Capability Assessment.

APPENDIX A

PLAN CROSSWALK

Note, to be completed following conditional approval.

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Northern Virginia Region	Title of Plan: Northern Virginia Hazard Mitigation Plan Update	Date of Plan: February 2017
Local Point of Contact: Greg Zebrowski		Address: 4890 Alliance Drive Suite 2200 Fairfax, VA 22030
Title: Lead Planner		
Agency: Fairfax County Office of Emergency Management		
Phone Number: 571-350-1297		E-Mail:Gregory.zebrowski@fairfaxcounty.gov

State Reviewer:	Title:	Date:
-----------------	--------	-------

FEMA Reviewer:	Title:	Date:
Date Received in FEMA Region (insert #)		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1: REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met			
Regulation (44 CFR 201.6 Local Mitigation Plans)							
ELEMENT A. PLANNING PROCESS							
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))		Introduction p.1.1 Chapter 2 p.2-1 thru 2-6					
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))		Chapter 2, Section 2 p.2-4-2 thru 2-6					
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))		Chapter 2, Section 2 p.2-4-2 thru 2.6					
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))		Chapter 2, Section 2 p.2-6					
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))		Chapter 8 p. 8-5					
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))		Chapter 8 p. 8-1 thru 8-5					
<u>ELEMENT A: REQUIRED REVISIONS</u>							
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT							

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))		Chapter 1 : Section I Background p. 1-1 Chapter 4: Section III Hazard Identification: P. 4-27 thru 4-35		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))		Chapter 4 p.4-1 thru 4-191		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))		Chapter 4: Regional HIRA p. 4-38, Chapter 3: Regional Information p. 3-1-3-28 Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p. 7-117		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))		Chapter 4: Regional Hazard Identification and Risk Assessment p. 4-67 thru p.4-68 including Table 4.24		
ELEMENT B: REQUIRED REVISIONS				
•				
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))		Chapter 6: p. 6-1 thru 6-6 Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p. 7-117		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))		Chapter 6: pg. 6-1 thru 6-6 Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p.7-117		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))		Chapter 6: p. 6-1 thru p.6-6 Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p.7-117		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))		Chapter 6: p. 6-1 thru 6-6 Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p.7-117		

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))		Chapter 6: p. 6-1 thru 6-6 Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p.7-117		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))		Chapter 6: pg. 6-1 thru 6-6 Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p.7-117		
ELEMENT C: REQUIRED REVISIONS				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))		Chapter 3, p. 3-23		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))		Chapter 7: Jurisdiction Executive Summaries p.7-1 thru p.7-117		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))		Chapter 6: Section II: Considering Mitigation Alternatives p. 6-1		
ELEMENT D: REQUIRED REVISIONS				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))		This will be covered in the Final version in Appendix B-Adoption Resolution		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))		This will be covered in the Final version in Appendix B-Adoption Resolution		
ELEMENT E: REQUIRED REVISIONS				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1. Does the plan include a Capabilities Assessment for each participating jurisdiction?		Chapter 5 p.5-1thru p.5-17		

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
F2. Are flood maps included for each participating jurisdiction?		Included in Appendix D-HIRA Documentation		
F3. Have other high hazard risk maps been included for each participating jurisdiction?		Included in Appendix D-HIRA Documentation		
F4. Does the plan include a repetitive loss strategy to verify the geographic location of each repetitive loss property and determine if that property has been mitigated and by what means?		Chapter 4 p. 4-67 thru p.4-68		
<u>ELEMENT F: REQUIRED REVISIONS</u>				

SECTION 2:

PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on: 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically RiskMAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item, and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature, and should be open-ended and to provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future plan revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the overall plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

How does the Plan go above and beyond minimum requirements to document the planning process with respect to:

- *Involvement of stakeholders (elected officials/decision makers, plan implementers, business owners, academic institutions, utility companies, water/sanitation districts, etc.);*
- *Involvement of Planning, Emergency Management, Public Works Departments or other planning agencies (i.e., regional planning councils);*
- *Diverse methods of participation (meetings, surveys, online, etc.); and*
- *Reflective of an open and inclusive public involvement process.*

Element B: Hazard Identification and Risk Assessment

In addition to the requirements listed in the Regulation Checklist, 44 CFR 201.6 Local Mitigation Plans identifies additional elements that should be included as part of a plan's risk assessment. The plan should describe vulnerability in terms of:

- 1) *A general description of land uses and future development trends within the community so that mitigation options can be considered in future land use decisions;*
- 2) *The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; and*
- 3) *A description of potential dollar losses to vulnerable structures, and a description of the methodology used to prepare the estimate.*

How does the Plan go above and beyond minimum requirements to document the Hazard Identification and Risk Assessment with respect to:

- *Use of best available data (flood maps, HAZUS, flood studies) to describe significant hazards;*
- *Communication of risk on people, property, and infrastructure to the public (through tables, charts, maps, photos, etc.);*
- *Incorporation of techniques and methodologies to estimate dollar losses to vulnerable structures;*
- *Incorporation of Risk MAP products (i.e., depth grids, Flood Risk Report, Changes Since Last FIRM, Areas of Mitigation Interest, etc.); and*
- *Identification of any data gaps that can be filled as new data became available.*

Element C: Mitigation Strategy

How does the Plan go above and beyond minimum requirements to document the Mitigation Strategy with respect to:

- *Key problems identified in, and linkages to, the vulnerability assessment;*
- *Serving as a blueprint for reducing potential losses identified in the Hazard Identification and Risk Assessment;*
- *Plan content flow from the risk assessment (problem identification) to goal setting to mitigation action development;*
- *An understanding of mitigation principles (diversity of actions that include structural projects, preventative measures, outreach activities, property protection measures, post-disaster actions, etc.);*
- *Specific mitigation actions for each participating jurisdictions that reflects their unique risks and capabilities;*
- *Integration of mitigation actions with existing local authorities, policies, programs, and resources; and*
- *Discussion of existing programs (including the NFIP), plans, and policies that could be used to implement mitigation, as well as document past projects.*

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

How does the Plan go above and beyond minimum requirements to document the 5-year Evaluation and Implementation measures with respect to:

- *Status of previously recommended mitigation actions;*
- *Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk;*
- *Documentation of annual reviews and committee involvement;*
- *Identification of a lead person to take ownership of, and champion the Plan;*
- *Reducing risks from natural hazards and serving as a guide for decisions makers as they commit resources to reducing the effects of natural hazards;*
- *An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.);*
- *Discussion of how changing conditions and opportunities could impact community resilience in the long term; and*
- *Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience.*

B. Resources for Implementing Your Approved Plan

Ideas may be offered on moving the mitigation plan forward and continuing the relationship with key mitigation stakeholders such as the following:

- *What FEMA assistance (funding) programs are available (for example, Hazard Mitigation Assistance (HMA)) to the jurisdiction(s) to assist with implementing the mitigation actions?*
- *What other Federal programs (National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk MAP, etc.) may provide assistance for mitigation activities?*
- *What publications, technical guidance or other resources are available to the jurisdiction(s) relevant to the identified mitigation actions?*
- *Are there upcoming trainings/workshops (Benefit-Cost Analysis (BCA), HMA, etc.) to assist the jurisdictions(s)?*
- *What mitigation actions can be funded by other Federal agencies (for example, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA) Smart Growth, Housing and Urban Development (HUD) Sustainable Communities, etc.) and/or state and local agencies?*

SECTION 3:

MULTI-JURISDICTION SUMMARY SHEET (OPTIONAL)

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it should be used as an optional worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

#	Jurisdiction Name	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
						A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Requirements
1	Alexandria	Corey A. Smedley		Corey.smedley@alexandriava.gov	703.746.5256						
2	Arlington County	David R. Morrison		Dmorrison@arlingtonva.us	703.228.3256						
3	Fairfax County	Gregory Zebrowski	4890 Alliance Drive, Suite 2200 Fairfax, VA 22030	Gregory.zebrowski@fairfaxcounty.gov	571-350-1297						
4	Loudoun County	Kevin Johnson	801 Sycolin Road SE #100 PO Box 7100 Leesburg, VA 20177-7100	Kevin.Johnson@loudoun.gov	703-737-8831						
5	Prince William County	Alexa (Hussar) Lenhart		AHussar@pwgov.org	703-792-5254						

MULTI-JURISDICTION SUMMARY SHEET										
#	Jurisdiction Name	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)				
						A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption
6	City of Fairfax	Walter English,III	City of Fairfax Office of Emergency Management 10455 Armstrong Street Fairfax, VA 22030	walter.english@fairfaxva.gov	703-273-6269					
7	City of Falls Church	Tom Polera	300 Park Ave, G2 East Falls Chuch, VA 22046	TPolera@fallschurchva.gov	703-248-5058					
8	City of Manassas	Amelia Gagnon	9324 West Street - Suite 103 Manassas, Virginia 20110	agagnon@ci.manassas.va.us	703-257-8062					
9	City of Manassas Park	Robert Hoffower	4975 Alliance Drive, 4th Floor, Suite 4E-200 Fairfax, VA 22033	robert.hoffower@vdem.virginia.gov	804-205-6911					
10	Town of Dumfries	Richard Paul West	17755 Main Street Dumfries, VA 22026	rwest@dufmriesva.gov	703-221-3400 ext: 119					
11	Town of Haymarket	Holly Montague	15000 Washington Street #100 Haymarket, Virginia 20169	hmontague@townofhaymarket.org	703-753-2600					
12	Town of Herndon	Lt. Stephen Thompson	397 Herndon Parkway Herndon, VA 20170	stephen.thompson@herndonva.gov	(703) 436-6881 x2332					

MULTI-JURISDICTION SUMMARY SHEET										
#	Jurisdiction Name	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)				
						A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption
13	Town of Leesburg	Kevin Johnson	801 Sycolin Road SE #100 PO Box 7100 Leesburg, VA 20177-7100	Kevin.Johnson@loudoun.gov	703-737-8831					
14	Town of Middleburg	Kevin Johnson	801 Sycolin Road SE #100 PO Box 7100 Leesburg, VA 20177-7100	Kevin.Johnson@loudoun.gov	703-737-8831					
15	Town of Occoquan	Kirstyn B. Jovanovich	314 Mill Street PO Box 195 Occoquan, VA 22125	kjovanovich@occoquanva.gov	703-491-1918 Ext. 2					
16	Town of Purcellville	Kevin Johnson	801 Sycolin Road SE #100 PO Box 7100 Leesburg, VA 20177-7100	Kevin.Johnson@loudoun.gov	703-737-8831					
17	Town of Round Hill	Kevin Johnson	801 Sycolin Road SE #100 PO Box 7100 Leesburg, VA 20177-7100	Kevin.Johnson@loudoun.gov	703-737-8831					
18	Town of Vienna	Daniel Janickey,		dan.janickey@viennava.gov	703-255-6397					

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Northern Virginia	Title of Plan: Northern Virginia PDC HMP	Date of Plan:
Local Point of Contact:		Address:
Title:		
Agency:		
Phone Number:	E-Mail:	
State Reviewer: Debbie Messmer		Title: Date:
FEMA Reviewer: Matt McCullough		Title: Community Planner Date: 01/06/17
Date Received in FEMA Region (insert #)		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1: REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Pg. 2-1 – 2-6 Table 2.2 Appx C	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Pg. 2-1 – 2-6	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Pg. 2-4 – 2-6	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	P. 2-6		X
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Pg. 8-5	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Pg. 8-1 – 8-4	X	

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)		Met	Not Met
ELEMENT A: REQUIRED REVISIONS			
Note: Pg. 2-4: Are there specific public outreach meetings types following the conditional approval of the plan? Pg. 2-5: References Appendix H. The CD only lists Appendices up to F. Pg. 2-5: Fairfax County Outreach- was there any feedback documented for the newsletters sent to the Council of Governments or Businesses?			
A2.) Recommended Revision: Pg. 2-4 & 2-5: In the next plan update please include a description as to how neighboring jurisdictions were invited to participate.			
A4.) Required Revision: <ul style="list-style-type: none"> - Please include a brief narrative as to how the documents listed on pg. 2-6 were incorporated into the plan. - Please cite the additional sources of data and information that was used. Example-NCDC site 			
A5.) Note: Utilizing the idea of after-conditional meetings noted on Pg. 2-4; communities could create a bi-annual or annual opportunity for continued public involvement.			
Kudos: Excellent documentation			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Pg. 4-50 – 4-193	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Pg. 4-30 – 4-193	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Pg. 4-50 – 4-193	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Pg. 4-67 – 4-68	X	

1. REGULATION CHECKLIST	Location in Plan (section and/or page number)	Not Met	Met
Regulation (44 CFR 201.6 Local Mitigation Plans)		Met	Met
<u>ELEMENT B: REQUIRED REVISIONS</u>			
<p>B1.) Required Revision:</p> <p>Pg. 4-90 & 4-91: Please better identify the planning area for Figures 4.24 & 4.25. Highlighting the borders of the PDC will be sufficient.</p> <p>Pg. 4-97 -4-100: Please better identify the planning area for Figures 4.26 -4.29. Circling the general Northern Virginia area will suffice.</p> <p>Pg. 4-132: Figure 4.34, 4.35, 4.37, 4.41,-Ditto- Circle or Highlight</p> <p>Pg 4-173: Figure 4.46 Please remove circled portion and circle or highlight the NoVA PDC</p>			
<p>Discussion:</p> <p>Pg. 4-35 – 4-42: Are the rankings on Table 4.10 – 4.15 being attributed to individual jurisdictions? Pg. 4-44 and 4-46 are no present. Is there additional information on those pages? (Unique and varied risk)</p>			
<p>Note:</p> <p>Pg. 4-110: Was there a disaster declaration for Virginia for Hurricane Sandy?</p>			
<p>Kudos:</p> <p>Great mapping! Yes, I made it all the way to page 1092 in Appendix D</p>			
ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Chapter 5	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Pg. 5-17 & 5-18		X
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Pg. 6-3 – 6-4	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Pg. 7-1 – 7-132	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Pg. 6-3 Table 6.1	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Pg. 5-13 – 5-16	X	

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Not Met	Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT C: REQUIRED REVISIONS				
C2.) Required Revision:				
Pg. 5-17: Please include information for each jurisdiction as to their day-to-day management of the floodplain. This would include mapping, enforcement and insurance. Please see the attached Strategy Guide and Matrix for reference.				
Discussion:				
Pg. 7-9- Action 2010-16: Fairfax County has only listed Buy-Out as a strategy.				
Pg. 7-39: Prince William County does not have a strategy noted for Acquisition, Elevation, Relocation, etc..				
Pg. 7-73: Town of Dumfries does not have a strategy noted for Acquisition, Elevation, Relocation, etc..				
Pg. 7-98: Town of Lovettsville does not have a strategy noted for Acquisition, Elevation, Relocation, etc..				
Note:				
Pg. 7-48: City of Fairfax strategy 2017-6. The development of this platform could be extremely useful in the plan integration realm.				
Recommended Revision:				
More accurately align the strategy to the hazard it is supposed to be addressing. Example: Pg. 7-121; Strategy 2010-3				
C6.) Kudos:				
Excellent write-up on potential plan integration opportunities. Please see the attached copy of "Plan Integration: Linking Local Planning Efforts". This tool can be used to further identify specific points of risk reduction integration, into other planning mechanisms.				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Pg. 3-21 – 3-29	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Chapter 7	X		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Pg. 6-1	X		
ELEMENT D: REQUIRED REVISIONS				
D.1) Kudos:				
Very in-depth discussion on land use, population and potential change.				
Note:				
Pg. 7-48: City of Fairfax strategy 2017-6. The development of this platform could be extremely useful in the plan integration realm.				
D.2) Recommendation:				
Enhance the Executive Summary space to include a narrative on mitigation practices and principles that are being engaged in for that given jurisdiction.				
ELEMENT E. PLAN ADOPTION				

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)		
		Met	Not Met
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))			
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))			
<u>ELEMENT E: REQUIRED REVISIONS</u>			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
<u>ELEMENT F: REQUIRED REVISIONS</u>			

SECTION 2: PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on: 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically RiskMAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item, and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature, and should be open-ended and to provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future plan revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the overall plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

How does the Plan go above and beyond minimum requirements to document the planning process with respect to:

- *Involvement of stakeholders (elected officials/decision makers, plan implementers, business owners, academic institutions, utility companies, water/sanitation districts, etc.);*
- *Involvement of Planning, Emergency Management, Public Works Departments or other planning agencies (i.e., regional planning councils);*
- *Diverse methods of participation (meetings, surveys, online, etc.); and*
- *Reflective of an open and inclusive public involvement process.*

Element B: Hazard Identification and Risk Assessment

In addition to the requirements listed in the Regulation Checklist, 44 CFR 201.6 Local Mitigation Plans identifies additional elements that should be included as part of a plan's risk assessment. The plan should describe vulnerability in terms of:

- 1) *A general description of land uses and future development trends within the community so that mitigation options can be considered in future land use decisions;*
- 2) *The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; and*
- 3) *A description of potential dollar losses to vulnerable structures, and a description of the methodology used to prepare the estimate.*

How does the Plan go above and beyond minimum requirements to document the Hazard Identification and Risk Assessment with respect to:

- *Use of best available data (flood maps, HAZUS, flood studies) to describe significant hazards;*
- *Communication of risk on people, property, and infrastructure to the public (through tables, charts, maps, photos, etc.);*
- *Incorporation of techniques and methodologies to estimate dollar losses to vulnerable structures;*
- *Incorporation of Risk MAP products (i.e., depth grids, Flood Risk Report, Changes Since Last FIRM, Areas of Mitigation Interest, etc.); and*
- *Identification of any data gaps that can be filled as new data became available.*

Element C: Mitigation Strategy

How does the Plan go above and beyond minimum requirements to document the Mitigation Strategy with respect to:

- *Key problems identified in, and linkages to, the vulnerability assessment;*
- *Serving as a blueprint for reducing potential losses identified in the Hazard Identification and Risk Assessment;*
- *Plan content flow from the risk assessment (problem identification) to goal setting to mitigation action development;*
- *An understanding of mitigation principles (diversity of actions that include structural projects, preventative measures, outreach activities, property protection measures, post-disaster actions, etc.);*
- *Specific mitigation actions for each participating jurisdictions that reflects their unique risks and capabilities;*
- *Integration of mitigation actions with existing local authorities, policies, programs, and resources; and*
- *Discussion of existing programs (including the NFIP), plans, and policies that could be used to implement mitigation, as well as document past projects.*

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

How does the Plan go above and beyond minimum requirements to document the 5-year Evaluation and Implementation measures with respect to:

- *Status of previously recommended mitigation actions;*
- *Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk;*
- *Documentation of annual reviews and committee involvement;*
- *Identification of a lead person to take ownership of, and champion the Plan;*
- *Reducing risks from natural hazards and serving as a guide for decisions makers as they commit resources to reducing the effects of natural hazards;*
- *An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.);*
- *Discussion of how changing conditions and opportunities could impact community resilience in the long term; and*
- *Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience.*

B. Resources for Implementing Your Approved Plan

Ideas may be offered on moving the mitigation plan forward and continuing the relationship with key mitigation stakeholders such as the following:

- *What FEMA assistance (funding) programs are available (for example, Hazard Mitigation Assistance (HMA)) to the jurisdiction(s) to assist with implementing the mitigation actions?*
- *What other Federal programs (National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk MAP, etc.) may provide assistance for mitigation activities?*
- *What publications, technical guidance or other resources are available to the jurisdiction(s) relevant to the identified mitigation actions?*
- *Are there upcoming trainings/workshops (Benefit-Cost Analysis (BCA), HMA, etc.) to assist the jurisdictions(s)?*
- *What mitigation actions can be funded by other Federal agencies (for example, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA) Smart Growth, Housing and Urban Development (HUD) Sustainable Communities, etc.) and/or state and local agencies?*

SECTION 3:

MULTI-JURISDICTION SUMMARY SHEET (OPTIONAL)

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it should be used as an optional worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

#	Jurisdiction Name	Jurisdiction Type (city/borough/township/village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Requirements
1												
2												
3												
4												
5												
6												
7												
8												
9												

MULTI-JURISDICTION SUMMARY SHEET											
#	Jurisdiction Name	Jurisdiction Type (city/borough/ township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)				
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Northern Virginia	Title of Plan: Northern Virginia PDC HMP	Date of Plan:
Local Point of Contact:		Address:
Title:		
Agency:		
Phone Number:	E-Mail:	
State Reviewer: Debbie Messmer		Title: Date:
FEMA Reviewer: Matt McCullough		Title: Community Planner Date: 01/06/17
Date Received in FEMA Region (insert #)		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

SECTION 1: REGULATION CHECKLIST

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Pg. 2-1 – 2-6 Table 2.2 Appx C	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Pg. 2-1 – 2-6	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Pg. 2-4 – 2-6	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	P. 2-6		X
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Pg. 8-5	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Pg. 8-1 – 8-4	X	

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)		Met	Not Met
ELEMENT A: REQUIRED REVISIONS			
<p>Note:</p> <p>Pg. 2-4: Are there specific public outreach meetings types following the conditional approval of the plan?</p> <p>Pg. 2-5: References Appendix H. The CD only lists Appendices up to F.</p> <p>Pg. 2-5: Fairfax County Outreach- was there any feedback documented for the newsletters sent to the Council of Governments or Businesses?</p>			
<p>A2.) Recommended Revision:</p> <p>Pg. 2-4 & 2-5: In the next plan update please include a description as to how neighboring jurisdictions were invited to participate.</p>			
<p>A4.) Required Revision:</p> <ul style="list-style-type: none"> - Please include a brief narrative as to how the documents listed on pg. 2-6 were incorporated into the plan. - Please cite the additional sources of data and information that was used. Example-NCDC site <p>Language was updated to include other jurisdictions and partners draft was sent to. Language was added to describe what other documents were used and how they were utilized.</p>			
<p>A5.) Note:</p> <p>Utilizing the idea of after-conditional meetings noted on Pg. 2-4; communities could create a bi-annual or annual opportunity for continued public involvement.</p>			
<p>Kudos:</p> <p>Excellent documentation</p>			
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Pg. 4-50 – 4-193	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Pg. 4-30 – 4-193	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Pg. 4-50 – 4-193	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Pg. 4-67 – 4-68	X	

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Not Met	Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				Met
<u>ELEMENT B: REQUIRED REVISIONS</u>				
B1.) Required Revision:				
Pg. 4-90 & 4-91: Please better identify the planning area for Figures 4.24 & 4.25. Highlighting the borders of the PDC will be sufficient.				
Pg. 4-97 -4-100: Please better identify the planning area for Figures 4.26 -4.29. Circling the general Northern Virginia area will suffice.				
Pg. 4-132: Figure 4.34, 4.35, 4.37, 4.41,-Ditto- Circle or Highlight				
Pg 4-173: Figure 4.46 Please remove circled portion and circle or highlight the NoVA PDC				
Map revisions were completed. However, for Figure 4.46 the circled portion was not changed as it is part of the file image and represents a historical subsidence area noted in the map's key.				
Discussion:				
Pg. 4-35 – 4-42: Are the rankings on Table 4.10 – 4.15 being attributed to individual jurisdictions? Pg. 4-44 and 4-46 are no present. Is there additional information on those pages? (Unique and varied risk)				
Tables 4.10-4.15- the scores are summed at a jurisdictional level for each hazard separately, permitting comparison between jurisdictions for each hazard type. Additional language has been added for clarification. See page 4-38 for additional clarification.				
Page 4-44 now appears in the draft. Page 4-46 remains missing. It's a formatting error in the original draft that cannot be corrected without recreating the entire document. There is no data on page 4-46; it's an issue of sections/footers/pagination.				
Note:				
Pg. 4-110: Was there a disaster declaration for Virginia for Hurricane Sandy?				
Information for Sandy has been added, though the declaration did not include the NoVA area.				
Kudos:				
Great mapping! Yes, I made it all the way to page 1092 in Appendix D				
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Chapter 5	X		
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Pg. 5-17 & 5-18		X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Pg. 6-3 – 6-4	X		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Pg. 7-1 – 7-132	X		

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)		Met	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Pg. 6-3 Table 6.1	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Pg. 5-13 – 5-16	X	
ELEMENT C: REQUIRED REVISIONS			
<p>C2.) Required Revision: Pg. 5-17: Please include information for each jurisdiction as to their day-to-day management of the floodplain. This would include mapping, enforcement and insurance. Please see the attached Strategy Guide and Matrix for reference.</p> <p>Plan was updated to include Appendix G – Appendix is the NFIP survey completed by all participating jurisdictions.</p> <p>Discussion: Pg. 7-9- Action 2010-16: Fairfax County has only listed Buy-Out as a strategy. Pg. 7-39: Prince William County does not have a strategy noted for Acquisition, Elevation, Relocation, etc.. Pg. 7-73: Town of Dumfries does not have a strategy noted for Acquisition, Elevation, Relocation, etc.. Pg. 7-98: Town of Lovettsville does not have a strategy noted for Acquisition, Elevation, Relocation, etc..</p> <p>Fairfax County and Prince William updated language in Mitigation actions included in Chapter 7 – Fairfax and Prince William sections attached for review</p> <p>Note: Pg. 7-48: City of Fairfax strategy 2017-6. The development of this platform could be extremely useful in the plan integration realm.</p> <p>Recommended Revision: More accurately align the strategy to the hazard it is supposed to be addressing. Example: Pg. 7-121; Strategy 2010-3</p> <p>C6.) Kudos: Excellent write-up on potential plan integration opportunities. Please see the attached copy of “Plan Integration: Linking Local Planning Efforts”. This tool can be used to further identify specific points of risk reduction integration, into other planning mechanisms.</p>			
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Pg. 3-21 – 3-29	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Chapter 7	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Pg. 6-1	X	

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Not Met	Met
Regulation (44 CFR 201.6 Local Mitigation Plans)			Met	Met
<u>ELEMENT D: REQUIRED REVISIONS</u>				
<p>D.1) Kudos: Very in-depth discussion on land use, population and potential change.</p> <p>Note: Pg. 7-48: City of Fairfax strategy 2017-6. The development of this platform could be extremely useful in the plan integration realm.</p>				
<p>D.2) Recommendation: Enhance the Executive Summary space to include a narrative on mitigation practices and principles that are being engaged in for that given jurisdiction.</p>				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))				
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))				
<u>ELEMENT E: REQUIRED REVISIONS</u>				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1.				
F2.				
<u>ELEMENT F: REQUIRED REVISIONS</u>				

SECTION 2: PLAN ASSESSMENT

INSTRUCTIONS: The purpose of the Plan Assessment is to offer the local community more comprehensive feedback to the community on the quality and utility of the plan in a narrative format. The audience for the Plan Assessment is not only the plan developer/local community planner, but also elected officials, local departments and agencies, and others involved in implementing the Local Mitigation Plan. The Plan Assessment must be completed by FEMA. The Assessment is an opportunity for FEMA to provide feedback and information to the community on: 1) suggested improvements to the Plan; 2) specific sections in the Plan where the community has gone above and beyond minimum requirements; 3) recommendations for plan implementation; and 4) ongoing partnership(s) and information on other FEMA programs, specifically RiskMAP and Hazard Mitigation Assistance programs. The Plan Assessment is divided into two sections:

1. Plan Strengths and Opportunities for Improvement
2. Resources for Implementing Your Approved Plan

Plan Strengths and Opportunities for Improvement is organized according to the plan Elements listed in the Regulation Checklist. Each Element includes a series of italicized bulleted items that are suggested topics for consideration while evaluating plans, but it is not intended to be a comprehensive list. FEMA Mitigation Planners are not required to answer each bullet item, and should use them as a guide to paraphrase their own written assessment (2-3 sentences) of each Element.

The Plan Assessment must not reiterate the required revisions from the Regulation Checklist or be regulatory in nature, and should be open-ended and to provide the community with suggestions for improvements or recommended revisions. The recommended revisions are suggestions for improvement and are not required to be made for the Plan to meet Federal regulatory requirements. The italicized text should be deleted once FEMA has added comments regarding strengths of the plan and potential improvements for future plan revisions. It is recommended that the Plan Assessment be a short synopsis of the overall strengths and weaknesses of the Plan (no longer than two pages), rather than a complete recap section by section.

Resources for Implementing Your Approved Plan provides a place for FEMA to offer information, data sources and general suggestions on the overall plan implementation and maintenance process. Information on other possible sources of assistance including, but not limited to, existing publications, grant funding or training opportunities, can be provided. States may add state and local resources, if available.

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

How does the Plan go above and beyond minimum requirements to document the planning process with respect to:

- *Involvement of stakeholders (elected officials/decision makers, plan implementers, business owners, academic institutions, utility companies, water/sanitation districts, etc.);*
- *Involvement of Planning, Emergency Management, Public Works Departments or other planning agencies (i.e., regional planning councils);*
- *Diverse methods of participation (meetings, surveys, online, etc.); and*
- *Reflective of an open and inclusive public involvement process.*

Element B: Hazard Identification and Risk Assessment

In addition to the requirements listed in the Regulation Checklist, 44 CFR 201.6 Local Mitigation Plans identifies additional elements that should be included as part of a plan's risk assessment. The plan should describe vulnerability in terms of:

- 1) *A general description of land uses and future development trends within the community so that mitigation options can be considered in future land use decisions;*
- 2) *The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; and*
- 3) *A description of potential dollar losses to vulnerable structures, and a description of the methodology used to prepare the estimate.*

How does the Plan go above and beyond minimum requirements to document the Hazard Identification and Risk Assessment with respect to:

- *Use of best available data (flood maps, HAZUS, flood studies) to describe significant hazards;*
- *Communication of risk on people, property, and infrastructure to the public (through tables, charts, maps, photos, etc.);*
- *Incorporation of techniques and methodologies to estimate dollar losses to vulnerable structures;*
- *Incorporation of Risk MAP products (i.e., depth grids, Flood Risk Report, Changes Since Last FIRM, Areas of Mitigation Interest, etc.); and*
- *Identification of any data gaps that can be filled as new data became available.*

Element C: Mitigation Strategy

How does the Plan go above and beyond minimum requirements to document the Mitigation Strategy with respect to:

- *Key problems identified in, and linkages to, the vulnerability assessment;*
- *Serving as a blueprint for reducing potential losses identified in the Hazard Identification and Risk Assessment;*
- *Plan content flow from the risk assessment (problem identification) to goal setting to mitigation action development;*
- *An understanding of mitigation principles (diversity of actions that include structural projects, preventative measures, outreach activities, property protection measures, post-disaster actions, etc.);*
- *Specific mitigation actions for each participating jurisdictions that reflects their unique risks and capabilities;*
- *Integration of mitigation actions with existing local authorities, policies, programs, and resources; and*
- *Discussion of existing programs (including the NFIP), plans, and policies that could be used to implement mitigation, as well as document past projects.*

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

How does the Plan go above and beyond minimum requirements to document the 5-year Evaluation and Implementation measures with respect to:

- *Status of previously recommended mitigation actions;*
- *Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk;*
- *Documentation of annual reviews and committee involvement;*
- *Identification of a lead person to take ownership of, and champion the Plan;*
- *Reducing risks from natural hazards and serving as a guide for decisions makers as they commit resources to reducing the effects of natural hazards;*
- *An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.);*
- *Discussion of how changing conditions and opportunities could impact community resilience in the long term; and*
- *Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience.*

B. Resources for Implementing Your Approved Plan

Ideas may be offered on moving the mitigation plan forward and continuing the relationship with key mitigation stakeholders such as the following:

- *What FEMA assistance (funding) programs are available (for example, Hazard Mitigation Assistance (HMA)) to the jurisdiction(s) to assist with implementing the mitigation actions?*
- *What other Federal programs (National Flood Insurance Program (NFIP), Community Rating System (CRS), Risk MAP, etc.) may provide assistance for mitigation activities?*
- *What publications, technical guidance or other resources are available to the jurisdiction(s) relevant to the identified mitigation actions?*
- *Are there upcoming trainings/workshops (Benefit-Cost Analysis (BCA), HMA, etc.) to assist the jurisdictions(s)?*
- *What mitigation actions can be funded by other Federal agencies (for example, U.S. Forest Service, National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA) Smart Growth, Housing and Urban Development (HUD) Sustainable Communities, etc.) and/or state and local agencies?*

SECTION 3:

MULTI-JURISDICTION SUMMARY SHEET (OPTIONAL)

INSTRUCTIONS: For multi-jurisdictional plans, a Multi-jurisdiction Summary Spreadsheet may be completed by listing each participating jurisdiction, which required Elements for each jurisdiction were 'Met' or 'Not Met,' and when the adoption resolutions were received. This Summary Sheet does not imply that a mini-plan be developed for each jurisdiction; it should be used as an optional worksheet to ensure that each jurisdiction participating in the Plan has been documented and has met the requirements for those Elements (A through E).

#	Jurisdiction Name	Jurisdiction Type (city/borough/township/village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)					
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption	F. State Requirements
1												
2												
3												
4												
5												
6												
7												
8												
9												

MULTI-JURISDICTION SUMMARY SHEET											
#	Jurisdiction Name	Jurisdiction Type (city/borough/ township/ village, etc.)	Plan POC	Mailing Address	Email	Phone	Requirements Met (Y/N)				
							A. Planning Process	B. Hazard Identification & Risk Assessment	C. Mitigation Strategy	D. Plan Review, Evaluation & Implementation	E. Plan Adoption
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

APPENDIX B

PLAN ADOPTION

Note, to be completed following conditional approval.



Appendix B – Sample Plan Adoption Resolution

Adoption of the Multi-Jurisdictional Hazard Mitigation Plan Update for the Northern Virginia Region

(Name of Jurisdiction) _____

(Governing Body) _____

(Address) _____

WHEREAS, the Disaster Mitigation Act of 2000, as amended, requires that local governments, develop, adopt and update natural hazard mitigation plans in order to receive certain federal assistance; and,

WHEREAS, the Northern Virginia Regional Hazard Mitigation Plan has been prepared in accordance with FEMA requirements at 44C.F.R. 201.6; and,

WHEREAS, a Mitigation Advisory Committee (*MAC), comprised of representatives from the Counties of Arlington, Fairfax, Loudon, and Prince William; the Cities of Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park; and Towns of Clifton, Dumfries, Haymarket, Herndon, Leesburg, Middleburg, Purcellville, Occoquan, Quantico, Round Hill, and Vienna, was convened in order to assess the risks of hazards facing the Northern Virginia region, and to make recommendations on actions to be taken to mitigate these hazards; and,

WHEREAS, a request for proposals was issued to hire an experienced consulting firm to work with the MAC to update a comprehensive hazard mitigation plan for the Northern Virginia region; and,

WHEREAS, the plan incorporates the comments, ideas and concerns of the community and of the public in general, which this plan is designed to protect, ascertained through a series of public meetings, publication of the draft plan, press releases, and other outreach activities; and

RESOLVED – the jurisdiction of (governing body name) recognizes that recent events of the Virginia Earthquake, Hurricane Irene, and Tropical Storm Lee are not captured in the current FEMA approved pending adoption update of the local Hazard Mitigation Plan. Being committed to mitigation planning and activities, the jurisdiction of (governing body name), as part of the next update, will fully endeavor to identify, evaluate, and include these event and their impacts as part of the next update cycle.

NOW THEREFORE, BE IT RESOLVED by the (governing body name) that the Northern Virginia Hazard Mitigation Plan Update dated (mm/dd/yyyy) is hereby approved and adopted by the (governing body name), and resolves to execute the actions in the plan. A copy of the plan is attached to this resolution.

ADOPTED by the on this _____ day of _____, 2012.

APPROVED

(Head of jurisdiction's governing body)

ATTEST

(Jurisdiction representative)

APPENDIX C

Meeting Documentation

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Agenda

October 8, 2015

2:00 PM

1. Opening Remarks
 - a. On behalf of Dave and Roy, Thank you all for coming to the meeting. The goal of today's meeting is to relay to you all the status of the Hazard Mitigation Plan, and the actions that have been taken to date so that you can take them back to your jurisdiction to further discuss.
2. Roll Call - Since there are folks on the phone, let's do a quick roll call.
3. Overview of plan status and actions taken to date
 - a. As I am sure you all know by now, at a recent NVERS meeting there was discussion of the Hazard Mitigation Plan, and that it was due for update. Dave volunteered Fairfax to take the lead on that and the group supported it.
 - b. Plan is due February 2017 and the 2012 plan update took 2 years to complete and cost approximately 200,000
 - c. We applied for a hazard mitigation grant. The application was submitted to the state and subsequently FEMA in August.
 - d. We applied for 150,000 and there is a requirement for 25% match. We plan to do in kind match, and match cannot be grant funded.
 - e. Grant funds would be awarded sometime in the summer of 2016.
 - f. We put together a scope of work that we sent to Witt, as we have had good luck with them in the past.
 - g. Their quote came back at 194,000, which is in line with the last update.
 - h. Funding:
 - i. Obviously there is the grant we applied for next summer
 - ii. NVERS has all but promised me 50,000. Their surveys were to be reviewed today, so we should know very soon. Money must be spent by May 2016.
 - iii. NVERS was also talking to the state to try to get another 50,000 for this project.
4. Discussion of next steps
 - a. Group recommendations for how to proceed
 - i. There seem to be two broad choices for how to proceed
 1. Continue pursuing grant funds to cover the whole project
 2. Write the plan internally. If we do this, we can use the funds to hire a consultant for project management etc.
 - ii. What else should we do? Another quote? From who?

- b. October 26 NVERS Meeting – Dave plans to put this on the agenda for the October NVERS meeting so the local EMs can make the final decision on how to proceed.
- 5. Validate group membership – I just want to check and confirm that I have the right people in the room from each jurisdiction. Check in. Only inviting cities and counties. Rely on counties to involve the towns?
- 6. Adjournment

Hazard Mitigation Plan Update Briefing

10/8/2015

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

December 1, 2015

1:00 PM

Meeting Attendance:

Amelia Gagnon

Carrie Gonzalez

Mike Guditus

Robb Hoffower

Kevin Johnson

Jake Kazele

Adam Kelly

Alexa Lenhart

David Morrison

Tom Polera

Greg Zebrowski

Notes:

1. Project Update
 - a. NVERS is working to secure the \$50,000 in grant funds for the HIRA. They expect to have the money officially allocated, and the contract with WITT setup within the week. They are currently working on the PMP for the project.
2. Timeline and Responsibilities
 - a. See attached. Please note with the schedule, the dates are when things happen, preparations for events such as public outreach will need to start sooner. The group did not have any substantive comments on the schedule and agreed with it.
3. Establish a Meeting Schedule
 - a. I will setup monthly meetings on Tuesdays at 1:30 PM. The meeting invite will go out shortly. If the meetings are not necessary, we will cancel. There will always be a call in number available.
4. Data Requirements for HIRA
 - a. See attached. Witt will have more information on this when they have had a chance to review the data from the last plan update.
 - b. Please review the attachment and provide necessary information by January 1.
 - c. Review the list of hazards in the 2012 plan. Let me know by January 1 if you feel the list of hazards need to change.
 - i. The thought yesterday was that the list of hazards is probably okay, but that descriptions of events that have happened since 2011 need to be included.

5. Inclusion of Towns

- a. Provide me with the contact information for the Towns within your jurisdiction (should just apply to Fairfax, Loudoun, and Prince William). I will include them on my emails, but I will not reach directly to the Towns until the corresponding County has briefed them and told me it is okay.

Action Items:

1. Provide Data by January 1. - All
2. Provide list of hazards by January 1. - All
3. Determine the best source for the NFIP data to ensure properties attributed to the Towns are within the corporate limit, and not just the zip code.

Hazard Mitigation Plan December Meeting 12/1/2015

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

January 12, 2016

1:30 PM

Meeting Attendance:

Hal Cohen
Amelia Gagnon
Kelly George
Mike Guditus
Brian Henshaw
Robb Hoffower
Dan Janickey
Kevin Johnson
Kirstyn Jovanovich
Jake Kazele
Adam Kelly
Alexa Lenhart
David Morrison
Blake Stave
Sandra Sca
Steve Thompson
Greg Zebrowski

Notes:

1. Project Update
 - a. Due to timing constraints we have chosen to update the vast majority of this plan ourselves as directed by the NOVA Emergency Managers group. We are no longer pursuing the State Hazard Mitigation Grant because the timing would not allow us to complete the plan by the 2017 deadline.
 - b. We have secured \$50,000 in funding from NVERS to have Witt perform the HIRA portion of our plan. These funds do not have any local match requirement. The only stipulation is that the funds need to be spent by May 2016.
 - c. The current project timeline is attached.
2. HIRA
 - a. Please see the attached presentation from Kelly George with Witt. The one major change to the attached spreadsheet is that data is now due to Witt on February 15, not January 31.

- b. There was discussion of how the HIRA associated with this plan interacts with the NCR THIRA. The group agreed that this HIRA would likely drive what is in the THIRA. Witt will review the THIRA and HIRA to make sure there are no conflicts.
- c. There was discussion of the methodology used in the HIRA. As outlined in the power point, Witt has proposed and the group has approved using the same methodology as the previous plan. This will allow for comparison to the previous. The methodology is complex, but produces good results. The group approved the usage of the 2012 HIRA methodology.
- d. There was discussion of what data sets should be used in this plan update. The committee voiced concern with the 2012 plan update because there were several events that happened while the plan was in draft status and were not included when the plan was finalized. The recommendation of Witt was that every plan needs to have a defined time period that it examines. The Committee will discuss strategies for presenting this to our elected officials at a later Committee meeting.
- e. The group approved the usage of 2010 census data for the plan.
- f. In 2012 FEMA changed their interpretation of the hazard mitigation regulations, and now requires each jurisdiction to be fully participating in the plan update. The towns will need to be split into their own section and not lumped in with the Counties.
- g. Witt clarified that there will be a regional summary to the HIRA, but there will not be regional analysis. The analysis will be done at the local level.
- h. The time period that will be examined in this HIRA is January 1, 2011 – December 31, 2015.
- i. When collecting historic site data. If there is a historic district designation there is no need to list all historic sites within that. For instance, the Town of Haymarket is considered a historic district so they do not need to provide any data on specific historic sites.
- j. Witt proposed adding the category of Extreme Temperatures to the HIRA list of hazards, and removing those from Winter Storm and Drought because it's possible to have extreme temperatures without drought or a winter storm. The committee approved this.
- k. Witt discussed that the requirements have changed significantly since 2012 for what data needs to be used in the HIRA. In our 2012 plan, most of the asset data was open source.
- l. When referring to assets in the data requirements this generally refers to facilities owned by the jurisdiction that have some sort of infrastructure, but does not include equipment (trucks etc). It should be all facilities owned by the jurisdiction. Generally, leased facilities are not required to be reported. When listing the use of the facility, include all uses (for instance, police station fire station and public office).

Action Items:

1. **Provide requested data by February 15** – All Jurisdiction to include Counties, Cities, and Towns.

Hazard Mitigation Plan December Meeting

1/12/2016

Northern Virginia Hazard Mitigation Plan Update

HAZARD IDENTIFICATION & RISK ASSESSMENT

JANUARY 12, 2016

HIRA Update

Meeting Agenda

- What is a HIRA?
- Regulatory requirements of a HIRA
- Review/validation of hazards to be included
- Risk assessment update and methodology
- Documents and data needed
- HIRA update schedule
- Contact information

What is a HIRA?

WITT|O'BRIEN'S

What is a hazard identification & risk assessment (HIRA)?

- FEMA's *Local Mitigation Planning Handbook* (March 2013) breaks this section of the plan into four steps:
 1. Describe hazards
 2. Identify community assets
 3. Analyze risks
 4. Summarize vulnerability

1. Describe hazards

- Each hazard must be described in terms of:
 - Definition: what the hazard is (or is not)
 - Location: the geographic area that is affected (or likely to be affected) by the hazard
 - Extent: the strength or magnitude of the hazard (e.g., scale values, depth, speed of onset, or duration)
 - Previous occurrences
 - Probability of future events

2. Identify community assets

- Assets include things like:
 - People
 - Economy
 - Built environment:
 - Critical facilities
 - Other facilities
 - Housing stock
 - Infrastructure
 - Transportation routes
 - Natural environment
- Note: as a general rule, assets should be owned/operated/serviced by the jurisdiction if included in this listing.

3. Analyze risk

- Involves evaluating vulnerable assets, describing potential impacts, and estimating losses for each hazard.
- Methods include:
 - Exposure analysis (quantifies the number, type, and value of assets in the hazard areas)
 - Historical analysis (uses information on impacts and losses from previous events to predict potential impacts and losses from a similar future event)
 - Scenario analysis (predicts the impacts of a particular event)
- Note: Updated HIRAs must address changes in development since the previous plan was approved.

4. Summarize vulnerability

- The hazard and risk information must be summarized so that the average person can understand the most significant risks and vulnerabilities of their community.
- The plan must provide an overall summary of each jurisdiction's vulnerability to the identified hazards.

Legislative & Regulatory Requirements

WITT|O'BRIEN'S

Legislative and regulatory requirements

- Local mitigation plans became a requirement to receive federal mitigation grant funding with the passage of the Disaster Mitigation Act of 2000 (DMA2K); this legislation went into effect for disasters declared after November 1, 2004.
- The legislation was codified into rules in 44 CFR §201.6
- FEMA has issued several versions of guidance documents related to mitigation planning and the contents of HIRAs

44 CFR §201.6(c)

Plan Content

- (c) *Plan Content.* The Plan shall include the following:
 - (1) Documentation of the *planning process* used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.
 - (2) A *risk assessment* that provides the factual basis for activities proposed in the strategy to reduce losses from the identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include:

44 CFR §201.6(c)

Plan Content (continued)

➤ ... (c)(2)

- (i) a description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
- (ii) a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i)(A) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:

44 CFR, §201.6(c)

Plan Content (continued)

➤ ... (c)(2)(ii)

- (A) The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;
- (B) An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepared the estimate;
- (C) Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
- (iii) For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Review/validation of the hazards to be included

WITT|O'BRIEN'S

Hazards in the current plan

- Flood:
 - Flash flooding
 - Sea level rise
 - Flood-related erosion
- Winter storm (includes extreme cold):
 - Snow
 - Sleet
 - Freezing rain
 - Freezing temperatures
- High wind/Severe storms (includes thunderstorms and hurricanes):
 - Severe thunderstorms
 - Hailstorms
- Tornadoes
- Drought (and extreme heat)
- Earthquake
- Landslides
- Wildfire
- Sinkholes/Karst/Land subsidence
- Dam failure

Recommendation

➤ We recommend:

- Separating extreme cold from winter storm
- Separating extreme heat from drought
- Including Extreme temperatures (both cold and heat) as an independent hazard
- Rationales:
 - It's possible to have occurrences of extreme temperatures in the absence of other hazard events
 - Extreme cold is not necessarily a component of winter storms
 - Extreme heat is not necessarily a component of a drought

➤ Recommendation accepted? Yes

Risk Assessment

WITT|O'BRIEN'S

Risk assessment update

- No requirements exist as to the methodology used for risk assessments, so long as the criteria in 44 CFR §201.6 are met
- We will use the same methodologies to update the risk assessment as are used in the current plan:
 - Exposure analysis
 - Historical analysis
 - Scenario analysis
- The updated HIRA will contain GIS products to ensure both continuity and familiarity for ease of understanding for users and readers

Risk assessment methodology

- The risk assessment methodology used in the 2010 update is the same as the methodology used in the 2010 *Commonwealth of Virginia Hazard Mitigation Plan*.
- This methodology was originally developed for VDEM by the Center for Geospatial Information Technology (CGIT) at Virginia Tech.
- This methodology is based on the use of NCDC data, with other data input as necessary to fill gaps

Risk assessment methodology description

"CGIT and VDEM developed a standardized methodology to compare different hazards' risk on a jurisdictional basis. As some of the hazards assess in this plan did not have a precisely quantifiable probability or impact data, a semi-quantitative scoring system was used to compare all of the hazards. This method prioritized hazard risk based on a blend of quantitative factors from the available data. A number of parameters have been considered in this methodology, all of which could be derived from the NCDC dataset:

- History occurrence
- Vulnerability of people in the hazard area;
- Probably geographic extent of the hazard area; and
- Historical impact, in terms of human lives and property." (NOVA HMP, p. 82)

Risk assessment methodology description

“The ranking methodology tries to balance these factors, whose reliability varies from hazard to hazard due to the nature of the underlying data. Each parameter was rated on a scale of one through four.... These scores are summed at the jurisdictional level for each hazard separately, permitting comparison between jurisdictions for each hazard type. A summation of all the scores from all hazards in each jurisdiction provides an overall all-hazards risk prioritization.” (NOVA HMP, pp. 82-3)

Risk assessment methodology parameters

➤ Population vulnerability and density

<i>Population Vulnerability</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 0.229 % of the total population of the State
2	0.230% - 0.749% of the total population of the State
3	0.750% - 2.099% of the total population of the State
4	> = 2.100% of the total population of the State

<i>Population Density</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 60.92 people/sq mi
2	60.93 – 339.10 people/sq mi
3	339.11 - 1,743.35 people/sq mi
4	> = 1,743.36 people/sq mi

Risk assessment methodology parameters

➤ Geographic extent

Table 4.16: Geographic Extent as the percentage of a jurisdiction impacted by the hazard.

Geographic Extent			
Hazard	Description	Category Breaks	
		Rank	Definition
Flood	Percent of a jurisdiction that falls within FEMA Special Flood Hazard Area (SFHA). Data: FEMA Floodplains (DFIRMs)	1	<=2.99%
		2	3.00-4.99%
		3	5.00 -9.99%
		4	>=10.00%
High Wind	Average maximum wind speed throughout the entire jurisdiction. Data: HAZUS ^{MH} 3-second Peak Gust Wind Speeds	1	<= 59.9
		2	60.0 - 73.9
		3	74.0 - 94.9
		4	>= 95.0
Wildfire	Percent of jurisdiction that falls within a “high” risk. Data: VDOF Wildfire Risk Assessment	1	<= 9.9%
		2	10.0% - 19.9%
		3	20.0% - 49.9%
		4	>= 50.0%
Karst	Percent of jurisdiction where the risk is “high” for karst related events. Data: USGS Engineering Aspects of Karst	1	<= 24.9%
		2	25.0% - 49.9%
		3	50.0% - 74.9%
		4	>= 75.0%

Risk assessment methodology parameters

➤ Geographic extent (continued)

Geographic Extent			
Hazard	Description	Category Breaks	
		Rank	Definition
Landslide	Percent of jurisdiction where a high landslide risk exists. Data: USGS Landslide Incidence & Susceptibility	1	<= 24.9%
		2	25.0% - 49.9%
		3	50.0% - 74.9%
		4	>= 75.0%
Earthquake	Average 2,500-year return period max percent of gravitational acceleration (PGA).	1	<= 0.069
		2	0.070 - 0.159
		3	0.160 - 0.299
	Data: HAZUS ^{MH} 2,500-year PGA	4	>= 0.300
Winter Storm	Average annual number of days receiving at least 3 inches of snow, calculated as an area-weighted average for each jurisdiction. Data: NWS snowfall statistics	1	<= 1.49
		2	1.50 - 1.99
		3	2.00 - 2.99
		4	>= 3.0
Tornado	Annual tornado hazard frequency (times 1 million), calculated as an area-weighted average for each jurisdiction. Data: NCDC tornado frequency statistics	1	<= 1.24
		2	1.25 - 9.99
		3	10.00 - 99.9
		4	>= 100.00

Risk assessment methodology parameters

➤ Annualizing the data for analysis

- Data from the NCDC database was annualized in order to compare the results on a common system. In general, this was completed by taking the parameter of interest and dividing by the length of record for each hazard. The annualized value should only be utilized as an estimate of what can be expected in a given year.
- Deaths/injuries, property and crop damage, and events were all annualized in this fashion.

Risk assessment methodology parameters

➤ Annualized deaths and injuries

Table 4.17: Annualized Deaths and Injuries as the number of deaths or injuries that a hazard event would likely cause in a given year.

<i>Annualized Deaths and Injuries</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 1.019 deaths and/or injuries per year
2	1.020 – 6.279 deaths and/or injuries per year
3	6.280 – 13.199 deaths and/or injuries per year
4	>= 13.200 deaths and/or injuries per year

Risk assessment methodology parameters

- Annualized crop and property damage

Table 4.18: Annualized Crop and Property Damage as the estimated damages that a hazard event will likely cause in a given year.

<i>Annualized Crop and Property Damage</i>	
<i>Rank</i>	<i>Definition: Crop Damage</i>
1	<i><= \$25,711 per year</i>
2	<i>\$25,712 – \$100,270 per year</i>
3	<i>\$100,271 - \$291,384 per year</i>
4	<i>>= \$291,385 per year</i>

Risk assessment methodology parameters

➤ Annualized events

Table 4.19: Annualized Events as the number of times that a hazard event would likely happen in a given year.	
<i>Annualized Events</i>	
<i>Rank</i>	<i>Definition</i>
1	<= 0.09 events per year
2	0.10 – 0.99 events per year
3	1.00 – 4.99 events per year
4	>= 5.00 events per year

Risk assessment methodology parameters

➤ Overall hazard ranking

- The scores from these categories were added together for each hazard to estimate the total jurisdictional risk due to that hazard.
- The total scores were broken into five categories to better illustrate the distribution of risk scores.
 - <8.50 = low risk
 - 8.50 to 9.99 = medium-low risk
 - 10.0 to 11.49 = medium risk
 - 11.50 to 12.99 = medium-high risk
 - >13.00 = high risk

Risk assessment methodology parameters

➤ Overall hazard ranking (continued)

- In order to asses the total risk of a jurisdiction across all hazard categories, each of the previous categories were summed across the different hazard types:
 - <86.00 = low risk
 - 86.01 to 93.50 = medium-low risk
 - 95.51 to 100.00 = medium risk
 - 100.01 to 108.00 = medium-high risk
 - >108.01 = high risk

Risk assessment methodology recommendation

- As this is an update to an existing plan, we recommend continuing with this established methodology, with the following exceptions:
 - Towns will be added to the HIRA as independent jurisdictions
 - The HIRA will be reformatted to be organized by jurisdiction, rather than by hazard
- Recommendation accepted? Yes

Documents and data needed

WITT|O'BRIEN'S

Documents and data previously requested

- Listing of assets owned by each participating jurisdiction, including:
 - Street address
 - Lat/long coordinates
 - Footprint (sf)
 - Type of construction
 - Type of roof
 - Number of stories
 - Typical use of asset
 - Current value of the asset
 - Current value of the contents of the asset
- Same details for any historic structures in each participating jurisdiction, including registry status

Documents and data previously requested (cont.)

- Detailed descriptions of hazard occurrences since 2011 in each participating jurisdiction, including:
 - Type of incident
 - Narrative description of what occurred
 - Any damages associated with the incident, including increased operating or manpower costs
 - Any cleanup costs associated with the incident

Documents and data previously requested (cont.)

- Current NFIP data for each participating jurisdiction, including:
 - Listing of policies in effect
 - Claims from those policies
 - Listing of structures designed as Repetitive Loss (RL) by the NFIP
 - Listing of structures designated as Severe Repetitive Loss (SRL) by the NFIP
- All of this data has been received – thanks!

Documents and data previously requested (cont.)

- To meet the timeline for this project, we must have all of this data in hand no later than ~~January 31~~ February 15.
- What questions can I answer about this data request?

HIRA update schedule

WITT|O'BRIEN'S

Estimated schedule for HIRA update completion

- January 2016:
 - Kickoff meeting with Committee
 - Data/documentation collection
 - ~~- All data/documentation received by Jan. 31~~
- February 2016:
 - ~~- All data/documentation received by February 15~~
 - HAZUS runs for HIRA update
 - GIS development
 - Reformatting of HIRA
- March 2016:
 - ~~- HAZUS runs for HIRA update~~
 - ~~- GIS development~~
 - Drafting of HIRA update
 - QA/QC of HIRA update
- ~~April 1, 2016~~ **April 15, 2016:** Updated HIRA delivered to Committee for review/comment

Contact information

WITT|O'BRIEN'S

Consultant contact information

- Kelly George, CFM – Project Manager/Senior Mitigation Planner:
 - kgeorge@wittobriens.com
- Hal Cohen – Subject Matter Expert
 - hcohen@wittobriens.com
- Erin Buchanan, CFM – Mitigation Planner/Data Management Specialist:
 - ebuchanan@wittobriens.com
- Jake Halley – GIS Specialist:
 - jhalley@wittobriens.com

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

February 9, 2016

1:30 PM

Meeting Attendance:

Walter English

Amelia Gagnon

Carrie Gonzalez

Brian Henshaw

Dan Janickey

Adam Kelly

Alexa Lenhart

David Morrison

Blake Stave

Notes:

1. Project Update – Attached is the updated schedule to reflect the slightly later completion of the HIRA, all other dates remain the same. HIRA delivery is expected to be April 15.
Tentatively, Kelly George plans to attend our May meeting to present the HIRA and answer any questions we may have after we have had an opportunity to review it.
2. Data Collection
 - a. NFIP and Hospital Data has been collected by Adam Kelly for all jurisdictions and has been provided to Witt. NFIP data was provided by the state, and NVHA provided the hospital data.
 - b. Arlington County: Working on data, and should have no problem meeting the Tuesday deadline. They have having the hardest time finding roof data for their facilities.
 - c. Alexandria: Data will be delivered on Friday.
 - d. Falls Church: Working on data collection and plan to have it in by the deadline.
 - e. Fairfax City: In the process of compiling data and hope to have it done by the deadline.
 - f. Fairfax County: All data has been compiled for Fairfax County and will be submitted to Witt this week.
 - i. Clifton: Only owns 1 facility, will provide data.
 - ii. Herndon: Data has been submitted to Fairfax.
 - iii. Vienna: working on compiling data, plan to have it complete by Friday.
 - g. Manassas: They are good on compiling the asset data, but finding some holes in data on past hazard occurrences. Working to complete the data collection.

- h. Manassas Park: On schedule with data collection, will deliver by Tuesday.
 - i. Loudoun County: (not on call, update submitted via email) e data collection continues for Loudoun County and incorporated towns. As a result of the blizzard, I was unable to meet with the Towns of Middleburg and Round Hill. I have spoken with the Town contact's and we are working to identify a date/time convenient to meet with them. I'm hopeful that we will be able to accomplish this sometime soon. In the meantime both jurisdictions have limited owned, leased, operated facilities, so I should be able to collect the information by the requested deadline for those two jurisdictions. I have received preliminary information from the Town of Leesburg and am working to incorporate their data into our spreadsheet. I don't believe there will be any issue with delivery by Monday, February 15, 2016.
 - j. Prince William County: Awaiting data from the service authority and plan to have it done by the end of the week. Hazard information has been submitted. Working to contact Dumfries and Quantico.
 - i. Haymarket: Asset data has been submitted.
 - ii. Occoquan: Asset data has been submitted, and they are working to compile hazard data.
3. Next Meeting: The first round of public outreach is planned to happen in the April/May timeframe where we will provide the public an opportunity to weigh in on the HIRA. Please come to next month's meeting prepared to discuss ideas for this.

Action Items:

1. **Provide requested data by February 15** – All Jurisdiction to include Counties, Cities, and Towns.
2. **Brainstorm Outreach Methods by March 8** – Come to the March Meeting prepared to discuss possible outreach strategies.

Hazard Mitigation Plan December Meeting

2/9/2016

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

March 8, 2016

1:30 PM

Meeting Attendance:

Walter English

Amelia Gagnon

Carrie Gonzalez

Brian Henshaw

Robert Hoffower

Kevin Johnson

Adam Kelly

David Morrison

Blake Stave

Stephen Thompson

Greg Zebrowski

1. HIRA Update

- a. Witt is in the process of entering all data so they can begin the HIRA, they have asked some follow ups, but no major issues. Once all the locations are entered into HAZUS there may be some additional follow ups, but they do not expect any major issues.
- b. Witt is scheduled to deliver the HIRA to us on April 15. Comments are due May 6, and Witt will be here on May 10 to attend our meeting and address any remaining issues.

2. Review of the Outreach Plan and Schedule

- a. The original plan was to post the HIRA for public review. The regulations state “An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval.” Per Witt, their interpretation of this is that the “during drafting stage” review needs to be giving the public an opportunity to review the full draft plan. I will confirm this with VDEM and Witt and get back to you all. Kelly George with Witt is out of the office for a few days so this will not happen until next week. Getting public input is as simple as posting the plan on our websites, so it’s not a huge rush to make this decision.
- b. Whatever our outreach strategy is for the plan, every jurisdiction will need to advertise and request feedback on the plan. We can post it on one website and direct everyone to that if we want, but every jurisdiction will have to notify the public of the opportunity to review.

3. Initial Review of Mitigation Actions (found in the Jurisdiction Executive Summaries)

- a. It was presented to the Committee, and approved that each jurisdiction will perform an initial review of the mitigation actions found in the Hazard Mitigation Plan. While the

HIRA must be complete to fully review and determine mitigation actions, this will be a good opportunity to start the review process and clear out any obvious changes that need to be made.

- b. Deadline is May 2.
- 4. Update of the Capability Assessment
 - a. It was presented to the Committee, and approved that each jurisdiction will review the capability assessment chapter (chapter 5) and validate the information. For all jurisdictions who participated in the 2012 plan, please review chapter 5 and confirm that all information is still valid for your jurisdiction. For the couple new jurisdictions in Loudoun provide the information needed that has been provided for all other jurisdictions.
 - b. Deadline is May 2.
- 5. Project Update
 - a. I will be out of the office for 2 weeks in late March/Early April. My wife and I are expecting a baby March 28. During my absence, Greg Zebrowski will be the point of contact. He can be reached at Gregory.zebrowski@fairfaxcounty.gov or 571-350-1297.
 - b. The April 12 meeting will be cancelled.

Action Items

- 1. Confirm requirements for public input in the plan (Adam, due April 1)
- 2. Perform initial review of your jurisdiction's mitigation actions (Everyone, May 2)
- 3. Review and validate the information in the capability assessment (Everyone, May 2)
- 4. Review and provide comment to me and Witt on the HIRA (Everyone, due May 6)

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Agenda

May 10, 2016

1:30 PM

Attendance:

Walter English

Amelia Gagnon

Kelly George

Carrie Gonzalez

Mike Guditus

Brian Henshaw

Robert Hoffower

Dan Janickey

Kevin Johnson

Kirstyn Jovanovich

Adam Kelly

Alexa Lenhart

David Morrison

Tom Polera

Blake Stave

Steve Thompson

Greg Zebrowski

1. HIRA Overview and Discussion – See attached presentation

- a. HIRA Comments are due to Kelly George at Witt by May 13, her email is in the previously distributed spreadsheet.
- b. The group asked that the HIRA be reviewed for consistency and consolidation where appropriate. There are inconsistencies with how hazards are addressed and how the document is formatted.
- c. Witt will perform a methodology consistency check and technical edit before the final delivery.
- d. The group asked Witt to remove references to the previous plans as much as possible.
- e. The state Dam data has over 200 dams, the ones listed in the plan are the high and significant hazard dams. Witt will add reference to the fact that all 200 were used in the analysis. Methodology and assumptions used for this analysis will be added to the plan.
- f. Witt will compile everyone's comments with notes for how they were adjudicated and share that with the Steering Committee.

2. Regional Mitigation Strategy and Goals (Chapter 6)

- a. In the meeting we discussed and reaffirmed our regional mitigation strategy and goals. Below is a summary of specific changes and decisions by the Steering Committee.
- b. It was proposed that we remove the reference to EMAP on page 297. The group chose to leave the reference in the document.
- c. The group reaffirmed the guidance for activities considered when coming up with mitigations actions on pages 298-299.
- d. The group reaffirmed the use of STAPLE\E as our criteria for assigning priority to jurisdictional mitigation activities.
 - i. A spreadsheet will be provided to aid each jurisdiction in using this criteria. Each mitigation action will be scored using the criteria in STAPLE\E. For each of the 7 criteria in STAPLE\E, a low, medium or high (1 for low, 2 for medium, 3 for high) ranking will be assigned, then averaged to determine the overall ranking for that action.
- e. The current plan does not elaborate on why some mitigation actions are listed as critical. The Steering Committee agreed to remove Critical and prioritize each mitigation action as Low, Medium or High based on the STAPLE\E criteria
 - i. Text will be added to chapter 6 to justify this.
- f. The group chose to remove the table of regional mitigation actions on page 303. Each jurisdiction should include these actions as appropriate. Text will be added to the chapter 6 to explain this.
- g. The 6 regional mitigations goals were reaffirmed with the following changes
 - i. Remove references to human caused hazards.
 - ii. Add “and nonstructural” to goal 5 as a way to capture mitigation actions that do not fall easily into another category.

3. Mitigation Recommendations from Witt

- a. Based on our HIRA, Kelly discussed the fact that wind (from all sources – hurricane, tornado and severe storms) is our biggest threat.
- b. It was recommended that we each examine a range of mitigation activities to address high winds. Some of these include:
 - i. Building 361 compliant safe rooms. <https://www.fema.gov/media-library/assets/documents/3140>
 - ii. Tie downs and other building improvements.
- c. Include emergency utilities in the mitigation activities, not just generators.
- d. After the meeting Kelly committed to providing examples of other plans she has worked on to give us suggestions for mitigation activities that we could include. These will be distributed as soon as received.
- e. Kelly recommended breaking the next update of the Mitigation Plan up. It is becoming too large to manage the process and the document itself. She suggested that if we did individual plans, but still went through the process at the same time and in coordination we could still have the economy of scale by all utilizing the same consultant.

4. Jurisdictional Mitigation Strategy Assignment

- a. Each jurisdiction is responsible for updating their section of Chapter 7 of the plan and developing their own mitigation strategy/actions.
- b. This must be complete and all documents delivered to me by July 15. Each jurisdiction must update chapter 7 and complete the spreadsheet that describes any mitigation actions that were in the 2012 plan that were removed from this one, and the STAPLE\E spreadsheet.
- c. I will provide Microsoft Word versions of these sections as well as a table to detail any mitigation actions that appeared in the 2012 plan that are removed from this plan and a spreadsheet to facilitate the STAPLE\E ranking.

5. Public Input Process

- a. As part of our planning process we are required to provide two opportunities for public input on our plan. The regulations state (http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=44:1.0.1.4.53#se44.1.201_16):
 - (b) *Planning process. An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:*
 - (1) *An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;*
 - (2) *An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process; and*
 - (3) *Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information*
- b. As shown above, the regulations are relatively vague for how to receive public input. Per Witt, the general guidance from FEMA is that you advertise the document as you would other public documents in your jurisdiction. Each jurisdiction must check their regulations and report back by May 20.
 - i. It was proposed that we will advertise the plan from June 13-24. This was tabled until jurisdictions have an opportunity to review their own requirements.
 - ii. I will confirm with VDEM, but it is acceptable to post the plan on our websites and direct the public to review it.
- c. Each jurisdiction must request public input on the plan and will be responsible for providing documentation to me after the input process.
 - i. I contacted Debbie Messmer at VDEM as requested and she did say FEMA likes to see the plan advertised two different ways. She said that posting it on the website and advertising it via social media/blogs etc was acceptable. Forums like public meetings and posting in the library are also acceptable.
- d. Comments will be given to Witt for incorporation into the HIRA.
- e. We also need to provide an opportunity for stakeholders to review. This includes surrounding jurisdictions (D.C., Montgomery, Clarke, Fauquier, Stafford), VOAD,

educational facilities (schools, universities, and community colleges), and business partners.

- i. Provide list of who you would like me to email by May 20, I will send it to all of these stakeholders so it is easier to document who we sent it to.

Action Items:

Adam:

1. **Provide editable versions of the following documents to each jurisdiction by May 27:**
 - a. Chapter 7
 - b. STAPLE\E ranking spreadsheet
 - c. Table to document actions removed from this version of the plan

Group:

1. **Provide comments on the HIRA to Kelly by May 13.**
2. **Provide information to me on how long/how your jurisdiction will advertise the plan for public comment by May 20.**
3. **Provide contacts to review the HIRA, and completed Plan (late summer/early fall) to Adam by May 20 (reference Section 5e above).**
4. **Provide Completed Chapter 7, STAPLE\E and appendix table to Adam by July 15.**

Hazard Mitigation Plan December Meeting

5/10/2016

Northern Virginia Hazard Mitigation Plan Update

HAZARD IDENTIFICATION & RISK ASSESSMENT

REVIEW MEETING

MAY 10, 2016

Hazard Identification & Risk Assessment Update

WITT|O'BRIEN'S

What is a hazard identification & risk assessment (HIRA)?

- FEMA's *Local Mitigation Planning Handbook* (March 2013) breaks this section of the plan into four steps:
 1. Describe hazards
 2. Identify community assets
 3. Analyze risks
 4. Summarize vulnerability

Risk assessment update

- No requirements exist as to the methodology used for risk assessments, so long as the criteria in 44 CFR §201.6 are met
- We used the same methodologies to update the risk assessment as are used in the 2010 plan:
 - Exposure analysis
 - Historical analysis
 - Scenario analysis
- The updated HIRA used both GIS and HAZUS-MH 3.1, where appropriate

Risk assessment methodology

- The risk assessment methodology used in the 2016 update is the same or very similar as the methodology used in the 2010 update
- This methodology is primarily based on the use of NCDC data (where applicable and appropriate), with other data input as necessary to fill gaps
- Where applicable and appropriate, GIS and HAZUS-MH (version 3.1) were also used, just as in the 2010 update

Risk assessment methodology description

“CGIT and VDEM developed a standardized methodology to compare different hazards’ risk on a jurisdictional basis. As some of the hazards assess in this plan did not have a precisely quantifiable probability or impact data, a semi-quantitative scoring system was used to compare all of the hazards. This method prioritized hazard risk based on a blend of quantitative factors from the available data. A number of parameters have been considered in this methodology, all of which could be derived from the NCDC dataset:

- History occurrence
- Vulnerability of people in the hazard area;
- Probably geographic extent of the hazard area; and
- Historical impact, in terms of human lives and property.” (2010 NOVA HMP, p. 82)

Risk assessment methodology description

“The ranking methodology tries to balance these factors, whose reliability varies from hazard to hazard due to the nature of the underlying data. Each parameter was rated on a scale of one through four.... These scores are summed at the jurisdictional level for each hazard separately, permitting comparison between jurisdictions for each hazard type. A summation of all the scores from all hazards in each jurisdiction provides an overall all-hazards risk prioritization.” (2010 NOVA HMP, pp. 82-3)

Process for HIRA Update

- Starting point: data, sources, and calculations in the 2010 update
- Added data from October 2009-December 2015 to HIRA:
 - Occurrences
 - Impacts
 - Vulnerabilities
- Data obtained from:
 - Federal: NCDC, FEMA, USACE (National Inventory of Dams), Forest Service
 - State: forestry
 - Local: user reports
 - Other: media accounts

Process for HIRA Update (continued)

- Recreated/created GIS products with updated data
 - Locally-provided assets were included
 - Where appropriate, GIS products were created for each hazard and each jurisdiction
 - The individual jurisdiction maps are in the appendix, as there are approximately 200 of them
- Recreated HAZUS-MH models with updated runs (HAZUS-MH v.3.1 and ArcGIS 10.2)
 - Three models: flood, hurricane wind, & earthquake
 - Default assets were included (due to time constraints caused by release date)
 - Variances in model output from last run, which was completed using HAZUS-MH 2.1 and ArcGIS 10
 - The individual reports and maps are in the appendix, as there are more than 100 of them

Process for HIRA Update (continued)

- Removed the majority of references to 2006 plan
 - Information was dated and no longer applicable
 - Methodology no longer applied
- Removed repetitive narrative
 - Largely methodology descriptions
- Reformatted to specifically include all participating jurisdictions
 - Though many sub-sections were consolidated where appropriate, noting jurisdictions included in narrative, to avoid extraneous text

HIRA Update: Remaining Tasks & Schedule

WITT|O'BRIEN'S

Remaining Tasks for HIRA Update

- Receipt and compilation of Committee comments
- Revisions to HIRA based on comments
 - Re-inserting Lewisburg data (Sorry, Lewisburg!)
- QA/QC of data and calculations
- Creation of HIRA summary tables
- Consolidation of HIRA files into single section (Chapter 4)
- QA/QC of document (i.e., tense, numbering, typos, formatting, etc.)
- Finalization of appendices for HIRA
- Delivery of HIRA and appendices to Adam

Estimated schedule for HIRA update completion

- April 22, 2016: Review Draft of Updated HIRA delivered to Committee for review/comment
- May 10, 2016: Presentation to Committee
- May 13, 2016: All Committee Review comments due to consultants
- June 03, 2016: Final Draft of Updated HIRA (and appendices) delivered
- June 2016-September 2017: Technical assistance/revisions (from public, VDEM, and FEMA reviews) as required

Contact information

WITT|O'BRIEN'S

Consultant contact information

- Kelly George, CFM – Project Manager/Senior Mitigation Planner:
 - kgeorge@wittobriens.com
- Hal Cohen – Subject Matter Expert
 - hcohen@wittobriens.com
- Erin Buchanan, CFM – Mitigation Planner/Data Management Specialist:
 - ebuchanan@wittobriens.com
- Jake Halley – GIS Specialist:
 - jhalley@wittobriens.com

Fairfax County Mitigation Strategy Session

5/26/2016

Name	Agency	Initials
Alvarez, Carmita	DAHS	
Baldwin, Sara K.	FCPA	
Barbiere, Marc	FCHD	<i>MB</i>
Batts, Dennis E.	DPWES	<i>DB</i>
Bilowus, Jonathan	HCD	
Bird Shrout, Cynthia	DPSC	
Black, Beverly	NCS	<i>BdB</i>
Braff, Evan L.	NCS	
Bui, Joseph L	DPWES	
Coyle, Regina	DPZ	
Dove, James	FMD	<i>JD</i>
Easley, Robert C.	HCD	
Erhard, Carol	HCD	
Flynn, Teri	RMD	
Green, Lynn S.	DPWES	<i>LLG</i>
Gregoire, Ian P.	Fire	<i>IG</i>
Guditus, Michael	OEM	
Habourn, Jesse	HCHD	<i>JH</i>
Hatfield, Doug	FMD	
Henry, Elizabeth	DFS	
Innocenti, Patricia	DPSM	
Johnson, Todd	FCPA	<i>TJ</i>
Kelly, Adam C.	OEM	
Lane, G. Michael	CSB	
Lay, Dean	FCPD	
Leduc, Leonise D.	HCD	
Liberman, Michael S.	DCCS	
Matos Candelario, Jansel	FMD	

Fairfax County Mitigation Strategy Session

5/26/2016

Hazard Mitigation Strategy

May 26, 2016

Mitigation Plan Overview

- Purpose
 - Requirement to apply for mitigation funds
 - Utilized in the Community Rating System which, in part determines our residents flood insurance rates.
- Overview
 - Public document
 - Local plan done regionally
 - 21 participating jurisdictions
 - 5 year cycle, last approved spring 2012 (but generally referred to as the 2010 plan)
- Project Timeline / Status
 - We plan to submit it to VDEM/FEMA in October at the latest
 - 2 rounds of public input, one in June, one early fall before submission

Significant changes in the 2017 plan

- The Northern Virginia Emergency Managers gave the planning team the committee the direction to remove the human caused hazards section of the plan.
- Regional Mitigation Actions are being removed and incorporated locally, if applicable.

Plan Components

1. Introduction
2. Planning Process
3. Regional Information (geography, climate, population, economy, land use and development etc...)
4. Hazard Identification and Risk Assessment (HIRA)
5. Capability Assessment
6. Regional Mitigation Strategy
7. **Executive Summaries (local mitigation activities)**
8. Plan Maintenance

HIRA Overview

- FEMA's *Local Mitigation Planning Handbook* (March 2013) breaks this section of the plan into four steps:
 1. Describe hazards
 2. Identify community assets
 3. Analyze risks
 4. Summarize vulnerability
- Listing of Hazards

Flood	Winter Storm	High Wind/Severe Storm	Tornado
Drought	Earthquake	Landslide	Wildfire
Geologic	Dam Failure	Extreme Temps	

Hazards Changes from 2010

- Extreme cold was removed from winter storm
- Extreme heat was removed from drought
- Extreme temperatures was added as a hazard (heat and cold)
- Rationales:
 - It's possible to have occurrences of extreme temperatures in the absence of other hazard events
 - Extreme cold is not necessarily a component of winter storm
 - Extreme heat is not necessarily a component of a drought

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration
Flood	Highly Likely	Critical	Moderate	6-12 hours	Less than one week
Winter Storm	Highly Likely	Critical	Moderate	6-12 hours	Less than one week
High Wind / Severe Storms	Highly Likely	Critical	Moderate	12-24 hours	Less than one week
Tornado	Highly Likely	Critical	Moderate	0-12 hours	Less than one week
Drought	Likely	Moderate	Moderate	3-6 months	More than one month
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than one week

Hazard	Probability	Impact	Spatial Extent	Warning Time	Duration
Landslide	Unlikely	Critical	Moderate	Less than 6 hours	Less than one week
Wildfire	Unlikely	Critical	Small	Less than 6 hours	Less than one week
Geologic (sinkholes / karst / land subsidence)	Very Low	Moderate	Low	6-12 hours	Less than one week
Dam Failure	Possible	Critical	Moderate	Less than 6 hours	Less than one week
Extreme Temps	Likely	Minor	Large	More than 24 hours	Less than one week

Mitigation Actions

- Mitigation activities should fit in the following categories.
 - Prevention
 - Property Protection
 - Natural Resource Protection
 - Structural Projects
 - Emergency Services
 - Public Education and Awareness
- **See Chapter 6 of the existing plan for more details**

Countywide Mitigation Recommendations

- **Outreach / Public Messaging**
- **Emergency Utilities / Generators**
- **Community Safe Rooms**

Hazard Mitigation Assistance

- Hazard Mitigation Grant Program – Assists in implementing long-term hazard mitigation measures following a Presidential major disaster declaration. Generally 15% of total Federal assistance provided to a state following a major disaster declaration
- Predisaster Mitigation Grant – Provides funds for hazard mitigation planning and projects on an annual basis
- Flood Mitigation Assistance Grant – Provides funds for projects to reduce or eliminate risk of flood damage to buildings that are insured under NFIP
- <http://www.fema.gov/hazard-mitigation-assistance>

Next Steps – What do I need to do?

- **Agencies need to provide an update for all actions in the 2010 plan**
 - Status – in progress, complete, no longer valid etc.
 - Brief comment/update on the action.
- **Develop new mitigation actions**
 - Provide me any new mitigation actions your agency thinks are appropriate. Include all of the information found in the 2010 mitigation actions handout.
 - I will distribute several other mitigation plans that may give you ideas.
 - **Provide all updates to me by June 24.**

Current Plan

- The current plan can be found here:

<http://www.fairfaxcounty.gov/oem/northern-virginia-hazard-mitigation-plan-2012final.pdf>

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

June 14, 2016

1:30 PM

Meeting Attendance:

Amelia Gagnon

Carrie Gonzalez

Robert Hoffower

Jake Kazele

Adam Kelly

Alexa Lenhart

David Morrison

Tom Polera

Stephen Thompson

1. Project Update

- a. HIRA Update – The draft HIRA has been delivered and all comments should be in by July 1 to pass along to Witt.
- b. Status of the rest of the plan – Drafts of the rest of the chapters of the plan are complete and Greg Zebrowski will be sending those out in the next week. You will have 3 weeks to review the documents and provide comments to Greg. For the most part, the documents were just updated to reflect current statistics etc, but the Plan Maintenance chapter is undergoing a significant update.
- c. Outreach – We are all responsible for advertising the plan to the public. Please provide all comments to Greg and me so we can pass them along to Witt. Please provide screen shots or other documentation of your outreach efforts. Remember to advertise the document in two ways, most jurisdictions are doing social media and a web site posting.
- d. Capability Assessment – If you have not completed this, please do it ASAP and provide it to Greg. Also attached to this email is a summary of who has completed it and other aspects of the plan.
- e. Jurisdictional Mitigation Action Plans – These are due July 15 to Greg. Please let Greg or me know ASAP if you have any questions. There were no questions on this process during the meeting. At the meeting we discussed deleting the annualized loss data from the jurisdictional executive summaries. There were no objections, I have attached the Fairfax County Executive Summary as an example. We will all be deleting the text in red (starting directly below the Hazard Ranking Table) and running down to the Action Plan. This information is in the HIRA and is repetitive. The information you need to update

the Hazard Ranking table is found on page 4-45 of the updated HIRA.

http://www.fairfaxcounty.gov/oem/mitigation/nova_hira - chapter 4 - final draft - 06.09.16.pdf

2. **Project Management Update** – I will be out of the office for 10 weeks this summer beginning Saturday, July 2 and running through early September. I will send you another note about this as the time gets a little closer. If you need anything related to hazard mitigation during my absence please contact Greg Zebrowski, 571-350-1297, or Gregory.zebrowski@fairfaxcounty.gov. You will start seeing him reaching out to you for things in the coming days (such as providing drafts of the other plan chapters).

Hazard Mitigation Plan Meeting

6/14/2016

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

July 12, 2016

1:30 PM

Meeting Attendance:

Walter English

Amelia Gagnon

Carrie Gonzalez

Mike Guditus

Robb Hoffower

Aaron Hope

Dan Janickey

Jake Kazele

Alexa Lenhart

Holly Montague

David Morrison

Tom Polera

Steve Thompson

Greg Zebrowski

Notes:

1. Roll Call

2. Project Update

- a. HIRA update: The draft HIRA has been delivered to Witt. They are updating the draft HIRA and expect to have the finalized draft returned by the first week of September.
- b. Status of the plan: Jurisdictions are still providing required data and updates for the plan and the Draft 2017 Hazard Mitigation plan is being compiled.
- c. Outreach: We are all responsible for advertising the plan to the public. Remember to advertise the document in two ways, most jurisdictions are doing social media and a web site posting.
- d. Capability Assessment: These are past due. If you have not submitted please submit to Greg as soon as possible. July 15. There were no questions on this process during the meeting.

- e. Jurisdictional Mitigation action plans: These are due July 15 to Greg. Please let Greg or me know ASAP if you have any questions. There were no questions on this process during the meeting.
- 3. Project Management Update: Greg Zebrowski, is now the project team lead for the Hazard Mitigation Plan project. . If you need anything related to hazard mitigation please contact Greg Zebrowski, 571-350-1297, or Gregory.zebrowski@fairfaxcounty.gov. You will start seeing him reaching out to you for things in the coming days (such as providing drafts of the other plan chapters).
- 4. Adjournment

Action Items:

- 1. Executive summary/ Action plan is due by July 15

Hazard Mitigation Plan Meeting

7/12/2016

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

August 9, 2016

1:30 PM

Meeting Attendance:

Walter English

Amelia Gagnon

Carrie Gonzalez

Robb Hoffower

Aaron Hope

Dan Janickey

Kevin Johnson

Holly Montague

David Morrison

Tom Polera

Steve Thompson

Richard West

Greg Zebrowski

Notes:

1. Roll Call
2. Project Update
 - a. Overdue jurisdiction status: At this time 2 jurisdictions are overdue in submitting their data to Greg Zebrowski. They are aware they are overdue and Greg Zebrowski will be working with them to get things submitted as soon as possible.
 - b. Status of the plan: The draft HIRA has been delivered to Witt. They are updating the draft HIRA and expect to have the finalized draft returned by the first week of September. Jurisdictions are still providing required data and updates for the plan and the Draft 2017 Hazard Mitigation plan is being compiled.
 - c. Outreach: The group was reminded they are all responsible for advertising the plan to the public. Remember to advertise the document in two ways, most jurisdictions are doing social media and a web site posting.

3. Project Management Update: Greg Zebrowski, is now the project team lead for the Hazard Mitigation Plan project. . If you need anything related to hazard mitigation please contact Greg Zebrowski, 571-350-1297, or Gregory.zebrowski@fairfaxcounty.gov.
4. Questions and comments: There were no questions or comments from the group.
5. Adjournment

Action Items:

1. Work with overdue jurisdictions to complete required work

Hazard Mitigation Plan Meeting

8/9/2016

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

September 13, 2016

1:30 PM

Meeting Attendance:

Walter English
Amelia Gagnon
Carrie Gonzalez
Mike Guditus
Robb Hoffower
Dan Janickey
Kirstyn Jovanovich
Alexa Lenhart
Holly Montague
David Morrison
Ray Whatley
Greg Zebrowski

Notes:

1. Roll Call
2. Project Update
 - a. Jurisdiction status: Question was asked if the jurisdictions are still looking to have the plan finalized to present to their political body by February. All jurisdictions agreed February is the required timeframe.
 - b. Status of the plan: The draft HIRA has been delivered from Witt and is being incorporated into the plan. Jurisdictions are still providing required data and updates for the plan and the Draft 2017 Hazard Mitigation plan is being compiled. The draft plan will be compiled and delivered to the jurisdictions to outreach on September 16.
 - c. Outreach: The group was reminded they are all responsible for advertising the plan to the public. Remember to advertise the document in two ways, most jurisdictions are doing social media and a web site posting.

3. Project Management Update: Greg Zebrowski, is now the project team lead for the Hazard Mitigation Plan project. . If you need anything related to hazard mitigation please contact Greg Zebrowski, 571-350-1297, or Gregory.zebrowski@fairfaxcounty.gov.
4. Questions and comments: There were no questions or comments from the group.
5. Adjournment

Action Items:

1. Work with overdue jurisdictions to complete required work
2. Deliver the draft plan to jurisdictions by September 16
3. Jurisdiction need to send screenshots of the draft plan outreach efforts. This is a required element for the final plan.

Hazard Mitigation Plan Meeting

9/13/2016

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

December 13, 2016

1:30 PM

Meeting Attendance:

Walter English
Robb Hoffower
Dan Janickey
Holly Montague
David Morrison
Tom Polera
Stephen Thompson
Greg Zebrowski

Notes:

1. Roll Call
2. Project Update
 - a. Status of the plan: The Hazard Mitigation Plan has been submitted to the state in November for the State and Region review. The state completed their review and the draft plan was submitted to FEMA Region III for review and approval.
 - b. Jurisdiction status: Question was asked if the jurisdictions are still looking to have the plan finalized to present to their political body by February. All jurisdictions agreed February is the required timeframe. Jurisdictions also asked for standardized talking points.
3. Questions and comments: There were no questions or comments from the group.
4. Adjournment

Action Items:

1. Work with overdue jurisdictions to complete required work
2. Develop standardized talking points

Hazard Mitigation Plan Meeting

12/13/2016

Name	Agency	Initials
Christman, Amanda	Town of Clifton	
English, Walter	City of Fairfax	on phone
Gagnon, Amelia	City of Manassas	
George, Kelly	Witt O'Briens	
Gonzalez, Carrie	VDEM	
Guditus, Michael	Fairfax County	
Hoffower, Robert	VDEM	on phone
Hope, Aaron	City of Alexandria	
Janickey, Dan	Town of Vienna	on phone
Johnson, Kevin	Loudoun County	
Jovanovich, Kirstyn	Town of Occoquan	
Kazele, Jake	VDEM	
Lenhart, Alexa	Prince William County	
Montague, Holly	Town of Haymarket	on phone
Morrison, David	Arlington County	on phone
Polera, Tom	City of Falls Church	on phone
Smedley, Corey	City of Alexandria	
Teevan, Francis	City of Manassas	
Thompson, Stephen	Town of Herndon	on phone
West, Richard	Town of Dumfries	
Whatley, Ray	City of Alexandria	
Zebrowski, Greg	Fairfax County	on phone host GJ

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

January 10, 2017

1:30 PM

Meeting Attendance:

Walter English

Amelia Gagnon

Dan Janickey

Kevin Johnson

Kirstyn Jovanovich

Holly Montague

Tom Polera

Katie Smith

Stephen Thompson

Ray Whatley

Greg Zebrowski

Notes:

1. Roll Call
2. Project Update
 - a. State review was completed: VDEM completed their review of the draft plan on November 14, 2016 with no comment and submitted the plan to FEMA Region III on the same date.
 - b. FEMA Region III review was completed: The draft HazMit was delivered from VDEM to FEMA on November 14, 2016. The Draft 2017 Hazard Mitigation plan review was completed and FEMA returned the Northern Virginia PDC Plan Review Tool. The review was sent to the committee for their review.
3. The Northern Virginia PDC Plan Review Tool demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.
4. Work Assignments: The committee was assigned the task of completing the NFIP survey as a required element of the 2017 Hazard Mitigation Plan.
5. Questions and comments: There were no questions or comments from the group.

6. Adjournment

Action Items:

1. Work with overdue jurisdictions to complete required work
2. Jurisdictions must complete the NFIP survey
3. Complete development of the standardized talking points

Hazard Mitigation Plan Meeting

1/10/2017

Name	Agency	Initials
Christman, Amanda	Town of Clifton	withdrawn
English, Walter	City of Fairfax	
Gagnon, Amelia	City of Manassas	on phone
George, Kelly	Witt O'Briens	
Gonzalez, Carrie	VDEM	excused
Guditus, Michael	Fairfax County	
Hoffower, Robert	VDEM	excused
Hope, Aaron	City of Alexandria	
Janickey, Dan	Town of Vienna	on phone
Johnson, Kevin	Loudoun County	on phone
Jovanovich, Kirstyn	Town of Occoquan	on phone
Kazele, Jake	VDEM	excused
Lenhart, Alexa	Prince William County	
Montague, Holly	Town of Haymarket	on phone
Morrison, David	Arlington County	
Polera, Tom	City of Falls Church	excused/joining phone
Smedley, Corey	City of Alexandria	
Teevan, Francis	City of Manassas	
Thompson, Stephen	Town of Herndon	on phone
West, Richard	Town of Dumfries	
Whatley, Ray	City of Alexandria	on phone
Zebrowski, Greg	Fairfax County	gf
Katie Smith	Prince William	on phone

Northern Virginia Hazard Mitigation Plan Status Update

Meeting Notes

February 14, 2017

1:30 PM

Meeting Attendance:

Walter English
Amelia Gagnon
Dan Janickey
Kevin Johnson
Kirstyn Jovanovich
Holly Montague
David Morrison
Tom Polera
Katie Smith
Stephen Thompson
Ray Whatley
Greg Zebrowski

Notes:

1. Roll Call
2. Project Update
 - a. FEMA Region III review was completed: The draft HazMit was delivered from VDEM to FEMA on November 14, 2016. The Draft 2017 Hazard Mitigation plan review was completed and FEMA returned the Northern Virginia PDC Plan Review Tool. The review was sent to the committee for their review.
3. Work Assignments: The committee was assigned the task of completing the NFIP survey as a required element of the 2017 Hazard Mitigation Plan. Most Jurisdictions have completed the survey but a few still need to submit.
4. Presentation for your Jurisdictional leadership: Fairfax County is putting together a PowerPoint presentation to share with the other Committee members. This presentation will be sent out as soon as it is approved by Senior Leadership.
5. Questions and comments: There were no questions or comments from the group.
6. Adjournment

Action Items:

1. Work with overdue jurisdictions to complete required work
2. Send Presentation and Adoption Agreement to Jurisdictions
3. Complete development of the standardized talking points

Hazard Mitigation Plan Meeting

2/14/2017

Name	Agency	Initials
Christman, Amanda	Town of Clifton	
English, Walter	City of Fairfax	On phone
Gagnon, Amelia	City of Manassas	On phone
George, Kelly	Witt O'Briens	N/A
Gonzalez, Carrie	VDEM	Excused
Guditus, Michael	Fairfax County	Excused
Hoffower, Robert	VDEM	Excused
Hope, Aaron	City of Alexandria	HN
Janickey, Dan	Town of Vienna	excuse
Johnson, Kevin	Loudoun County	on phon
Jovanovich, Kirstyn	Town of Occoquan	On phon
Kazele, Jake	VDEM	excused
Lenhart, Alexa	Prince William County	
Montague, Holly	Town of Haymarket	on phone
Morrison, David	Arlington County	DM
Polera, Tom	City of Falls Church	on phon
Smedley, Corey	City of Alexandria	Excused
Teevan, Francis	City of Manassas	Excused
Thompson, Stephen	Town of Herndon	excused
West, Richard	Town of Dumfries	
Whatley, Ray	City of Alexandria	On phone
Zebrowski, Greg	Fairfax County	
Smith, Katie	Prince William County	KS

APPENDIX D

HAZARD IDENTIFICATION AND RISK ASSESSMENT INFORMATION

APPENDIX D

Critical Assets – All Jurisdictions

Arlington County Critical Assets

Critical Asset	Jurisdiction	Tornado Scenario .25 Mile Buffer	SFHA 100 Year	SFHA 500 Year	WFP Class	Asset Values	Content Values
ΓÇ£Super StopΓÇ¥	Arlington County	No	No	No	Non-burnable	\$250,000	\$0
Activated Sludge Effluent Pump Station 1 - ASE1	Arlington County	Yes	No	Yes	Water	\$4,276,200	\$0
Advance Backwash Building - ABWB	Arlington County	Yes	No	No	Non-burnable	\$4,603,600	\$0
Alcove Heights - Restrooms	Arlington County	No	No	No	Very Low	\$109,000	\$0
Alcove Heights Park	Arlington County	No	No	No	Very Low	\$124,800	\$0
Animal Welfare League	Arlington County	No	No	Yes	Very Low	\$0	\$0
ANSER	Arlington County	No	No	No	Non-burnable	\$0	\$2,575,000
Argus House	Arlington County	No	No	No	Non-burnable	\$990,500	\$135,000
Arlington Arts Center	Arlington County	No	No	No	Non-burnable	\$1,906,400	\$45,000
Arlington Children's Center	Arlington County	No	No	No	Non-burnable	\$548,800	\$0
Arlington Hall West Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Arlington Heights Park	Arlington County	No	No	No	Very Low	\$0	\$5,000
Arlington Mill Community Center	Arlington County	No	No	No	Very Low	\$22,000,000	\$2,000,000
Arlington Transit Bur	Arlington County	Yes	No	No	Non-burnable	\$0	\$10,000
Art Bus Office	Arlington County	Yes	No	No	Non-burnable	\$46,233	\$0
Art Bus Shed	Arlington County	Yes	No	No	Non-burnable	\$13,700	\$0
ARTISPHERE	Arlington County	No	No	No	Very Low	\$0	\$5,586,713
Aurora Hills Library / Aurora Hills Community Center & Senior Center	Arlington County	Yes	No	No	Very Low	\$3,636,200	\$2,535,000
Bailey's Branch Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Ballston Garage	Arlington County	No	No	No	Non-burnable	\$58,384,500	\$0
Ballston Plaza III	Arlington County	Yes	No	No	Non-burnable	\$0	\$2,575,000
Ballston Plaza Place	Arlington County	No	No	No	Non-burnable	\$0	\$2,935,500
Barcroft Park	Arlington County	No	No	Yes	Non-burnable	\$1,000,000	\$0
Barcroft Park - Bike Shop	Arlington County	No	No	Yes	Non-burnable	\$52,000	\$25,750
Barcroft Park - Concessions	Arlington County	No	No	Yes	Non-burnable	\$169,400	\$5,000
Barcroft Park - Greenhouse	Arlington County	No	No	Yes	Non-burnable	\$78,000	\$5,150
Barcroft Park - Metal Storage Building	Arlington County	No	No	Yes	Non-burnable	\$5,200	\$2,060
Barcroft Park - Nursery Shop	Arlington County	No	No	Yes	Non-burnable	\$52,000	\$20,600
Barcroft Park - Parking Deck	Arlington County	No	No	Yes	Non-burnable	\$4,946,500	\$5,000

Arlington County Critical Assets

Barcroft Park - Picnic Shelter #1	Arlington County	No	No	Yes	Non-burnable	\$75,000	\$0
Barcroft Park - Restrooms	Arlington County	No	No	Yes	Non-burnable	\$213,900	\$0
Barcroft Park - Synthetic field	Arlington County	No	No	Yes	Non-burnable	\$0	\$0
Barcroft Sports & Fitness Ctr.	Arlington County	No	No	No	Non-burnable	\$4,379,200	\$415,000
BB&T	Arlington County	No	No	No	Non-burnable	\$0	\$2,575,000
Benjamin Banneker Park	Arlington County	No	Yes	No	Non-burnable	\$0	\$0
Big Walnut Park	Arlington County	No	No	No	Very Low	\$0	\$0
Biological Sludge Processing Building - BIO / Household Hazardous Waste Disposal Point - HHW	Arlington County	Yes	No	No	Very Low	\$15,454,976	\$206,000
Bluemont Junction Park - Caboose	Arlington County	Yes	No	No		\$81,600	\$2,000
Bluemont Park	Arlington County	No	No	No	Very Low	\$0	\$0
Bluemont Park - Picnic shelter	Arlington County	No	Yes	No	Very Low	\$260,700	\$2,575,000
Bluemont Park - Reeves Property	Arlington County	No	No	No	Very Low	\$282,400	\$25,000
Bluemont Park - Restrooms	Arlington County	No	Yes	No	Very Low	\$52,000	\$0
Bluemont Park - Shelter	Arlington County	No	No	No	Very Low	\$217,500	\$0
Bon Air Park	Arlington County	No	No	No	Very Low	\$0	\$0
Bon Air Park - Pesticide Storage Building	Arlington County	No	No	No	Very Low	\$26,000	\$5,150
Bon Air Park - Picnic Shelter	Arlington County	No	No	No	Very Low	\$90,000	\$0
Bon Air Park - Restrooms	Arlington County	No	No	No	Very Low	\$31,200	\$0
Bus shelters (98)	Arlington County	No	No	No	Non-burnable	\$153,184	\$0
Butler Holmes Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Cable TV Equip	Arlington County	No	No	No	Non-burnable	\$0	\$927,000
Capital Hospice / Hospice of Northern Virginia	Arlington County	No	No	No	Non-burnable	\$0	\$0
Carlin Hall Community Center	Arlington County	No	No	No	Non-burnable	\$387,100	\$45,000
Carver Community Center	Arlington County	No	No	No	Very Low	\$0	\$50,000
Carver Park	Arlington County	No	No	No	Very Low	\$0	\$0
Central Library	Arlington County	No	No	No	Very Low	\$12,055,600	\$11,600,000
Charles E. Stewart Park	Arlington County	No	No	No	Very Low	\$0	\$0
Cherrydale Branch Library	Arlington County	No	No	No	Very Low	\$990,400	\$1,200,000
Cherryvale Park	Arlington County	No	No	No	Non-burnable	\$0	\$0

Arlington County Critical Assets

Chestnut Hills Park	Arlington County	No	No	No	Very Low	\$0	\$0
Clarendon Central Park	Arlington County	No	No	No	Very Low	\$0	\$0
Clarendon House	Arlington County	No	No	No	Very Low	\$457,300	\$75,000
Clarendford Station Park	Arlington County	Yes	No	No	Low	\$0	\$0
Clarmount Mini Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Columbia Pike Branch Library	Arlington County	No	No	No	Non-burnable	\$0	\$1,815,281
Community Residence	Arlington County	No	No	No	Non-burnable	\$389,900	\$25,500
Computer Software	Arlington County	No	No	No	Non-burnable	\$0	\$9,391,200
Computers	Arlington County	No	No	No	Non-burnable	\$0	\$0
Court Square West	Arlington County	No	No	No	Non-burnable	\$10,770,300	\$1,700,000
Court Square West - Back-up 911 Center	Arlington County	No	No	No	Non-burnable	\$0	\$6,386,000
Courthouse and Police Building	Arlington County	No	No	No	Non-burnable	\$91,642,100	\$10,300,000
Courthouse and Police Building -911 Center	Arlington County	No	No	No	Very Low	\$0	\$7,807,400
Courthouse Plaza	Arlington County	No	No	No	Very Low	\$0	\$11,985,270
Courthouse Plaza	Arlington County	No	No	No	Very Low	\$0	\$2,575,000
Culpepper Garden Senior Center	Arlington County	No	No	No	Very Low	\$0	\$25,853
Nastos	Arlington County	No	No	No	Non-burnable	\$597,800	\$25,000
DES Traffic Engineering / Solid Waste Bureau	Arlington County	No	No	No	Non-burnable	\$1,954,300	\$275,000
Detention Facility	Arlington County	No	No	No	Very Low	\$103,217,800	\$8,300,000
Dewatering Building - DWB	Arlington County	Yes	No	No	Non-burnable	\$41,152,600	\$47,100
DHS Headquarters	Arlington County	No	No	No	Very Low	\$0	\$4,236,000
Dissolved Air Floatation Building - DAFT	Arlington County	Yes	No	No	Very Low	\$8,440,000	\$155,000
Distribution Center No. 5 -DSB-5	Arlington County	Yes	No	No	Non-burnable	\$824,230	\$0
Doctor's Run Park	Arlington County	No	No	No	Very Low	\$0	\$0
Donaldson Run Pump Station - DON	Arlington County	Yes	No	No	Very Low	\$389,400	\$1,171,200
Douglas Park	Arlington County	No	No	No	Very Low	\$0	\$0
Dover Run Pump Station - DOV	Arlington County	No	No	No	Very Low	\$132,800	\$669,900
Drew Community Center	Arlington County	No	No	No	Non-burnable	\$0	\$47,174
Drew Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Drewry Center	Arlington County	No	No	No	Very Low	\$5,070,500	\$350,000
Eads Park	Arlington County	Yes	No	No	Non-burnable	\$0	\$0

Arlington County Critical Assets

East Falls Church Park	Arlington County	No	No	No	Very Low	\$0	\$0
East Mixed Liquor Flow Distribution Structure - Building #33- EMLFDS	Arlington County	Yes	No	Yes	Non-burnable	\$5,250,000	\$0
East Tunnel Access Building - ETAB	Arlington County	Yes	No	No	Very Low	\$0	\$0
Edison Park	Arlington County	Yes	No	No		\$0	\$0
Electrical Distribution Center #1 (DC#1)	Arlington County	Yes	No	No	Very Low	\$900,000	\$0
Ethan Allen Pump Station	Arlington County	No	No	No	Non-burnable	\$1,407,500	\$0
Fairlington Community Center	Arlington County	No	No	No	Non-burnable	\$5,024,900	\$185,000
Fences & Lights	Arlington County	No	No	No	Non-burnable	\$0	\$0
Fenwick Center	Arlington County	No	No	No	Non-burnable	\$3,221,900	\$100,000
Fillmore Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Filtration and Disinfection Facility / Sodium Hypochlorite Facility	Arlington County	Yes	No	No	Non-burnable	\$49,676,600	\$0
Fire Academy	Arlington County	No	No	No	Non-burnable	\$1,705,200	\$85,200
Fire Academy Fire Tower	Arlington County	No	No	No	Non-burnable		\$50,000
Fire Academy Three Bay Tent	Arlington County	No	No	No	Non-burnable	\$170,000	\$40,000
Fire Academy Two Bay Tent	Arlington County	No	No	No	Non-burnable	\$60,000	\$20,000
Fire Station 1	Arlington County	No	No	No	Low	\$2,396,900	\$125,000
Fire Station 10	Arlington County	No	No	No	Non-burnable	\$1,902,600	\$95,000
Fire Station 2	Arlington County	Yes	No	No	Non-burnable	\$1,999,200	\$115,000
Fire Station 3	Arlington County	No	No	No	Non-burnable	\$3,000,000	\$175,000
Fire Station 4	Arlington County	No	No	No	Low	\$4,401,100	\$145,000
Fire Station 5	Arlington County	Yes	No	No	Very Low	\$5,209,500	\$210,000
Fire Station 6	Arlington County	No	No	No	Very Low	\$0	\$0
Fire Station 7	Arlington County	No	No	No	Low	\$463,100	\$25,000
Fire Station 8	Arlington County	No	No	No	Very Low	\$1,345,400	\$75,000
Fire Station 9	Arlington County	No	No	No	Very Low	\$2,423,400	\$123,500
Flow Equalization Tanks 1, 2, and 3	Arlington County	Yes	No	No	Non-burnable	\$23,616,600	\$0
FMR meter vault	Arlington County	Yes	No	Yes	Non-burnable	\$49,920	\$1,833,456
Foam Collection Pumping Station Building - FCPS #33	Arlington County	Yes	No	Yes	Non-burnable	\$7,052,100	\$0
Former Thrifty Car Rental Site	Arlington County	Yes	No	No	Non-burnable	\$208,900	\$0
Fort Bernard Park	Arlington County	No	No	No	Non-burnable	\$0	\$0

Arlington County Critical Assets

Fort Bernard Park - Shelter	Arlington County	No	No	No	Non-burnable	\$20,000	\$0
Fort Bernard Pump Station	Arlington County	No	No	No	Very Low	\$1,290,700	\$0
Fort Bernard Pumping Station - Reservoir	Arlington County	No	No	No	Very Low	\$0	\$0
Fort CF Smith - Caretaker Cottage	Arlington County	No	No	No	Non-burnable	\$108,400	\$25,000
Fort CF Smith - Main House	Arlington County	No	No	No	Non-burnable	\$634,000	\$55,000
Fort CF Smith - Tractor Shed and Cottage	Arlington County	No	No	No	Non-burnable	\$74,000	\$12,000
Fort Ethan Allen Park	Arlington County	No	No	No	Non-burnable	\$3,120	\$0
Fort Myer Heights Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Fort Scott Park	Arlington County	Yes	No	No	Very Low	\$0	\$0
Fort Scott Park - Restrooms	Arlington County	Yes	No	No	Very Low	\$0	\$0
Fort Scott Park - Shelter	Arlington County	Yes	No	No	Very Low	\$43,000	\$0
Four Mile Run Pumping Station - FMRL	Arlington County	Yes	No	No	Very Low	\$8,226,900	\$75,000
Foxcroft Heights Park	Arlington County	No	No	No	Very Low	\$0	\$0
Fraser Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Fueling Station	Arlington County	No	No	No	Very Low	\$994,500	\$0
Gallery at the Ellipse	Arlington County	Yes	No	No	Very Low	\$0	\$46,350
Gateway Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
George Mason Center	Arlington County	No	No	No	Non-burnable	\$3,585,800	\$100,000
Glebe Road Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Glen Carlyn Branch Library	Arlington County	No	No	No	Non-burnable	\$659,200	\$1,125,000
Glen Carlyn Park	Arlington County	Yes	Yes	No	Non-burnable	\$0	\$0
Glen Carlyn Park - Restrooms	Arlington County	Yes	Yes	No	Non-burnable	\$93,000	\$0
Glen Carlyn Park - Shelter 1	Arlington County	Yes	Yes	No	Non-burnable	\$72,800	\$0
Glen Carlyn Park - Shelter 2	Arlington County	Yes	Yes	No	Non-burnable	\$72,800	\$0
Greenbrier - Bleachers	Arlington County	No	No	No	Non-burnable	\$0	\$0
Greenbrier - Synthetic field	Arlington County	No	No	No	Non-burnable	\$0	\$0
Greenbrier Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Greenbrier Park - Baseball Concessions	Arlington County	No	No	No	Non-burnable	\$63,232	\$0
Greenbrier Park - Press box / Softball Concessions	Arlington County	No	No	No	Non-burnable	\$30,784	\$0
Greenbrier Park - Pressbox	Arlington County	No	No	No	Very Low	\$70,400	\$15,000
Greenbrier Park - Restrooms	Arlington County	No	No	No	Very Low	\$298,200	\$0
Greenbrier Park - Stadium Concessions	Arlington County	No	No	No	Non-burnable	\$110,900	\$15,000

Arlington County Critical Assets

Greenbrier Park - Ticket booth	Arlington County	No	No	No	Non-burnable	\$51,584	\$0
Guard House Booth - Salt	Arlington County	No	No	No	Non-burnable	\$7,800	\$0
Gulf Branch County Park	Arlington County	No	No	No	Very Low	\$0	\$0
Gulf Branch Nature Center - Blacksmith	Arlington County	No	No	No	Very Low	\$15,600	\$3,090
Gulf Branch Nature Center - Log Cabin	Arlington County	No	No	No	Very Low	\$52,000	\$22,660
Gulf Branch Nature Center Main - Building	Arlington County	No	No	No	Very Low	\$582,300	\$25,000
Gulf Run Pump Station - GRPS	Arlington County	No	No	No	Very Low	\$316,700	\$1,389,100
Gunston Bubble	Arlington County	No	No	No	Non-burnable	\$310,700	\$45,000
Gunston Community Center and Theater Props	Arlington County	No	No	No	Very Low	\$0	\$200,000
Gunston Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Gunston Park - Synthetic field	Arlington County	No	No	No	Non-burnable	\$0	\$0
Haley Park	Arlington County	No	No	No	Very Low	\$0	\$0
Hayes Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Hayes Park - Shelter	Arlington County	No	No	No	Non-burnable	\$169,000	\$0
Henry Clay Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
High View Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Highview Park - Restrooms	Arlington County	No	No	No	Non-burnable	\$5,200	\$0
Hillside Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Homeless Shelter and Offices	Arlington County	No	No	No	Non-burnable	\$1,445,800	\$75,000
Human Services Facility	Arlington County	No	No	No	Non-burnable	\$2,258,200	\$0
Human Services Facility	Arlington County	No	No	No	Non-burnable	\$1,479,800	\$105,000
Human Services Facility - Lab	Arlington County	No	No	No	Non-burnable	\$349,900	\$0
I-66 Parking Garage	Arlington County	No	No	No	Non-burnable	\$5,000,000	\$0
Independence House	Arlington County	No	No	No	Non-burnable	\$702,000	\$35,000
Jennie Dean Park	Arlington County	No	No	Yes	Non-burnable	\$0	\$0
Jennie Dean Park - Shelter and Restrooms	Arlington County	No	No	Yes	Non-burnable	\$159,800	\$0
Kirby Lithographic Building	Arlington County	Yes	No	No	Non-burnable	\$3,436,000	\$100,000
Kirkwood Run Pump Station - KWPS	Arlington County	No	No	No	Non-burnable	\$823,400	\$0
Lacey Woods - Shelter	Arlington County	No	No	No	Non-burnable	\$83,800	\$2,000
Lacey Woods - Shelter and Restrooms	Arlington County	No	No	No	Non-burnable	\$150,900	\$0

Arlington County Critical Assets

Lacey Woods Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Langston Brown Rec. Ctr.	Arlington County	No	No	No	Non-burnable	\$0	\$130,810
Lee Community Center	Arlington County	No	No	No	Non-burnable	\$1,543,000	\$110,000
Lee Pumping Station	Arlington County	No	No	No	Very Low	\$1,681,300	\$0
Lee Pumping Station #1	Arlington County	No	No	No	Very Low	\$0	\$0
Lee Pumping Station - Building under elevated tank	Arlington County	No	No	No	Very Low	\$20,800	\$0
Lee Pumping Station - Com. Building	Arlington County	No	No	No	Very Low	\$0	\$2,575,000
Lee Pumping Station - Elevated tank / 500,000 gallon	Arlington County	No	No	No	Very Low	\$0	\$0
Lee Pumping Station # 2	Arlington County	No	No	No	Very Low	\$0	\$0
Little Falls Booster Station	Arlington County	No	Yes	No	Non-burnable	\$1,641,400	\$0
Long Branch Nature Center	Arlington County	Yes	No	No	Non-burnable	\$473,300	\$35,500
Long Bridge Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Long Bridge Park - Maintenance	Arlington County	No	No	No	Non-burnable	\$357,068	\$5,000
Long Bridge Park - North Restrooms	Arlington County	No	No	No	Non-burnable	\$357,859	\$0
Long Bridge Park - South Restrooms	Arlington County	No	No	No	Non-burnable	\$357,859	\$0
Long Bridge Park - Synthetic fields	Arlington County	No	No	No	Non-burnable	\$0	\$0
Low Level Pump Station	Arlington County	Yes	No	Yes	Non-burnable	\$508,700	\$0
Lubber Run Park	Arlington County	Yes	No	No	Very Low	\$0	\$0
Lubber Run Park - Amphitheatre	Arlington County	Yes	No	No	Non-burnable	\$31,200	\$5,000
Lubber Run Park - Pavilion	Arlington County	Yes	No	No	Very Low	\$50,000	\$0
Lubber Run Park - Restrooms	Arlington County	Yes	No	No	Very Low	\$20,000	\$0
Lubber Run Recreation Center	Arlington County	Yes	No	No	Very Low	\$2,332,000	\$105,000
Lucky Run Meter Station - LRMS	Arlington County	No	No	Yes	Non-burnable	\$35,360	\$170,156
Lyon Village Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Lyon Village Park - Shelter	Arlington County	No	No	No	Non-burnable	\$41,600	\$0
Madison Community Center	Arlington County	No	No	No	Non-burnable	\$4,328,500	\$55,000
Madison Manor	Arlington County	No	No	No	Non-burnable	\$0	\$0
Madison Manor - Restrooms	Arlington County	No	No	No	Non-burnable	\$41,600	\$0
Madison Manor - Shelter	Arlington County	No	No	No	Non-burnable	\$31,200	\$0

Arlington County Critical Assets

Marcey Creek Pump Station - MCPS	Arlington County	No	No	No	Non-burnable	\$5,491	\$226,453
Marcey Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Maury Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Maywood Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Meter Repair	Arlington County	No	No	No	Non-burnable	\$0	\$0
Methanol Feed Facility	Arlington County	Yes	No	No	Non-burnable	\$3,086,500	\$0
Metro Tunnel	Arlington County	No	No	No	Non-burnable	\$8,131,900	\$0
Minor Hill Pump Station	Arlington County	No	No	No	Non-burnable	\$1,420,500	\$0
Minor Hill Pump Station - Reservoirs	Arlington County	No	No	No	Non-burnable	\$0	\$0
Monroe Park	Arlington County	No	No	No	Very Low	\$0	\$0
Motorola Building	Arlington County	No	No	Yes	Non-burnable	\$717,700	\$25,000
NAC II	Arlington County	No	No	No	Non-burnable	\$4,000,000	\$1,500,000
National Center Ejector Station - NCES	Arlington County	Yes	No	No	Non-burnable	\$805,400	\$0
Nauck Park	Arlington County	No	No	No	Very Low	\$24,000	\$0
Nelly Custis Park	Arlington County	Yes	No	No	Non-burnable	\$0	\$0
New Maintenance Building - NMB	Arlington County	Yes	No	No	Very Low	\$9,567,234	\$500,000
North Ferric Facility (NFF)	Arlington County	Yes	No	Yes	Non-burnable	\$6,793,800	\$0
North Side Salt Storage Tank	Arlington County	No	No	No	Very Low	\$301,400	\$0
Nottingham Park	Arlington County	No	No	No	Very Low	\$0	\$0
Oak Grove Park	Arlington County	No	No	No	Very Low	\$0	\$0
Oakland Mini Park	Arlington County	No	No	No	Very Low	\$0	\$0
Old Scale House	Arlington County	No	No	No	Very Low	\$10,000	\$0
Old Signature Theater	Arlington County	No	No	Yes	Very Low	\$1,649,700	\$0
Old Vehicle Repair Building (Storage)	Arlington County	No	No	No	Very Low	\$1,025,200	\$300,000
Operations Control Building - OCB	Arlington County	Yes	No	Yes	Non-burnable	\$15,997,700	\$56,100
Paint and Sandblast Building - PB	Arlington County	Yes	No	No	Very Low	\$82,400	\$10,000
Palisades Pump Station - PAL	Arlington County	No	No	No	Non-burnable	\$5,491	\$1,724,844
Parkhurst Park	Arlington County	No	No	No	Very Low	\$0	\$0
Parks & Recreation Cultural Resource Center	Arlington County	No	No	Yes	Very Low	\$8,529,400	\$3,300,000
Penrose Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Police Impoundment Building	Arlington County	No	No	No	Non-burnable	\$325,300	\$65,000

Arlington County Critical Assets

Post Aeration Facility (Chlorine Contact Tanks)	Arlington County	Yes	No	No	Non-burnable	\$5,540,600	\$0
Potomac Intercept and Meter Vault	Arlington County	Yes	No	Yes	Non-burnable	\$950,200	\$0
Potomac Yards Pump Station - PYPS	Arlington County	Yes	No	No	Non-burnable	\$964,000	\$0
Powhattan Spring Park	Arlington County	No	No	No	Very Low	\$0	\$0
Powhattan Spring Park - Restrooms	Arlington County	No	No	No	Very Low	\$136,800	\$0
Powhattan Spring Park - Shelter	Arlington County	No	No	No	Very Low	\$75,000	\$0
Powhattan Spring Park - Office	Arlington County	No	No	No	Very Low	\$113,600	\$7,000
Preliminary Treatment Building - PTB	Arlington County	Yes	No	No	Very Low	\$12,347,400	\$0
Primary Clarifiers - PCL	Arlington County	Yes	No	Yes	Non-burnable	\$12,712,000	\$0
Primary Effluent Flume	Arlington County	Yes	No	Yes	Non-burnable	\$6,600,000	\$0
Primary Effluent Pumping Station - PEPS	Arlington County	Yes	No	Yes	Non-burnable	\$290,035	\$3,955,181
Primary Gravity Thickener Building and Tanks - PGTB	Arlington County	Yes	No	No	Very Low	\$6,026,800	\$0
Quincy Park	Arlington County	No	No	No	Non-burnable	\$20,800	\$0
Radios in police/fire & others	Arlington County	No	No	No	Non-burnable	\$0	\$0
Recycle Intercept Pump Station - RIPS Building #36	Arlington County	Yes	No	No	Very Low	\$70,000	\$0
Reeves Property - Garage	Arlington County	No	No	No	Very Low	\$20,800	\$0
Repair Garage	Arlington County	No	No	Yes	Non-burnable	\$439,900	\$0
Residential Program Center	Arlington County	No	No	No	Very Low	\$3,340,200	\$225,000
River Estates Ejector Station - REES	Arlington County	Yes	No	No	Very Low	\$32,448	\$196,868
Rivercrest Pump Station	Arlington County	Yes	No	No	Very Low	\$35,360	\$115,385
Riverwood Ejector Station - RWES	Arlington County	No	No	No	Very Low	\$59,904	\$67,973
Roaches Run Pump Station - RRPS	Arlington County	No	No	No	Very Low	\$677,200	\$837,000
Rocky Run Park	Arlington County	No	No	No	Very Low	\$0	\$0
Rosslyn Highlands Park	Arlington County	No	No	No	Very Low	\$0	\$0
Rosslyn Spectrum Theater	Arlington County	No	No	No	Very Low	\$0	\$195,700

Arlington County Critical Assets

Satellite Warehouse (DWB area)	Arlington County	Yes	No	No	Non-burnable	\$59,280	\$0
Scales	Arlington County	No	No	No	Very Low	\$146,000	\$0
Secondary Aeration Tanks - SAT	Arlington County	Yes	No	No	Non-burnable	\$62,700,000	\$0
Secondary Aeration Tanks Pipe Gallery	Arlington County	Yes	No	No	Non-burnable	\$0	\$0
Secondary Blower Building - SBB	Arlington County	Yes	No	Yes	Non-burnable	\$14,627,600	\$22,100
Secondary Clarifiers 1- to 6	Arlington County	Yes	Yes	No	Non-burnable	\$0	\$0
Secondary Clarifiers 7, 8. 9	Arlington County	Yes	No	No	Non-burnable	\$40,300,000	\$0
Secondary Services Pumping Station - SPR	Arlington County	Yes	Yes	No	Non-burnable	\$9,204,600	\$0
Shirlington Bus Station	Arlington County	No	No	No	Low	\$429,200	\$10,000
Unknown *	Arlington County	No	No	No	Non-burnable	\$17,840,300	\$4,605,800
Single Family Detached	Arlington County	No	No	No	Non-burnable	\$233,500	\$0
Skater Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Sludge Storage Tanks (SST1, SST2)	Arlington County	Yes	No	No	Non-burnable	\$3,830,500	\$0
Smartcape House	Arlington County	No	No	No	Non-burnable	\$271,100	\$45,000
South Ferric Facility (SFF)	Arlington County	Yes	Yes	No	Non-burnable	\$4,371,600	\$0
South Side Salt Storage Facility	Arlington County	No	No	No	Non-burnable	\$389,300	\$0
South Tunnel Access Building - STAB	Arlington County	Yes	No	Yes	Non-burnable	\$0	\$0
Standby Generator Facility	Arlington County	Yes	No	Yes	Non-burnable	\$5,350,781	\$8,671,083
Storage for Signs, Signals, Meters	Arlington County	No	No	No	Non-burnable	\$220,600	\$85,000
Sullivan House	Arlington County	No	No	No	Low	\$1,415,500	\$25,000
Surface Waste Pump Station - SWPS	Arlington County	Yes	No	Yes	Non-burnable	\$2,367,900	\$0
The Ritz Carlton Hotel	Arlington County	No	No	No	Non-burnable	\$0	\$2,575,000
Third Street Group	Arlington County	Yes	No	No	Non-burnable	\$150,000	\$10,000
Thomas Building	Arlington County	No	No	No	Non-burnable	\$10,181,730	\$140,000
Thomas Jefferson - Synthetic fields	Arlington County	No	No	No	Non-burnable	\$0	\$0
Thomas Jefferson Community Center	Arlington County	No	No	No	Non-burnable	\$0	\$300,000
Tower Park	Arlington County	No	No	No	Non-burnable	\$75,000	\$0
Trade Center Truck Wash	Arlington County	No	No	No	Non-burnable	\$250,400	\$1,500
Trades Center Parking Deck	Arlington County	No	No	No	Non-burnable	\$6,598,800	\$0

Arlington County Critical Assets

Traffic Warehouse Expansion	Arlington County	No	No	No	Non-burnable	\$523,000	\$65,000
Troy Park	Arlington County	No	Yes	No	Non-burnable	\$0	\$0
Tuckahoe Park	Arlington County	No	No	No	Very Low	\$0	\$0
Tyrol Hill Park	Arlington County	Yes	No	No	Very Low	\$5,000	\$0
Upper Pimmit Meter Station - UPMS	Arlington County	No	No	Yes	Very Low	\$11,970	\$225,034
Vacant Property	Arlington County	No	No	No	Very Low	\$0	\$0
Vacant Property	Arlington County	No	No	No	Very Low	\$70,000	\$0
Vehicle Repair Facility	Arlington County	No	No	No	Non-burnable	\$4,734,400	\$550,000
Virginia Highland - Comfort Station	Arlington County	No	No	No	Non-burnable	\$116,100	\$0
Virginia Highland Park	Arlington County	No	No	No	Non-burnable	\$11,440	\$0
Virginia Highland Park - Synthetic field	Arlington County	No	No	No	Non-burnable	\$0	\$0
Walnut Park	Arlington County	No	No	No	Non-burnable	\$0	\$0
Walter Reed Community Center	Arlington County	No	No	No	Non-burnable	\$4,048,800	\$250,000
Water / Sewer / Streets Bureau Building	Arlington County	No	No	No	Non-burnable	\$2,680,100	\$215,000
Water / Sewer / Streets Bureau Warehouse	Arlington County	No	No	No	Non-burnable	\$1,603,400	\$950,000
West Mixed Liquor Flow Distribution Structures- WMLFDS	Arlington County	Yes	No	Yes	Non-burnable	\$5,250,000	\$0
West Secondary Pump Services Building - WSPSB	Arlington County	Yes	No	No	Non-burnable	\$9,400,454	\$0
Westover Branch Library	Arlington County	No	No	No	Non-burnable	\$0	\$1,985,200
Westover Park	Arlington County	No	No	No	Low	\$0	\$0
Westover Park - Restrooms	Arlington County	No	No	No	Low	\$118,900	\$0
Westover Park - Shelter	Arlington County	No	No	No	Low	\$19,100	\$0
Wet Weather Filtration Facility	Arlington County	Yes	No	No	Non-burnable	\$16,192,436	\$0
WETA Cultural Affairs and Recreation	Arlington County	No	No	No	Non-burnable	\$3,977,800	\$310,000
Windy Run Pump Station - WIN	Arlington County	No	No	Yes	Non-burnable	\$633,200	\$1,058,800
Woodlawn Park	Arlington County	Yes	No	Yes	Non-burnable	\$0	\$0
Woodmont School - Records and Handicap Center	Arlington County	No	No	No	Non-burnable	\$4,222,300	\$110,000
Woodstock Park	Arlington County	Yes	No	No	Low	\$0	\$0

Arlington County Critical Assets

Fenwick Center	Arlington County	No	No	No	Non-burnable	\$3,221,900	\$0
Abingdon Elementary School	Arlington County	No	No	No	Non-burnable	\$12,330,600	\$1,173,400
Arlington Science Focus	Arlington County	No	No	No	Very Low	\$9,726,000	\$1,221,900
Arlington Traditional	Arlington County	Yes	No	No	Very Low	\$11,022,000	\$1,142,000
Ashlawn Elementary School	Arlington County	No	No	No	Very Low	\$11,109,370	\$1,097,977
Barcroft Elementary School	Arlington County	No	No	No	Very Low	\$9,533,700	\$965,500
Barrett Elementary School	Arlington County	No	No	No	Very Low	\$11,032,500	\$1,048,400
Campbell Elementary School	Arlington County	No	No	No	Low	\$9,713,000	\$991,400
Career Center	Arlington County	No	No	No	Non-burnable	\$28,905,000	\$2,425,000
Carlin Springs Elementary	Arlington County	No	No	No	Non-burnable	\$12,578,900	\$1,216,800
Claremont Elementary School	Arlington County	No	No	No	Non-burnable	\$10,909,400	\$1,038,600
Cottage at the Outdoor Lab	Arlington County	No	No	No	Non-burnable	\$253,500	\$75,000
Drew Elementary School	Arlington County	No	No	No	Non-burnable	\$14,367,400	\$1,397,300
Education Center	Arlington County	No	No	No	Non-burnable	\$8,759,900	\$225,000
Facilities and Operations	Arlington County	No	No	No	Non-burnable	\$8,619,800	\$1,285,000
Glebe Elementary School	Arlington County	No	No	No	Very Low	\$12,528,100	\$1,132,500
Gunston Middle School	Arlington County	No	No	No	Very Low	\$28,307,600	\$2,830,700
HB Woodlawn Secondary Program	Arlington County	Yes	No	No	Very Low	\$22,406,000	\$2,024,700
Henry Elementary School	Arlington County	No	No	No	Very Low	\$8,305,500	\$835,000
Hoffman-Boston Elementary	Arlington County	No	No	No	Very Low	\$15,893,400	\$1,464,600
Hoffman-Boston Elementary Annex	Arlington County	No	No	No	Very Low	\$308,100	\$300,000
Jamestown Elementary School	Arlington County	No	No	No	Very Low	\$10,777,000	\$1,250,300
Jefferson Middle School	Arlington County	No	No	No	Very Low	\$28,955,400	\$2,953,500
Kenmore Middle School	Arlington County	No	No	No	Low	\$28,233,700	\$1,888,000
Key Elementary School	Arlington County	No	No	No	Non-burnable	\$12,245,600	\$1,261,400
Langston HS Continuation Program	Arlington County	No	No	No	Non-burnable	\$5,240,032	\$183,600
Long Branch Elementary School	Arlington County	No	No	No	Non-burnable	\$10,493,400	\$965,600
Marshall Center	Arlington County	No	No	No	Non-burnable	\$1,466,100	\$150,000
McKinley Elementary School	Arlington County	No	No	No	Very Low	\$7,459,800	\$783,200
Nottingham Elementary School	Arlington County	No	No	No	Very Low	\$9,782,900	\$976,900
Oakridge Elementary School	Arlington County	No	No	No	Non-burnable	\$10,891,700	\$1,078,300
Outdoor Lab	Arlington County	No	No	No	Non-burnable	\$427,600	\$217,000
Planetarium	Arlington County	No	No	No	Non-burnable	\$329,600	\$50,000

Arlington County Critical Assets

Randolph Elementary School	Arlington County	No	No	No	Very Low	\$9,668,700	\$967,200
Reed Facility	Arlington County	No	No	No	Very Low	\$15,475,500	\$971,700
Sequoia	Arlington County	No	No	No	Very Low	\$0	\$1,500,000
Swanson Middle School	Arlington County	No	No	No	Very Low	\$18,115,500	\$1,816,700
Taylor Elementary School	Arlington County	Yes	No	No	Very Low	\$10,873,900	\$1,070,700
Tuckahoe Elementary School	Arlington County	No	No	No	Very Low	\$9,610,200	\$961,500
Wakefield High School	Arlington County	No	No	No	Non-burnable	\$86,645,000	\$3,490,300
Wakefield High School	Arlington County	No	No	No	Non-burnable	\$0	\$0
Wakefield High School - Football, Softball and Baseball Stadium - Bleachers, New Concession Stands and Press Boxes	Arlington County	No	No	No	Non-burnable	\$0	\$0
Wakefield - Synthetic field	Arlington County	No	No	No	Non-burnable	\$0	\$0
Wakefield High School - Stadium -Football Concessions	Arlington County	No	No	No	Non-burnable	\$7,000	\$3,000
Washington-Lee High School	Arlington County	No	No	No	Non-burnable	\$81,147,000	\$3,490,300
Washington-Lee High School Stadium -Bleachers and Press box	Arlington County	No	No	No	Non-burnable	\$0	\$0
Washington-Lee High School - Stadium Concessions	Arlington County	No	No	No	Non-burnable	\$20,000	\$3,000
Washington-Lee - Synthetic Field	Arlington County	No	No	No	Non-burnable	\$0	\$0
Washington-Lee High School Pedestrian Bridge to I-66 parking deck	Arlington County	No	No	No	Non-burnable	\$0	\$0
Williamsburg Middle School	Arlington County	No	No	No	Very Low	\$22,595,500	\$2,359,500
Wilson School	Arlington County	No	No	No	Very Low	\$2,578,800	\$682,696
Yorktown High School	Arlington County	No	No	No	Very Low	\$70,979,025	\$3,061,340
166 School buses (see Schedule under Vehicle coverage)	Arlington County	No	No	No	Non-burnable	\$0	\$0
Boat Fleet-not for rent	Arlington County	No	No	No	Non-burnable	\$0	\$0
EDP/Data/AV Equipment	Arlington County	No	No	No	Non-burnable	\$0	\$0
Telephone Systems	Arlington County	No	No	No	Non-burnable	\$0	\$0
Fences & Lights	Arlington County	No	No	No	Non-burnable	\$0	\$0

Arlington County Critical Assets

Leased and Owned Relocatables see attached schedule	Arlington County	No	No	No	Non-burnable	\$0	\$0
						\$1,623,587,490	\$207,061,157

City of Alexandria Critical Assets

Critical Asset	Jurisdiction	Tornado .25 Mile Buffer	SFHA 100 Year	SFHA 500 Year	WFP Class	Asset Values	Content Values
Alexandria Police Department	City of Alexandria	No	No	No	Non-burnable	\$0.00	\$0.00
Samuel W. Tucker Elementary School	City of Alexandria	Yes	No	Yes	Very Low	\$15,635,100	\$45,000,000.00
T.C. Williams High Schools	City of Alexandria	No	No	No	Very Low	\$91,553,900	\$5,000,000.00
James K Polk Elementary School	City of Alexandria	No	No	No	Very Low	\$14,871,170	\$4,000,000.00
Francis C. Hammond Middle School	City of Alexandria	No	No	No	Very Low	\$46,044,375	\$0.00
George Washington Middle School	City of Alexandria	No	No	No	Very Low	\$46,279,740	\$0.00
T.C. Williams High School Minnie Howard Campus	City of Alexandria	No	No	No	Low	\$25,434,825	\$0.00
Dee Campbell Rowing Center	City of Alexandria	No	Yes	No	Very Low	\$4,056,000	\$1,000,000.00
John Adams Elementary School	City of Alexandria	Yes	No	No	Very Low	\$26,783,250	\$0.00
Charles Barrett Elementary School	City of Alexandria	No	No	No	Very Low	\$12,238,200	\$4,000,000.00
Cora Kelly School of Math, Science and Technology	City of Alexandria	Yes	No	Yes	Non-burnable	\$13,455,000	\$5,000,000.00
Fire Station 201	City of Alexandria	No	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 202	City of Alexandria	Yes	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 203	City of Alexandria	No	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 204	City of Alexandria	No	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 205	City of Alexandria	No	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 206	City of Alexandria	No	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 207	City of Alexandria	No	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 208	City of Alexandria	Yes	No	No	Non-burnable	\$0.00	\$0.00
Fire Station 209	City of Alexandria	No	No	No	Very Low	\$0.00	\$0.00
Fire Station 210	City of Alexandria	Yes	No	No	Non-burnable	\$0.00	\$0.00
						\$296,351,560.00	\$64,000,000.00

City of Fairfax Critical Assets

Critical Asset	Jurisdiction	Tornado .25 Mile Buffer	SFHA 100 Year	SFHA 500 Year	WFP Class	Asset Values	Content Values
Fairfax High School	City of Fairfax	No	No	No	Non-burnable	\$60,537,800	\$0
Lanier Middle School	City of Fairfax	No	No	No	Non-burnable	\$25,714,000	\$0
Daniels Run Elementary	City of Fairfax	No	Yes	No	Non-burnable	\$17,240,300	\$0
Providence Elementary School	City of Fairfax	No	No	No	Non-burnable	\$19,736,400	\$0
City Of Fairfax Police Station	City of Fairfax	No	No	No	Non-burnable	\$11,060,200	\$0
City of Fairfax Fire Station 3	City of Fairfax	No	No	No	Non-burnable	\$5,124,600	\$0
City of Fairfax Fire Station 33	City of Fairfax	No	No	No	Non-burnable	\$3,587,000	\$0
City of Fairfax Public Safety Training Center	City of Fairfax	No	No	No	Non-burnable	\$1,810,976	\$0
City of Fairfax City Hall	City of Fairfax	No	No	No	Non-burnable	\$22,568,100	\$0
City of Fairfax Property Yard	City of Fairfax	No	Yes	No	Non-burnable	\$13,547,400	\$0
Cue Bus	City of Fairfax	No	Yes	No	Non-burnable	\$13,547,400	\$0
INOVA EMERGENCY CARE CENTER - FAIRFAX CITY	City of Fairfax	No	No	No	Non-burnable	\$0.00	\$0
Petroleum Tank Farm	City of Fairfax	No	No	No	Non-burnable	\$0.00	\$0
PAUL VI CATHOLIC HIGH SCHOOL	City of Fairfax	No	No	No	Non-burnable	\$0.00	\$0
ST LEO THE GREAT SCHOOL	City of Fairfax	No	No	No	Non-burnable	\$0.00	\$0
THE BOYD SCHOOL	City of Fairfax	No	No	No	Non-burnable	\$0.00	\$0
						\$194,474,176.00	\$0

City of Falls Church Critical Assets

Critical Asset	Jurisdiction	Tornado .25 Mile Buffer	SFHA 100 Year	SFHA 500 Year	WFP Class	Asset Values	Content Values
CITY OF FALLS CHURCH CITY HALL	City of Falls Church	Yes	No	No	Non-burnable	\$13,508,200	\$0
CITY OF FALLS CHURCH COMMUNTIY CENTER	City of Falls Church	No	No	No	Non-burnable	\$6,178,000	\$0
Mary Riley Styles Public Library	City of Falls Church	Yes	No	No	Non-burnable	\$3,294,300	\$0
THOMAS JEFFERSON ELEM.	City of Falls Church	No	No	No	Non-burnable	\$3,769,400	\$0
MARY ELLEN HENDERSON MIDDLE	City of Falls Church	No	No	No	Non-burnable	\$0.00	\$0
GEORGE MASON HIGH SCHOOL	City of Falls Church	No	No	No	Non-burnable	\$43,467,000	\$0
City of Falls Church Property Yard Building	City of Falls Church	No	No	No	Non-burnable	\$484,600	\$0
City of Falls Church Fire Station	City of Falls Church	No	No	No	Non-burnable	\$828,600	\$0
Aurora House	City of Falls Church	Yes	No	Yes	Very Low	\$1,860,200	\$0
						\$73,390,300.00	\$0

City of Manassas Park Critical Assets

Critical Asset	Jurisdiction	Tornado .25 Mile Buffer	SFHA 100 Year	SFHA 500 Year	WFP Class	Asset Value	Content Value
City Hall	Manassas Park	Yes	No	No	Non Burnable	\$2,658,000	\$0.00
Community Center	Manassas Park	No	No	No	Very Low	\$23,914,500	\$0.00
Police Department	Manassas Park	No	No	No	Non Burnable	\$5,435,300	\$0.00
Fire Department	Manassas Park	Yes	No	No	Very Low	\$4,868,500	\$0.00
Public Works and Garage	Manassas Park	No	No	No	Non Burnable	\$0.00	\$0.00
Mathis Tank	Manassas Park	No	No	No	Non Burnable	\$162,300	\$0.00
Matthew Dr Sewer Pump Station	Manassas Park	No	No	No	Very Low	\$0.00	\$0.00
Cynthia Dr Sewer Pump Station	Manassas Park	No	No	No	Very Low	\$0.00	\$0.00
Joshua Ct Water Pump Station and Tower	Manassas Park	No	No	No	Very Low	\$106,300	\$0.00
Blooms Quarry Water Pump Station and Tower	Manassas Park	Yes	No	No	Very Low	\$0.00	\$0.00
Signal Hill Park	Manassas Park	Yes	No	No	Non Burnable	\$0.00	\$0.00
Generals Ridge Golf Course	Manassas Park	No	No	No	Non Burnable	\$0.00	\$0.00
Conner House	Manassas Park	No	No	No	Very Low	\$0.00	\$0.00
Stone House	Manassas Park	No	No	No	Very Low	\$0.00	\$0.00
MP Pre_K	Manassas Park	No	No	No	Non Burnable	\$0.00	\$0.00
Cougar Elementary School	Manassas Park	No	No	No	Non Burnable	\$30,641,900	\$0.00
MP Elementary School	Manassas Park	No	No	No	Very Low	\$0.00	\$0.00
MP Middle School	Manassas Park	Yes	No	No	Very Low	\$0.00	\$0.00
MP High School	Manassas Park	Yes	No	No	Very Low	\$32,881,600	\$0.00
						\$100,668,400.00	\$0.00

City of Manassas Critical Assets

Critical Asset	Jurisdiction	Tornado .25 Mile Buffer	SFHA 100 Year	SFHA 500 Year	WFP Class	Asset Values	Content Values
Old Town Hall	City of Manassas	No	No	No	Very Low	\$736,848	\$180,386
New City Hall	City of Manassas	No	No	No	Very Low	\$7,192,122	\$947,683
Museum	City of Manassas	No	No	No	Very Low	\$1,506,030	\$193,390
Liberia House	City of Manassas	No	No	No	Very Low	\$816,306	\$0
Stonewall Recreation Center	City of Manassas	No	No	No	Very Low	\$346,432	\$3,470
Stonewall Recreation Center Swimming Pool	City of Manassas	No	No	No	Very Low	\$819,876	\$287,850
Stonewall Recreation Center Pavillion	City of Manassas	No	No	No	Very Low	\$48,996	\$0
Byrd Park Restrooms	City of Manassas	No	No	No	Very Low	\$42,142	\$0
Police Station	City of Manassas	No	No	No	Non-burnable	\$4,574,088	\$827,190
Old Electric Complex Shop	City of Manassas	No	No	No	Non-burnable	\$216,360	\$43,977
Old Electric Complex Warehouse	City of Manassas	No	No	No	Non-burnable	\$185,407	\$43,592
Old Electric Complex Generator Facility	City of Manassas	No	No	No	Non-burnable	\$313,242	\$4,277,350
Old Electric Complex Pole Barn	City of Manassas	No	No	No	Non-burnable	\$126,031	\$0
Public Works - Office Bldg	City of Manassas	No	No	No	Non-burnable	\$2,072,130	\$533,785
Public Works - Warehouse Bldg	City of Manassas	No	No	No	Non-burnable	\$1,727,166	\$1,956,697
Public Works - Maintenance Shop	City of Manassas	No	No	No	Non-burnable	\$1,415,964	\$476,872
Public Works - Generator Bldg	City of Manassas	No	No	No	Non-burnable	\$506,328	\$0
Public Works - Parking Garage	City of Manassas	No	No	No	Non-burnable	\$1,091,808	\$296,940
Public Works - Salt Storage	City of Manassas	No	No	No	Non-burnable	\$448,225	\$0
Airport Sewer Pump Station	City of Manassas	Yes	Yes	No	Non-burnable	\$15,000	\$0
Fairview Sewer Pump Station	City of Manassas	No	No	No	Non-burnable	\$15,000	\$0
Church Sewer Pump Station	City of Manassas	No	No	No	Non-burnable	\$15,000	\$0
Redoubt Sewer Pump Station	City of Manassas	Yes	No	No	Non-burnable	\$50,000	\$0
WTP Meter Vault	City of Manassas	No	No	No	Non-burnable	\$50,000	\$0
Dean Tank 2.5M	City of Manassas	No	No	No	Non-burnable	\$5,000,000	\$200,000
Dean Water Pump Station	City of Manassas	No	No	No	Non-burnable	\$250,000	\$0
Quarry Tower 1M	City of Manassas	No	No	No	Non-burnable	\$3,000,000	\$8,000
Prince William Tower 300k	City of Manassas	No	No	No	Non-burnable	\$1,500,000	\$2,500

City of Manassas Critical Assets

Water Treatment Plant - Diversion Structure	City of Manassas	No	No	No	Non-burnable	\$44,064	\$9,595
Water Treatment Plant - Control Bldg	City of Manassas	No	No	No	Non-burnable	\$5,147,124	\$2,186,650
Water Treatment Plant Flocculation Basin #1	City of Manassas	No	No	No	Non-burnable	\$2,182,596	\$653,268
Water Treatment Plant Flocculation Basin #2	City of Manassas	No	No	No	Non-burnable	\$2,005,116	\$591,759
Water Treatment Plant Generator Bldg	City of Manassas	No	No	No	Non-burnable	\$984,300	\$0
Water Treatment Plant Filter Bldg	City of Manassas	No	No	No	Very Low	\$1,297,848	\$531,058
Water Treatment Plant Pump Bldg	City of Manassas	No	No	No	Very Low	\$400,758	\$655,288
Water Treatment Plant Chemical Bldg	City of Manassas	No	No	No	Non-burnable	\$520,608	\$196,748
Water Treatment Plant Clarifier	City of Manassas	No	Yes	No	Non-burnable	\$1,011,024	\$290,880
Water Treatment Plant Surge Basin	City of Manassas	No	Yes	No	Non-burnable	\$905,148	\$65,246
Water Treatment Plant Ground Water Tank 1.25 M Gallons	City of Manassas	No	No	No	Very Low	\$1,150,560	\$0
Water Treatment Plant Decant Pump Station	City of Manassas	No	No	No	Very Low	\$66,810	\$25,048
Water Treatment Plant Caustic Soda Bldg	City of Manassas	No	No	No	Very Low	\$84,252	\$48,884
Water Treatment Plant Rapid Mix Tank	City of Manassas	No	No	No	Very Low	\$84,048	\$28,482
Dam Complex Plant	City of Manassas	No	Yes	No	Very Low	\$815,881	\$2,538,455
Dam with Rubber Skirt	City of Manassas	No	Yes	No	Very Low	\$7,497,714	\$227,250
Dam Complex Compressor Building	City of Manassas	No	No	No	Non-burnable	\$101,796	\$38,986
Generator Facility Building	City of Manassas	No	No	No	Non-burnable	\$1,671,678	\$14,791,450
Airport Complex Dulles Hanger	City of Manassas	Yes	No	Yes	Non-burnable	\$1,723,800	\$0
Airport Complex Maintenance Bldg	City of Manassas	No	No	No	Non-burnable	\$929,757	\$0
Airport Complex Electrical Vault Bldg	City of Manassas	No	No	No	Non-burnable	\$89,550	\$198,282

City of Manassas Critical Assets

Airport Complex Control Tower and base building	City of Manassas	Yes	No	No	Non-burnable	\$3,054,594	\$0
Airport Complex Aurora East	City of Manassas	Yes	No	No	Non-burnable	\$2,100,384	\$0
Airport Complex Generator Bldg	City of Manassas	No	No	No	Non-burnable	\$137,190	\$1,762,450
Airport complex Terminal	City of Manassas	No	No	No	Non-burnable	\$6,963,132	\$297,950
Railroad Depot	City of Manassas	No	No	No	Non-burnable	\$722,592	\$0
Diesel Peaking Bldg	City of Manassas	No	No	No	Non-burnable	\$263,874	\$4,735,486
Dominion Peaking Bldg	City of Manassas	No	No	No	Very Low	\$670,140	\$5,984,856
Hopkins Candy Factory	City of Manassas	No	No	No	Very Low	\$3,593,562	\$0
City Square Pavilion Ancillary Bldg	City of Manassas	No	No	No	Very Low	\$204,124	\$160,456
City Square Pavilion Pavilion	City of Manassas	No	No	No	Very Low	\$616,746	\$171,918
Animal Shelter	City of Manassas	No	No	No	Very Low	\$2,543,472	\$349,056
Speiden Carper Historic House	City of Manassas	No	No	No	Very Low	\$489,008	\$63,024
Prince William Street Parking Garage	City of Manassas	No	No	No	Very Low	\$12,960,222	\$0
Storage Bldg	City of Manassas	No	No	No	Very Low	\$511,632	\$651,450
DMV Building	City of Manassas	No	No	No	Very Low	\$2,270,736	\$0
Prince William Substation	City of Manassas	No	No	No	Very Low	\$1,375,000	\$500,000
Point of Woods Substation	City of Manassas	Yes	No	No	Very Low	\$1,175,000	\$500,000
Airport Substation	City of Manassas	No	No	No	Very Low	\$1,475,000	\$150,000
Battery Heights Substation	City of Manassas	No	No	No	Very Low	\$1,295,000	\$150,000
Micron Substation	City of Manassas	No	No	No	Very Low	\$2,125,000	\$250,000
Micron Substation	City of Manassas	No	No	No	Very Low	\$2,125,000	\$150,000
LOMAR Substation	City of Manassas	No	No	No	Non-burnable	\$2,095,000	\$150,000
Communications Server Building	City of Manassas	No	Yes	No	Non-burnable	\$65,000	\$1,500,000
Baldwin Elementary School	City of Manassas	No	No	No	Non-burnable	\$13,820,010	\$1,862,875
Jennie Dean Elementary School	City of Manassas	No	No	No	Non-burnable	\$22,329,250	\$1,848,530
Haydon Elementary School	City of Manassas	No	No	No	Non-burnable	\$15,167,580	\$1,197,620
Round Elementary School	City of Manassas	No	No	No	Non-burnable	\$17,608,110	\$1,750,000
Weems Elementary School	City of Manassas	No	No	No	Non-burnable	\$15,291,780	\$1,156,810
Mayfield Intermediate School	City of Manassas	No	No	No	Non-burnable	\$34,500,000	\$2,565,000
Metz Middle School	City of Manassas	No	No	No	Very Low	\$48,098,520	\$3,576,020
Osborn High School	City of Manassas	No	No	No	Very Low	\$71,135,090	\$5,808,326
Manassas Volunteer Fire Company (owned by the volunteers)	City of Manassas	No	No	No	Non-burnable	\$3,000,000	\$2,750,000

City of Manassas Critical Assets

Manassas Rescue Station	City of Manassas	Yes	No	No	Non-burnable	\$2,072,382	\$296,050
Central Fuel Farm	City of Manassas	No	No	No	Non-burnable	\$2,000,000	\$0
Airport East T-Hangars	City of Manassas	No	No	No	Non-burnable	\$0.00	\$0
Airport West T-Hangars	City of Manassas	No	No	No	Non-burnable	\$0.00	\$0
						#####	
						#####	\$73,694,888

Fairfax County Critical Assets

Critical Asset	Jurisdiction	Tornado .25 Mile Buffer	SFHA 100 Year	SFHA 500 Year	WFP Class	Asset Values	Content Values
Pohick Regional library	Fairfax County	No	No	No	Non-burnable	\$3,571,541	\$1,404,152
Cornerstones - Attached to A New Beginning Property 264 Occupancy listed there	Fairfax County	No	No	No	Non-burnable	\$1,163,341	\$104,835
Patrick Henry Library	Fairfax County	Yes	No	No	Non-burnable	\$1,685,961	\$575,564
Richard Byrd Library	Fairfax County	Yes	No	No	Non-burnable	\$3,810,536	\$222,768
Sherwood Regional Library	Fairfax County	No	No	No	Low	\$3,719,594	\$1,369,562
John Marshall Library	Fairfax County	No	No	No	Non-burnable	\$1,897,699	\$568,782
Kings Park Library	Fairfax County	No	No	No	Non-burnable	\$2,432,144	\$327,457
West Ford III - 59 units for Housing Authority located at: 3000-3043 Fordson Ct and 3001-3031 Westford View Ct	Fairfax County	No	No	No	Non-burnable	\$6,358,746	\$163,049
Four Townhouses at 6037 and 6043 Masondale Road, 5956 and 5953 Manorview Way. 6037 value \$132,580 at 1080 SqFt, 6043 valued \$133,830 at 1096 SqFt, 5956 valued \$130,960 at 1166 SqFt and 5953 valued \$132,190 at 1166 SqFt.	Fairfax County	No	No	No	Non-burnable	\$612,701	\$0
Thomas Jefferson Library	Fairfax County		No	No	Non-burnable	\$2,222,055	\$211,099
Martha Washington Library	Fairfax County	Yes	No	No	Non-burnable	\$2,138,949	\$462,894
George Mason Regional Library	Fairfax County	Yes	No	No	Non-burnable	\$3,825,215	\$1,205,176
Lincolnia Senior Center	Fairfax County	No	No	No	Non-burnable	\$8,847,985	\$652,630
Dolley Madison Library	Fairfax County	No	No	No	Very Low	\$1,385,900	\$444,030
Tysons-Pimmit Library	Fairfax County	No	No	No	Very Low	\$3,183,986	\$1,334,368
Springfield Green Apartments Housing Authority 19 Units 7087 - 7095 Springfield Garden Drive	Fairfax County	Yes	No	No	Very Low	\$4,055,899	\$70,000

Fairfax County Critical Assets

Woodrow Wilson Library	Fairfax County	No	No	No		\$1,646,546	\$508,759
Centreville Regional Library	Fairfax County	No	No	No	Non-burnable	\$3,762,935	\$1,277,111
Line Maint/ Robert P. Mcmath Facility	Fairfax County	Yes	No	No	Non-burnable	\$3,499,036	\$709,572
Line Maint Division Upper Cub Run Facility - No visible structure	Fairfax County	No	No	No	Non-burnable	\$255,079	\$0
Line Maint - Jones Pt. Pumping Station	Fairfax County	Yes	No	No	Non-burnable	\$574,625	\$0
West Glade Apartments Housing Authority 50 Units (HALP) 2100 through 2136 West Glade Drive (even #'s) - The Green LP	Fairfax County	No	No	No	Non-burnable	\$6,510,946	\$136,092
Line Maintenance - 50-66 Main Pump Stat	Fairfax County	No	Yes	No	Non-burnable	\$395,705	\$245,265
Line Maintenance Division - Accotink Pump Station	Fairfax County	No	Yes	No	Very Low	\$1,995,860	\$1,669,702
Line Maintenance - Arcturus Pump Station - 14 x 7 Brick structure	Fairfax County	No	No	No	Low	\$136,148	\$0
Line Maintenance - Barcroft #1 Pump Station	Fairfax County	No	No	No	Non-burnable	\$163,183	\$0
Line Mait Division- Barcroft #2 Pump Station	Fairfax County	No	No	No	Non-burnable	\$162,073	\$0
Line Maint Division- Belle Haven County Club pump/grinder station - no above ground structure. Only electircal box.	Fairfax County	Yes	No	No	Non-burnable	\$3,275	\$0
Line Maintenance Mt. Vernon Terrace Pump Station	Fairfax County	No	Yes	No	Very Low	\$574,625	\$0
Line Mait Division - CIA Pump Station	Fairfax County	No	No	No	Very Low	\$547,011	\$0

Fairfax County Critical Assets

Line Maint Division- Carters Pump Station - No above ground structure. Electrical box only	Fairfax County	No	Yes	No	Very Low	\$7,500	\$0
Line Maint Division - Columbia Oaks #1 Pump Station	Fairfax County	Yes	No	No	Low	\$18,118	\$0
Line Maint Division - Columbia Oaks #2 Pump Station	Fairfax County	Yes	No	No	Low	\$18,118	\$0
Line Maint Dead Run Pump Station	Fairfax County	No	Yes	No	Very Low	\$1,294,923	\$0
Line Maint Difficult Run Pump Station	Fairfax County	No	No	No	Very Low	\$2,448,628	\$1,784,273
Line Maint Freund House (previously called Dogue Creek) Pump Station	Fairfax County	No	No	Yes	Very Low	\$4,638,000	\$1,669,702
Line Maint Downcrest Pumping Station	Fairfax County	No	No	No	Very Low	\$66,286	\$0
Line Mait F Street Pump Station	Fairfax County	No	Yes	No	Very Low	\$732,368	\$0
Line Mait George Mason Univ Pump Station	Fairfax County	No	No	No	Non-burnable	\$855,039	\$0
Line Maint Georgetown Pike 1 Grinder--Underground Does not require inspection	Fairfax County	No	No	No	Non-burnable	\$18,006	\$0
Line Maint Georgetown Pike 2 Grinder Pump Station--underground does not require inspection	Fairfax County	No	No	No	Non-burnable	\$18,006	\$0
Line Mait Highridge Office Park Pump Station	Fairfax County	No	No	No	Non-burnable	\$168,809	\$0
Line Maintenance Holmes Run Pump Station	Fairfax County	No	No	Yes	Non-burnable	\$845,021	\$0
Line Maint Jefferson Ave Pump Station	Fairfax County	Yes	Yes	No	Non-burnable	\$19,973	\$0
Line Mait Keene Mill Rd Pump Station	Fairfax County	No	Yes	No	Non-burnable	\$616,944	\$0

Fairfax County Critical Assets

Line Mait Division Lakevale Estates Pump Station	Fairfax County	No	No	No	Very Low	\$211,901	\$0
Line Mait Langley Oaks Pump Station	Fairfax County	No	No	No	Very Low	\$162,621	\$0
Line Mait Division Langley School Pump Station	Fairfax County	No	No	No	Very Low	\$195,375	\$0
Line Mait Various Locations Grinder Pump @245 Homes---these do not require inspections	Fairfax County	No	No	No	Very Low	\$2,250,803	\$0
Line Maint Div Little Hunting Creek Pump Station	Fairfax County	No	No	No	Very Low	\$1,377,289	\$1,157,306
Line Maint Long Branch Pump Station	Fairfax County	No	Yes	No	Very Low	\$841,070	\$426,950
Line Mait Merrywood Pump Station	Fairfax County	No	No	No	Very Low	\$555,000	\$0
Stonegate Apartments Housing Authority 240 Units - HCDC I LP (HALP) 2200 - 2265 Stone Wheel Drive & 2200 - 2225 Mill Race Lane	Fairfax County	No	No	No	Non-burnable	\$17,579,177	\$27,516
Line Maint Oak Marr Pump Station	Fairfax County	No	No	No	Non-burnable	\$135,611	\$0
Line Maint Oxford Pump Station - 6 x 4 wooden shed	Fairfax County	No	No	No	Very Low	\$51,768	\$0
Line Mait Pender Pump Station	Fairfax County	Yes	No	No		\$937,474	\$0
Line Mait Penderbrook Pump Station	Fairfax County	No	No	No	Very Low	\$337,620	\$0
Line Maint Pike Branch Pump Station - No above ground structure. Electrical box only. Inspection not required	Fairfax County	No	No	No	Very Low	\$7,500	\$0
Line Maint Ravenwood Pump Station--Not inspected	Fairfax County	No	Yes	No	Non-burnable	\$31,511	\$0

Fairfax County Critical Assets

Line Mait River Towers Pump Station	Fairfax County	No	No	No	Non-burnable	\$525,490	\$0
Line Maint Riverwood Pump Station - 14 x 7 Brick structure	Fairfax County	No	No	No	Very Low	\$81,950	\$0
Line Maint Shirley Gate Grinder Pump Station - no above ground structure. Electrical box only. Does not Require Inspection	Fairfax County	No	No	No	Non-burnable	\$7,500	\$0
Line Mait Springfield Estates Pump Station - Behind wooden gate and inaccessible. Appears to be a 6 x 8 wooden shed.	Fairfax County	No	No	No	Non-burnable	\$155,305	\$0
Line Maint Springfield Forest Pump Station - Could not locate anything at the site. No above ground structure.	Fairfax County	No	No	No	Non-burnable	\$7,500	\$0
Line Maint Telgraph Rd Grinder Pump Station - no above ground structure. Only an electrical box	Fairfax County	No	No	No	Very Low	\$7,500	\$0
Line Maint Tysons Corner Pump Station	Fairfax County	No	No	No		\$283,048	\$0
Line Mait Washington Woods Pump Station - 14 x 7 Cement slab structure	Fairfax County	No	No	No	Very Low	\$137,298	\$0
Line Mait Waynewood #1 Pump Station -14 x 7 Brick	Fairfax County	No	No	No	Very Low	\$155,350	\$0
Line Mait Waynewood #2 Pump Station - 14 x 7 brick structure	Fairfax County	No	No	No	Very Low	\$165,151	\$0
Line Mait Weid Pump Station	Fairfax County	No	No	No		\$439,404	\$0
Line Mait Wellington #1 Pump Station	Fairfax County	No	Yes	No	Very Low	\$284,682	\$0

Fairfax County Critical Assets

Line Mait Wellington #2 Pump Station - GIS shows no indication of any above ground structure. Private property not accessible	Fairfax County	No	No	No	Very Low	\$184,085	\$0
Line Mait Wesley House Pump Station	Fairfax County	No	No	No	Very Low	\$189,067	\$0
Line Mait Yacht Haven Pump Station	Fairfax County	No	Yes	No	Very Low	\$991,526	\$0
Line Maintenance Belleview Pump Station	Fairfax County	No	Yes	No	Very Low	\$413,652	\$222,793
Line Mait Braddock Rd Pump Station	Fairfax County	No	Yes	No	Non-burnable	\$541,944	\$281,817
Line Maint Clifton Pump And Haul Station	Fairfax County	Yes	No	No	Non-burnable	\$13,504	\$0
Stormwater Dam Site #4 - No above ground structure. Earthen dam Does not require LP Audit	Fairfax County	No	No	No	Non-burnable	\$11,253	\$0
Line Mait The Fairfax Pump Station	Fairfax County	No	No	No	Very Low	\$365,755	\$0
Line Mait Giles Run Pump Station	Fairfax County	No	No	No	Very Low	\$390,513	\$0
The Park Apartments Housing Authority 24 Units 6440 - 6471 Burwell St(shows as 6319 Georgia St in tax system)	Fairfax County	No	No	No	Non-burnable	\$2,680,434	\$58,902
Line Mait Llv Odor Control Pump Station	Fairfax County	Yes	No	No	Non-burnable	\$382,931	\$0
Maintenance And Stormwater New Alex Storm Pump Station -maintained by Wastewater Collection.	Fairfax County	No	Yes	No	Non-burnable	\$545,782	\$382,047
Line Mait Piney Branch Pump Station	Fairfax County	No	No	No	Very Low	\$438,906	\$0

Fairfax County Critical Assets

Line Maintenance Edgewater Pump Station	Fairfax County	No	No	No	Low	\$675,241	\$0
Station 1 - Mclean Fire Station	Fairfax County	No	No	No	Very Low	\$2,899,072	\$577,333
Fire And Rescue Academy	Fairfax County	Yes	No	No	Very Low	\$12,309,547	\$1,591,226
Station 9 - Mount Vernon Fire Station	Fairfax County	No	No	No	Very Low	\$1,403,264	\$375,279
Station 10 - Bailey's Crossrds Fire Station	Fairfax County	No	No	No	Very Low	\$2,397,615	\$500,000
Station 11 - Penn Daw Fire Station	Fairfax County	No	No	No	Low	\$2,007,662	\$454,463
Station 12 - Great Falls Volunteer Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,240,576	\$676,373
Station 38 - West Centreville	Fairfax County	No	No	No	Non-burnable	\$1,629,051	\$350,884
Station 18 Jefferson fire station	Fairfax County	No	No	No	Non-burnable	\$1,866,206	\$400,067
Station 19 - Lorton Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,399,483	\$272,891
Station 20 - Gunston Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,081,786	\$224,392
Station 24 - Woodlawn Fire Station	Fairfax County	No	No	No	Non-burnable	\$840,278	\$412,313
Station 34- Oakton Fire Station	Fairfax County	Yes	No	No	Non-burnable	\$1,418,461	\$265,031
Station 32 - Fairview Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,254,763	\$228,158
Station 31 - Fox Mill Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,255,849	\$262,135
Station 29- Tysons Corner Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,504,759	\$272,127
Station 28 - Seven Corners Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,272,862	\$244,176
Station 26 - Edsall Rd Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,289,651	\$258,890
Station 25 - Reston Fire Station	Fairfax County	No	No	No	Very Low	\$1,274,556	\$267,261

Fairfax County Critical Assets

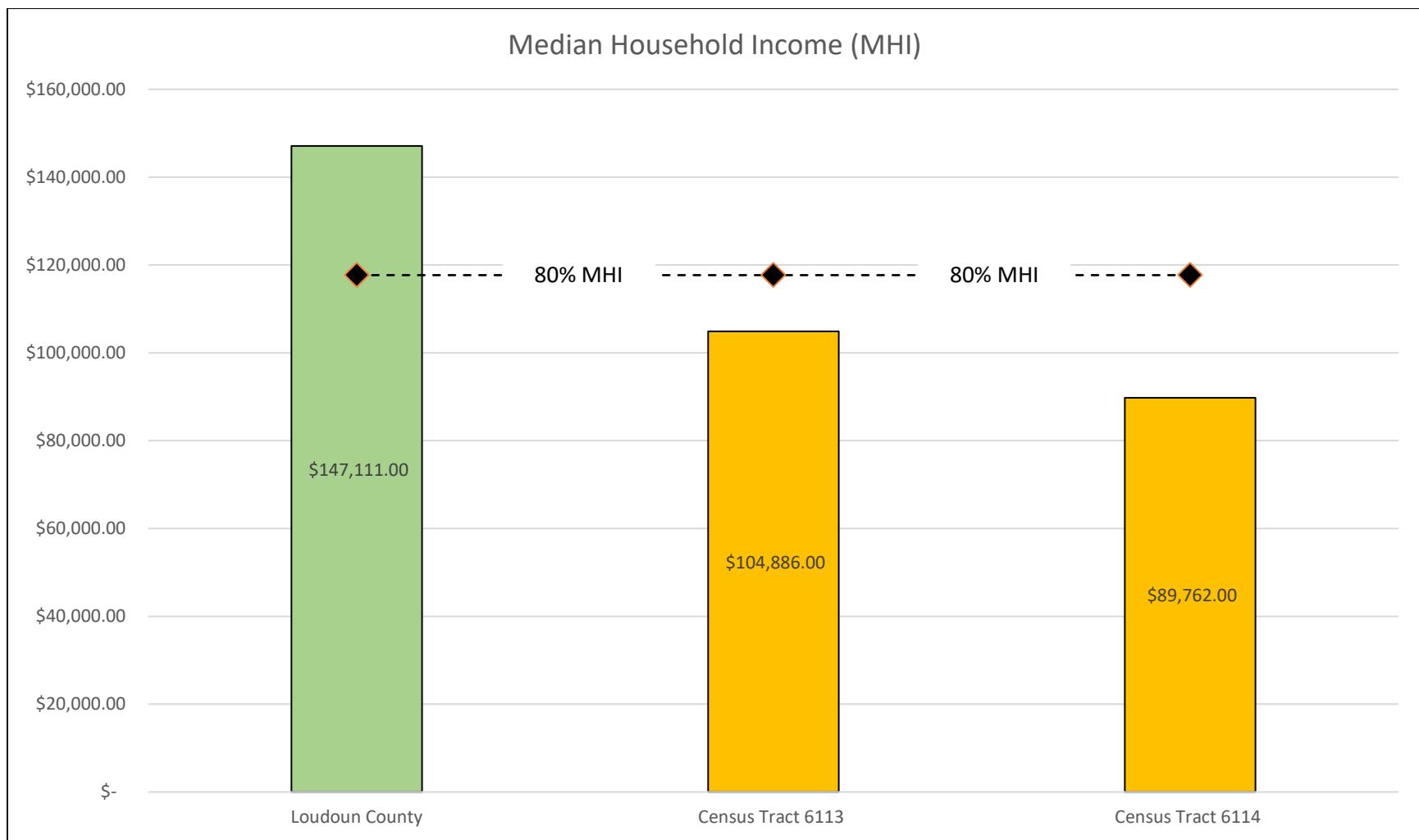
FairCrest North - 6 townhouses located at 5313, 5323, 5333 Rosemallow Circle, 5207 Prairie Willow Lane and 13522, 13507 Prairie Mallow Lane. Each unit is valued at \$130,774.	Fairfax County	No	No	No	Non-burnable	\$1,092,532	\$0
Station 15 - Chantilly Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,439,373	\$305,466
Station 36 - Frying Pan Fire Station	Fairfax County	No	No	No	Non-burnable	\$1,371,237	\$289,535
Station 30 - Merrifield Stat And Providence Dist Bus Office	Fairfax County	No	No	No	Non-burnable	\$1,609,180	\$327,943
Station 21 - Fair Oaks, & Police Department	Fairfax County	No	No	No	Non-burnable	\$7,701,719	\$510,530
Station 37 - Kingstowne Fire Station	Fairfax County	No	No	No	Non-burnable	\$2,083,387	\$435,097
Line Maintenance Ordway Road Pumping Station	Fairfax County	No	No	No	Non-burnable	\$574,625	\$0
Line Maintenance LLV Odor Control Site	Fairfax County	Yes	No	No	Very Low	\$574,625	\$0
Line Maintenance Lorton Road Pumping Station	Fairfax County	No	No	No	Low	\$574,625	\$0
Line Maintenance Langley Court Pumping Station	Fairfax County	No	No	No	Non-burnable	\$574,625	\$0
Arrowhead Park - Two 8X6 irrigation buildings. As of 10-27-2015, includes two synthetic turf fields and new fencing.	Fairfax County	No	No	No	Non-burnable	\$27,347	\$0
Line Maintenance Jermantown Road Pumping Station	Fairfax County	No	No	No	Non-burnable	\$574,625	\$0
Line Maintenance Gunston Pump and Haul	Fairfax County	No	No	No	Very Low	\$574,625	\$0
Noman C. Cole Pollution Control Plan	Fairfax County	No	No	No		\$151,602,820	\$15,047,198

Fairfax County Critical Assets

Line Maintenance Wiley Pump and Haul	Fairfax County	No	No	No	Very Low	\$574,625	\$0
Line Maintenance New Alexandria Tide Gate	Fairfax County	No	Yes	No	Non-burnable	\$574,625	\$0
Line Maintenance Hunter Estates Pumping Station	Fairfax County	No	No	No	Non-burnable	\$574,625	\$0
Line Maintenance Gunston Commerce Center Pumping Station	Fairfax County	No	No	No	Non-burnable	\$574,625	\$0
Line Maintenance Ordway Road Pumping Station (Also 7203, 7300, 7301 Ordway Road) No visible structure	Fairfax County	No	No	No	Non-burnable	\$574,625	\$0
McConnell Public Safety and Transportation Operations Center and Forensics Facility.	Fairfax County	Yes	No	No	Non-burnable	\$18,381,000	\$41,000,000
Burke Centre Library	Fairfax County	Yes	No	No	Non-burnable	\$2,338,369	\$500,000
Baron Cameron Park Irrigation Building	Fairfax County	No	No	No	Non-burnable	\$21,054	\$0
Dulles Corner park - Irrigation Building	Fairfax County	No	No	No	Non-burnable	\$25,025	\$0
8X6 irrigation building	Fairfax County	No	No	No	Non-burnable	\$20,052	\$0
Arrowbrook Park - Utilion Building, Pavillion and Rest Rooms	Fairfax County	No	No	No	Non-burnable	\$95,988	\$0
Mclean Community Center	Fairfax County	No	No	No	Non-burnable	\$7,434,531	\$616,127
Shelter House- Consisting Apartments For Families; Each Valued At \$50,000 Per Unit	Fairfax County	No	No	No	Non-burnable	\$584,358	\$37,128
Housing Authority property	Fairfax County	No	No	No	Non-burnable	\$296,085	\$100,000
Reston Regional Library	Fairfax County	No	No	No	Non-burnable	\$3,781,217	\$1,253,161

Fairfax County Critical Assets

Little River Glen Apartments Housing Authority 120 Units 4003, 4005, 4007, 4009 Barker Court	Fairfax County	Yes	No	No	Non-burnable	\$9,473,043	\$282,990
Spring Hill Recreation Ctr	Fairfax County	No	No	No	Very Low	\$15,787,035	\$482,609
Oak Marr Recreation Center, Golf Course and Maintenance Shop	Fairfax County	No	No	No	Non-burnable	\$10,826,290	\$574,127
Hollin Hall Senior Center	Fairfax County	No	No	No	Non-burnable	\$6,566,387	\$367,758
Baileys Community Center, Sr. Center and Higher Horizon Head start	Fairfax County	No	No	No	Non-burnable	\$2,003,597	\$52,479
Gum Springs Community Center	Fairfax County	No	No	No	Low	\$9,178,604	\$570,771
James Lee Community Center	Fairfax County	Yes	No	No	Non-burnable	\$4,918,597	\$262,395
Huntington Community Center	Fairfax County	No	Yes	No	Non-burnable	\$340,642	\$104,958
Mott Community Center	Fairfax County	No	No	No	Non-burnable	\$1,660,034	\$0
Lorton Prison Max Security Facility. Included all buildings at site, including Laurel Hill House, Education Services, Lipscomb House & Garage, Barrett House, Stempson House & Garage and Drug Testing facility. None are in current use.	Fairfax County	No	No	No	Very Low	\$53,592,000	\$0
Donated by Olander Banks, Jr who retains a life estate and lives on property.	Fairfax County	No	No	No	Non-burnable	\$464,341	\$400,000
Burgundy Recreation Ctr - Frame building with plastic siding.	Fairfax County	No	No	No	Non-burnable	\$233,163	\$20,992
I-66 Transfer Station	Fairfax County	Yes	No	No	Non-burnable	\$14,075,266	\$1,530,436
I-95 Landfill-Refuse Disp	Fairfax County	No	No	No	Non-burnable	\$973,983	\$81,164
Alban Maintenance Garage	Fairfax County	No	No	No	Non-burnable	\$2,928,353	\$2,800,000



CID#510090 Loudoun County – Comparison of Overall Loudoun County Median Household Incomes with Muddy Branch Study Census Tracts



Northern Virginia Hazard Mitigation Plan
Annex 8: Loudoun County

November 2022—FINAL



Loudoun County Overview

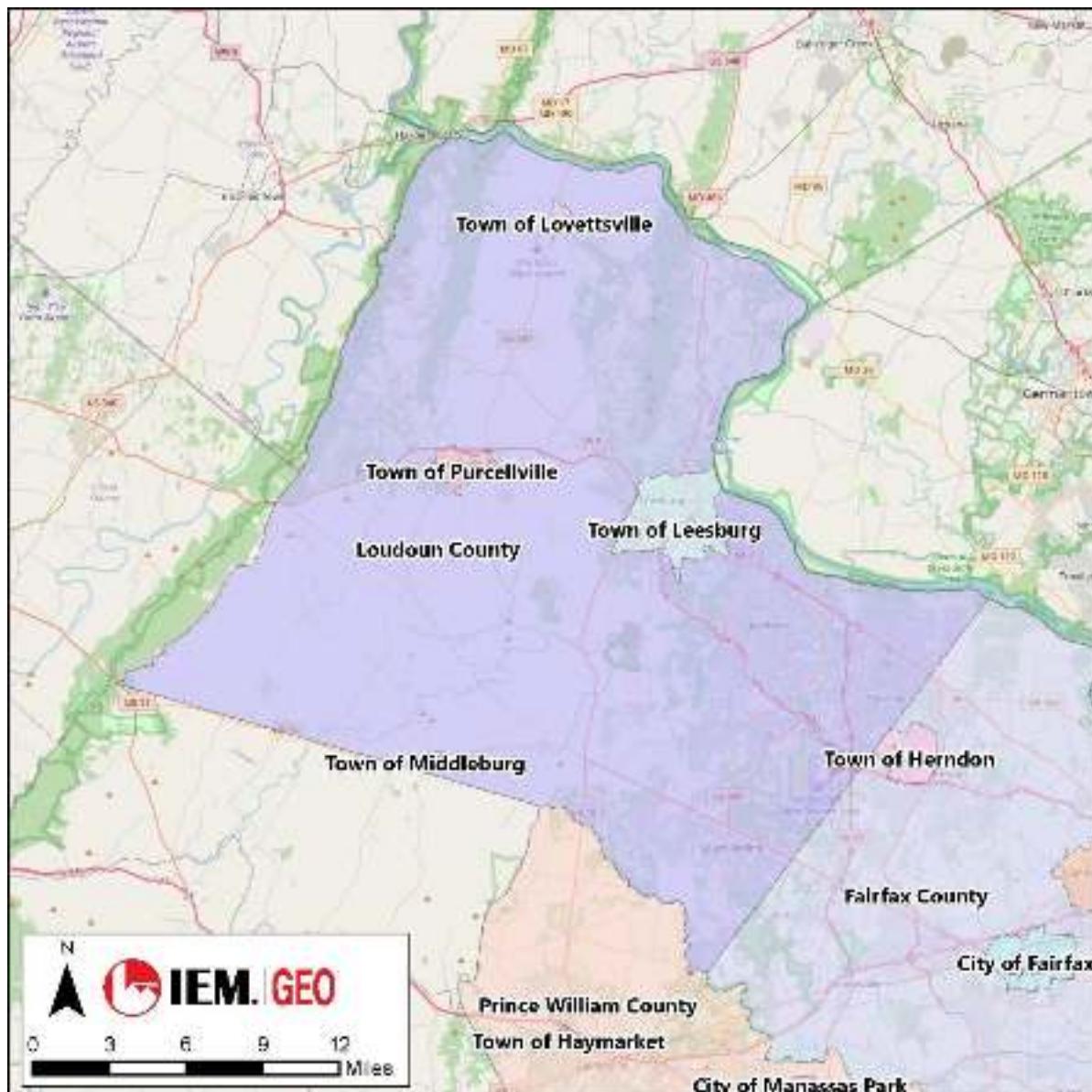


Table 1: Specific Jurisdictional Data

ESTABLISHED	LAND AREA	2020 POPULATION	GOVERNMENT ADDRESS	HOUSEHOLDS	MITIGATION FOCUS
1757	520 sq. mi.	421,636	1 Harrison St. Leesburg, VA 201745	142,074	Flood and Severe Storms

Loudoun County's Risk Environment

The following is a snapshot of the details in this annex. The well-researched details form the basis of effective mitigation strategies to improve community resilience.

Hazard Event History

National Centers for Environmental Information (NCEI), 1950–June 2021

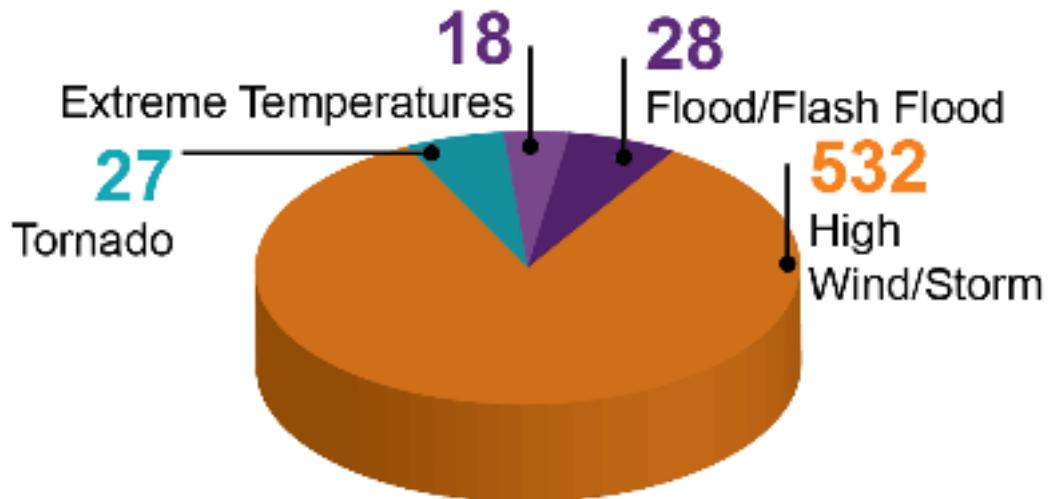


Figure 1: Number of Hazards

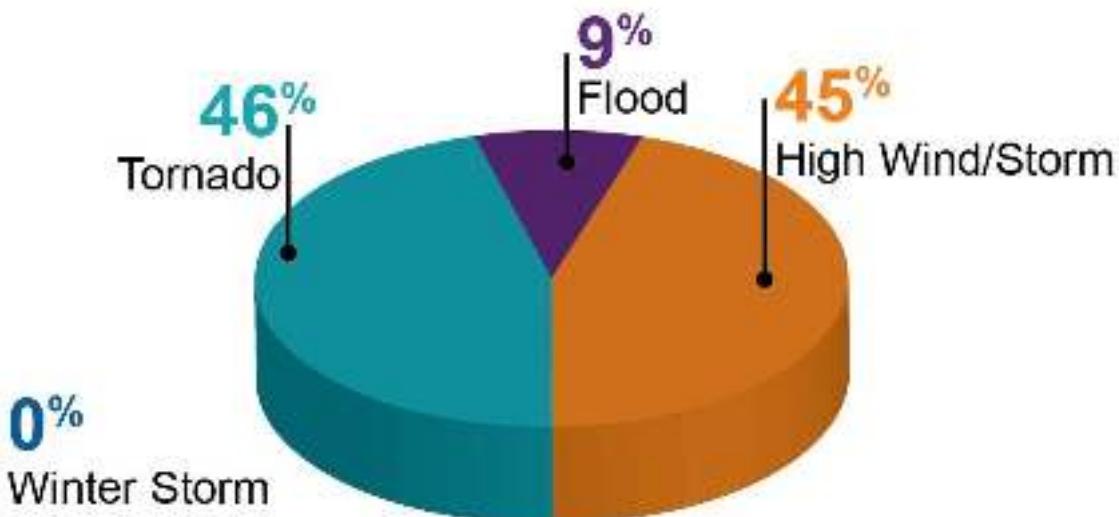


Figure 2: Property Damage Percentages from Natural Hazard Events

Natural Hazard Risk Ranking

Table 2: Natural Hazard Risk Ranking Summary

Hazard	Hazard Ranking
Winter Weather	High
High Wind/Severe Storm	High
Flood	High
Tornado	High
Dam Failure	Medium
Drought	Medium
Extreme Temperatures	Medium
Earthquake	Medium
Landslide	Low
Wildfire	Low
Karst/Sinkhole/Land Subsidence	Low

Community Lifelines and Respective Critical Assets

Table 3: Number of Critical Assets for Community Lifelines/Sectors

Lifeline/Sector	Number of Assets
Safety and Security	28
Food, Water, Shelter	59
Health and Medical	19
Energy	14
Communications	56
Transportation	922
Hazardous Materials	437
Education	146
Cultural/Historical	22
High Hazard Dams	23

A lifeline enables the continuous operation of government and business functions that are critical for human health, safety, or economic security. Lifelines are the most fundamental services for a community that, when stabilized, enable all other aspects of society to function. These lifelines are assets that may be a facility, infrastructure, operation, or entity. The information related to Community Lifelines and critical assets in Loudoun County is primarily provided by Hazus (Version 4.2). Due to the time lag in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by Loudoun County. Further information about Community Lifelines is discussed in Section 1.4 of this document.



Figure 3: Community Lifeline Components

Community Lifelines Outlined

- **Safety and Security:** Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Water, Shelter:** Food, Water, Shelter, Agriculture
- **Health and Medical:** Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy:** Power Grid, Fuel
- **Communications:** Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation:** Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Materials:** Facilities, HAZMAT, Pollutants, Contaminants

Mitigation Capabilities Summary

Table 4: Capability Assessment Summary Ranking for Loudoun County

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

Hazard Mitigation Plan Points of Contact

Table 5: Points of Contact Information

Contact Type	Contact Information
Primary Point of Contact	Kelly Myers, Assistant Coordinator—Planning Division Loudoun County Office of Emergency Management 703-771-5788—TTY 711 Kelly.Myers@loudoun.gov 801 Sycolin Road, SE Suite 100 Leesburg, VA 20175
Secondary Point of Contact	Jeff Fletcher, Deputy Coordinator 703-771-5788—TTY 711 Jeff.Fletcher@loudoun.gov 801 Sycolin Road, SE Suite 100 Leesburg, VA 20175

Loudoun County

This annex presents the following jurisdiction-specific information provided by Loudoun County for the 2022 update to the *Northern Virginia Hazard Mitigation Plan (NOVA HMP)*.

Table of Contents

Loudoun County Overview	i
Loudoun County's Risk Environment	ii
Hazard Event History	ii
Natural Hazard Risk Ranking	iii
Community Lifelines and Respective Critical Assets	iii
Community Lifelines Outlined	iv
Mitigation Capabilities Summary	v
Hazard Mitigation Plan Points of Contact	v
Loudoun County	vi
List of Tables	viii
List of Figures.....	ix
1. Jurisdiction Profile.....	1
1.1. Location.....	1
1.2. History	1
1.2.1. Loudoun Settlements.....	1
1.3. Demographics, Economy, and Governance	2
1.4. Built Environment and Community Lifelines.....	5
1.4.1. Safety and Security	6
1.4.2. Food, Water, Shelter.....	6
1.4.3. Health and Medical.....	6
1.4.4. Energy	6
1.4.5. Communications	6
1.4.6. Transportation	7
1.4.7. Hazardous Materials.....	8
1.4.8. Education.....	8
1.4.9. Recreational, Cultural, and Historic Sites and Assets.....	9
1.5. Growth and Development Trends	12
2. Jurisdiction Planning Process	14
2.1. Public Participation	17
3. Jurisdiction-Specific Hazard Event History	18
4. Hazard Risk Ranking.....	20
4.1. Additional Hazard Risk Considerations	21
4.1.1. National Risk Index.....	21
4.1.2. Dam Failure	22
4.1.3. Flood/Flash Flood	25
4.1.4. High Wind/Severe Storm	26

Northern Virginia (NOVA) Hazard Mitigation Plan	November 2022
4.1.5. Winter Weather.....	27
5. Vulnerability Assessment	28
5.1. National Flood Insurance Program.....	28
5.2. Population	30
5.3. Built Environment.....	33
5.4. Community Lifelines and Assets	33
5.5. Environment.....	35
5.6. Economy	35
5.7. Cultural/Historical.....	35
6. Capability Assessment.....	39
6.1. Capability Assessment Summary Ranking and Gap Analysis	39
6.1.1. Planning and Regulatory Capabilities Summary	41
6.1.2. Administrative and Technical Capabilities Summary	41
6.1.3. Safe Growth Capabilities Summary	42
6.1.4. Financial Capabilities Summary	42
6.1.5. Education and Outreach Capabilities Summary.....	43
6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts.....	43
7. Resilience to Hazards	45
7.1. Community Resilience Estimate	46
7.2. New Hazard Risk Challenges or Obstacles.....	47
8. Mitigation Actions	48
8.1. Goals and Objectives	48
8.2. Status of Previous Actions	48
8.3. New Mitigation Actions	48
8.4. Action Plan for Implementation and Integration	48
9. Annex Maintenance Procedures	51
9.1. Maintenance of the Jurisdiction Annex	51
9.1.1. Plan Maintenance Schedule.....	51
10. Annex Adoption	53
11. Loudoun County Attachments.....	54
11.1. Attachment 1: Adoption Resolution	55
11.2. Attachment 2: Planning Worksheets and Documentation	56
Capability Assessment	56
National Flood Insurance Program (NFIP) Survey Form	68
11.3. Attachment 3: Documentation of Public Participation	70
11.4. Attachment 4: Mitigation Actions	73

List of Tables

Table 1: Specific Jurisdictional Data	i
Table 2: Natural Hazard Risk Ranking Summary	iii
Table 3: Number of Critical Assets for Community Lifelines/Sectors.....	iii
Table 4: Capability Assessment Summary Ranking for Loudoun County	v
Table 5: Points of Contact Information.....	v
Table 6: Population and Growth Rate	3
Table 7: Economic Data.....	3
Table 8: Urban County Executive Governance.....	4
Table 9: Number of Community Lifelines and Critical Assets in Loudoun County'	5
Table 10: Quick Stats—The Loudoun County School District	9
Table 11: Loudoun County Population Estimates through 2045 by Subregions.....	13
Table 12: Local Planning Participants.....	14
Table 13: Schedule of Jurisdiction Meetings	16
Table 14: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County	18
Table 15: Significant Hazard Events Identified by Loudoun County, 2017–2021	18
Table 16: Hazard Risk Ranking Summary: Natural Hazards	20
Table 17: Hazard Risk Ranking Summary: Non-Natural Hazards	21
Table 18: State-Regulated High Hazard Dams in Loudoun County, as of May 2021	23
Table 19: Flood/Flash Flood Events in Loudoun County, 1950–May 31, 2021	26
Table 20: High Wind/Severe Storm Events in Loudoun County, 1950–June 30, 2021	26
Table 21: Severe Winter Storm Events in Loudoun County, 1950–June 30, 2021	27
Table 22: National Flood Insurance Program Status, Loudoun County.....	28
Table 23: NFIP Status, Insurance Summary, as of September 14, 2021	28
Table 24: NFIP Status, Staff Resources, as of September 14, 2021.....	29
Table 25: NFIP Status, Compliance History, as of September 14, 2021	29
Table 26: Building Stock Exposure by General Occupancy	33
Table 27: Vulnerable Community Lifeline Assets (in Thousands of Dollars)	33
Table 28: Critical Facilities Exposed to FEMA Floodplains, Loudoun County	34
Table 29: Direct Economic Losses Related to Earthquake, Flood, and Hurricane Wind.....	35
Table 30: Significant Historical and Cultural Landmarks	35
Table 31: Loudoun County Critical Assets Located in FEMA Identified Floodplains	36
Table 32: Capability Assessment Summary Ranking for Loudoun County	41
Table 33: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts	43
Table 34: Comparison of Loudoun County Scores with Virginia and National Average	45
Table 35: Loudoun County Risk Ranking	45
Table 36: Action Plan for Implementation and Integration, Loudoun County.....	49
Table 37: Loudoun County Plan Maintenance Responsibilities for the <i>Northern Virginia Hazard Mitigation Plan</i> , 2022 NOVA HMP Base Plan	51
Table 38: Loudoun County Jurisdiction Annex Maintenance Procedure	52
Table 39: Previous Mitigation Actions	73
Table 40: Non-Natural Hazard Mitigation Actions for County and Participants	79

List of Figures

Figure 1: Number of Hazards.....	ii
Figure 2: Property Damage Percentages from Natural Hazard Events	ii
Figure 3: Community Lifeline Components	iv
Figure 4: Race and Ethnicity Demographics.....	3
Figure 5: Loudoun County Road and Town Map	7
Figure 6: Loudoun County Historic Districts.....	11
Figure 7: Loudoun County Comprehensive Plan	13
Figure 8: Hazard Type Risk Index, National Risk Index.....	22
Figure 9: Overall Social Vulnerability (2018), Loudoun County	31
Figure 10: Social Vulnerability, by Theme, Loudoun County	32
Figure 11: Location of Loudoun County Rivers and Streams	34
Figure 12: Loudoun County Critical Assets Located in the Flood Zone	37
Figure 13: Legend to Figure 12 - Loudoun County Critical Assets Located in the Flood Zone	38
Figure 14: Summary of National Risk Index Findings, Loudoun County.....	45
Figure 15: Community Resilience Estimate for Loudoun County	47
Figure 16: Promotional Flyer Distributed throughout the Planning Area.....	71

1. Jurisdiction Profile

Established	1757
Incorporated Towns	7
Total Land Area	520 square miles (515 on land, 5 on water)
Geographic Region	Piedmont/Coastal Plain
Persons Per Household	3.06
Persons Per Square Mile	810
Median Age	36.2
Elevation	180 to 1,900 feet above sea level

1.1. Location

Located in the northeast region of the Commonwealth of Virginia, Loudoun County is part of the suburban ring of Washington, D.C. The county is partially bounded on north by the Potomac River. Directly across the river are three Maryland counties: Frederick, Montgomery, and Washington.

Loudoun County it is bounded on the east by Fairfax County, on the south by Prince William and Fauquier Counties, and to the west by Clarke County (VA), Jefferson County (WVA), and the Blue Ridge Mountain watershed. The Bull Run Mountains and Catoctin Mountain bisect the county. To the west of the range is the Loudoun Valley. Short Hill Mountain bisects the Loudoun Valley from Hillsboro to the Potomac River.

1.2. History

Loudoun County constitutes a part of the 5-million-acre Northern Neck of Virginia Proprietary granted by King Charles II of England to seven noblemen in 1649. This grant, later known as the Fairfax Proprietary, lay between the Potomac and Rappahannock Rivers. Between 1653 and 1730, Westmoreland, Stafford, and Prince William Counties were formed within the Proprietary, and in 1742 the remaining land was designated Fairfax County.

In 1757, by act of the Virginia House of Burgesses, Fairfax County was divided. The western portion was named Loudoun for John Campbell, the fourth earl of Loudoun, a Scottish nobleman who served as commander-in-chief for all British armed forces in North America and titular governor of Virginia from 1756 to 1759. Leesburg has served continuously as the county seat since 1757.

1.2.1. Loudoun Settlements

In-migration to the area in and around Loudoun County began between 1725 and 1730, while it was owned by Lord Fairfax. Permanent settlers came from Pennsylvania, New Jersey, and Maryland. During the same period, settlers from eastern Virginia, of English Cavalier stock, came to lower Loudoun and established large tobacco plantations. From 1745 to 1760, Germans from Pennsylvania and Maryland formed the settlement at Lovettsville. After General Braddock's defeat by the French at Fort Duquesne in 1755, refugees from the Shenandoah Valley of Virginia settled in the western part of Loudoun County, south of Short Hill. Catoctin Church became the center of that settlement.

For over two centuries, agriculture served as the main driver of the Loudoun County economy which had a relatively constant population of about 20,000. That began to change in the early 1960s, when Dulles

International Airport was built in the southeastern part of the county, with parts of the airport located in both Loudoun and Fairfax Counties. The airport attracted new businesses, workers, and their families to the area and increased tourism in the overall region, including the nation's Capital.

In addition to farm and cattle operations, the region supports large equine and microbrewery industries. In October 2021, the Virginia Equine Alliance generated an economic impact of over \$540 million and provided over 5,000 jobs across the Commonwealth.¹ Farms are also expanding their scope and have become a magnet for microbreweries since 2012, when the state allowed these businesses to serve pints instead of samples to visitors.² The website VisitLoudoun.org states that there are currently over 30 breweries in the county and the industry is growing.³

The 1970 population of 35,500 grew at a moderate pace for the next decade, reaching 87,208 in 1990. Beginning in 1990, the metropolitan region of Washington, D.C. began a period of rapid growth, spurred by the improvement of major transportation routes that enabled the resident population to commute to nearby industry centers. Development in the western areas of Loudoun County and inbound population movement to the area has been fostered by road access. In the last three decades, the population of Loudoun County has nearly quadrupled. The population grew 41% between 1990 and 2020, but growth in population since 1970 is significant at 1,138%.

Today, Loudoun County is a growing, dynamic county of 421,636 residents, renowned for its beautiful scenery, rich history, healthy diversity of expanding business opportunities, comfortable neighborhoods, and high-quality public services.

Due to its location on both the Virginia Piedmont near the Potomac River and its mountainous western region, the county experiences weather of all types, thus increasing the area's vulnerability to a range of hazards, notably flooding and severe storms. In addition to snow melt and rain-related river flooding episodes, low-lying areas of Loudoun 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 2015–2016 winter season, when snow levels in late January reached between 23 and 31 inches across the county, and ice and blizzard-related wind conditions impacted travel and caused power outages and property damage.

1.3. Demographics, Economy, and Governance

The Northern Virginia regional profile is presented in [Section 1, Base Plan](#) as context for the entire plan. The 2020 U.S. census population estimate for Loudoun County is 421,636, an increase of approximately 35% since 2010. The population density is 810 persons per square mile, significantly lower than other Northern Virginia counties, such as Fairfax County with 2,941.8 residents per square mile. Since 2008, the county has been ranked among the highest in the U.S. in median household income among jurisdictions with a population of 65,000 or more.

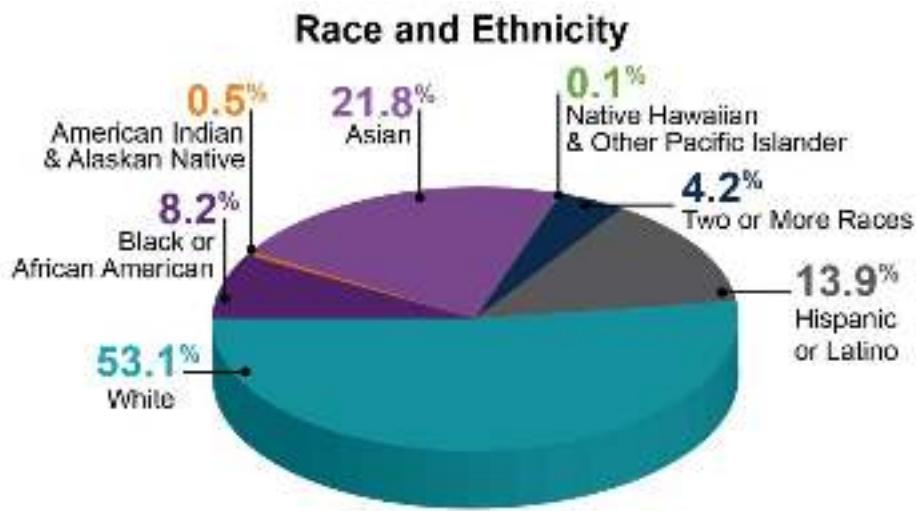
¹ Roy, Lisa (WUA) and McBride, Sharla (WUSA) (2021, October 28), A deeper look at the cultural and economic importance of horses in Virginia, WUSA9, <https://www.wusa9.com/article/features/cultural-economic-importance-horses-middleburg-virginia-salamander-hotel-national-sporting-library/65-0c508db6-0c1b-4d70-bcf5-2337015fc5>

² Freed, Benjamin, (2016, August 11), How Loudoun County Became a Beer-Head's Mecca, The Washingtonian, <https://www.washingtonian.com/2016/08/11/loudoun-county-beer-mecca-breweries/>

³ Visit Loudoun, Breweries (ND), <https://www.visitloudoun.org/drink/loco-ale-trail/breweries/>

Table 6: Population and Growth Rate⁴

Year	Population	Percent Increase over Previous Census
1970	37,150	
1980	57,427	55%
1990	87,208	52%
2000	173,897	99%
2010	312,468	80%
2020	421,636	35%

**Figure 4: Race and Ethnicity Demographics⁵****Table 7: Economic Data⁶**

Economy	Data
Median household income (2021)	\$142,299
Unemployment rate (November 2021) (September 2021)	2.1% 2.25%
Per capita income (2019)	\$55,744
Median house or condo market value (2021)	\$508,100
Percentage below poverty (2019)	3.2%
Number of businesses (2019)	11,028

⁴ U.S. Census (1970–2020), [City-Data](http://City-Data.com) (www.city-data.com), U.S. Census Bureau (www.census.gov), and Loudoun County (www.Loudouncounty.gov)

⁵ 2020 U.S. Census

⁶ U.S. Census (1970–2020), [City-Data](http://City-Data.com) (www.city-data.com), U.S. Census Bureau (www.census.gov), and Loudoun County (www.Loudouncounty.gov)

Economy	Data
Most common businesses	Agriculture (1,400 farms), Information and communications technology

Table 8: Urban County Executive Governance⁷

Urban County Executive Governance	Members
Board of Supervisors	9
Constitutional Officers	5
Congressional Districts	1 (VA-10)
Commonwealth's Attorney	1
Commissioner of the Revenue	1
Treasurer	1
County Executive	6
Sheriff	1
Clerk of Circuit Court	1
County Departments/Offices	38

Despite having a high median income, approximately 3.2% of residents live in poverty, the highest group being females between the ages of 1-24, or 17.71% of those impoverished. Rates for all older age groups are higher than those of the male population. It is likely that many of these women are heads of households with dependents under the age of 18.⁸

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. Much of the commercial development in Loudoun County is centered around three stations of Metrorail's Silver Line: the Ashburn Memorial Station, Dulles Airport Metrorail Station, and the Loudoun County Gateway Metrorail Station.

The Loudoun County Department of Economic Development (LCDE) is significant data source for information about current and growth business initiatives. The LCED identified key industry segments as follows:

- Data Centers
- Information and Communication Technology
- Federal Government Contracting
- Aerospace and Defense
- Aviation and Transportation
- Health Innovation and Technology
- Agriculture and Related Businesses

⁷ Ibid.

⁸ Data USA: Loudoun County, <https://datausa.io/profile/geo/loudoun-county-va#housing>

The LCDE reported that Loudoun is known as “Data Center Alley” because its data centers are home to more than 3,500 technology companies, including 25+ million square feet of current data centers and with another 4 million square feet under development. Astonishingly, there has not been a single day without data center construction in Loudoun in more than 13 years. Much of the world’s internet traffic passes through Loudoun’s digital infrastructure, making it a key player in the world’s technology economy.

The location of Dulles International Airport in Loudoun County has provided a boost to small businesses for which product shipping is essential to their operations. In an article about Loudoun’s Air Cargo Industry, the LCDE discusses how the agency helped small businesses, such as Georgetown Cupcake and Hypericum Flowers, work through steps needed to manage shipping nationally and internationally.⁹

1.4. Built Environment and Community Lifelines

The information related to Community Lifelines and critical assets in Loudoun County presented in this section has been collected from multiple sources, including Loudoun County Office of Emergency Management, Hazus (Version 4.2), and county government websites. Data extracted from the Hazus Level 1 assessment indicates that Loudoun County has an estimated total of 808 Community Lifelines and critical assets. Due to the time lag in collecting and verifying data and the method of documenting location and jurisdiction used in Hazus, this may not reflect the current inventory maintained by Loudoun County. Additional information about assets is included in the Base Plan.

Table 8 provides a summary of the number of critical assets, by type. Loudoun County maintains a detailed list of Community Lifeline facilities, sites, and critical assets.

Table 9: Number of Community Lifelines and Critical Assets in Loudoun County^{10, 11}

Lifeline/Sector	Number of Assets
Safety and Security	28
Food, Water, Shelter	59
Health and Medical	19
Energy	14
Communications	6
Transportation	433
Hazardous Materials	59
Education	145
Cultural/Historical	22
High Hazard Dams	23

⁹ Loudoun County Economic Development Council, (2012, May 17), From Flowers to Cupcakes -Loudoun’s Air Cargo Industry, <https://biz.loudoun.gov/2012/5/17/from-flowers-to-cupcakes-Loudoun’s-air-cargo-industry/>

¹⁰ Loudoun County, Hazus

¹¹ CountyOffice.gov, Hospitals-Loudoun County, VA (Emergency & Medical Care, <https://www.countyoffice.org/hospitals-virginia>

1.4.1. Safety and Security

Hazus data citing Loudoun County assets to address community Safety and Security included mention of one Emergency Operations Center, 20 fire stations, and eight police stations. Hazus medical data was combined with that found at www.countyoffice.org, a centralized database of government services provided in all 50 states.

1.4.2. Food, Water, Shelter

Food commodities are available throughout Loudoun County from public retail providers, wholesalers, and contracted services for specific institutions and facilities. Additional contracts may be entered into for post-disaster needs.

Four service providers in Loudoun County provide potable water services: Goose Creek Water Treatment Plant, Hamilton Acres Water Treatment Plant, Kenneth B. Rollins Memorial Water Filtration, and the Town of Purcellville Water Treatment Plant.

Wastewater treatment services are provided in all sectors of the county, although several of those managed by the county are just coming online. These facilities include reservoirs, lift stations, wells, and storage tanks. Hazus reports that there are 30 wastewater treatment plants and services managed by the county and an additional 24 managed by the Town of Round Hill, for a total of 59 wastewater treatment facilities.

1.4.3. Health and Medical

The Hazus program identified four hospitals as being located in Loudoun County:

- Stone Springs Hospital Center
- Inova Loudoun Hospital
- HealthSouth Rehabilitation Hospital
- North Spring Behavioral Healthcare

Additional healthcare resources identified as being located in the county include:

- Three Emergency Services Centers
- Three Health Department Offices
- Three Mental Health Services facilities (in addition to the North Spring facility)

1.4.4. Energy

Fourteen energy assets are identified in the Hazus database as being in Loudoun County. Natural gas pipelines include those maintained by Dominion Transmission Company, Columbia Gas Transmission Company, and Cove Point Pipeline. The county includes three natural gas compressor plants and the Stonewall Power Plant located in Leesburg.

1.4.5. Communications

Most communications and information systems and infrastructure in the United States are privately owned; however, the county maintains authority and control over public safety communications for fire, police, and other responding agencies. Hazus identified one broadcast station (WAGE 1200) as being in

the county, but the Loudoun County Department of Economic Development listed among its business members those who manage local news websites, magazines, and newsletters. Loudoun County is also well served by an array of broadcasters either in the county or the larger surrounding counties, Washington, D.C., and communities directly across the Potomac River in Maryland. On another front, Loudoun County is a national leader in information technologies (IT) communications given the region's concentration of businesses providing IT services.

In recent years, the federal government has taken a stronger role in protecting information and communications infrastructure, which may also present a challenge in relation to disaster impacts. Increasing reliance on this infrastructure by individuals, businesses, and government could cause vulnerabilities which emergency managers should take into consideration in pre- and post-incident planning and operations.

1.4.6. Transportation

U.S. Highway 15 and Virginia Route 7 intersect in Leesburg, providing highway access in all directions. The Point of Rocks bridge on U.S. Highway 15, north of Leesburg, is the only bridge across the Potomac River between it and the Capital Beltway.

Loudoun County is served by the following major highways and commuter lines shown on a map included on the LoudounHistory.org website.

- U.S. Highways: 7, 9, 15, 50, 340
- Loudoun County Parkway
- Dulles Greenway
- Washington Metrorail: Silver Lines



Figure 5: Loudoun County Road and Town Map¹²

¹² The History of Loudoun County, Loudoun County Town and Road Map, <https://www.loudounhistory.org/history/history-loudoun/>

The maintenance of transportation facilities and systems is the responsibility of the owner or entity with authority, including municipal, county, state, and federal highway departments and agencies; toll and rail authorities; and the military. The Virginia Department of Transportation maintains most primary and secondary roads in Loudoun County, except for the Dulles Toll Road, which is under the authority of the Metropolitan Washington Airports Authority. Loudoun County Transit (LCT) manages local fixed-route bus service from Purcellville through Leesburg and eastern Loudoun County. In keeping with the community's interest in outdoor recreation and environmental preservation, all local buses are equipped with bike racks. LCT also provides paratransit service for eligible persons with disabilities, but fixed-route busses are equipped with wheelchair lifts and are wheelchair-accessible.

Metrorail, operated by the Washington Metropolitan Area Transit Authority, enables commuters, visitors, and area residents a mechanism for travel throughout the Washington, D.C. area. The system is the second busiest in the U.S. and is currently piloting an After-Hours Commuter Service Program.

The Hazus database notes a total of 443 transportation structures, facilities, or segments, including the following:

- Highway bridges: 402
- Highway segments: 39
- Airport facilities: 2

However, it must be noted that the one airport facility listed by Hazus as being in Loudoun County is Leesburg Executive Airport. There are actually two airport facilities in Loudoun County, with Dulles International Airport being the more notable.

1.4.7. Hazardous Materials

The Hazus database identifies a list of assets including 10 natural gas pipelines, three natural gas compressor plants, and one power plant located in Loudoun County. In October 2021, the EPA issued its Toxic Release Inventory (TRI) of chemicals released in the year 2020. The report showed that 9,287 pounds of 19 different chemicals—from 1,2,4 trimethylbenzene and ammonia to xylene and n-hexane—were released through onsite or offsite disposal.¹³ The Loudoun County Office of Emergency Management works closely with companies that dispose of chemicals to monitor processes and ensure that hazardous materials are handled safely.

1.4.8. Education

Loudoun County Public Schools (LCPS) is the third largest school division in the Commonwealth of Virginia. Established in 1870, LCPS is in the rapidly growing Washington, D.C., metro area. Loudoun County is the fastest growing county in the Commonwealth of Virginia. Each year, LCPS opens one to three new school facilities to accommodate our growing student population.

LCPS students earned an average SAT score of 1173 (592 Reading and 581 Math). The LCPS Class of 2020 had 54 National Merit Semifinalists and an on-time graduation rate of 96.8%. They earned more than \$48.2 million in scholarships. Accreditation was waived by the Virginia Department of Education (VDOE) in 2020 due to the pandemic, but 100% of LCPS schools were fully accredited in 2019. LCPS has a nearly \$1.3 billion operating budget and prides itself on competitive starting teacher salaries.¹⁴

¹³ U.S. Environmental Protection Agency, Toxic Release Inventory (TRI), Toxic Release Explorer, Loudoun County Chemical Release Report, <https://tinyurl.com/yswvbxct>

¹⁴ <https://www.lcps.org>

A report on LCPS published in *U.S. News and World Report* highlighted key facts:

Table 10: Quick Stats—The Loudoun County School District¹⁵

Student-Teacher Ratio	14-1
Number of Schools	94
Number of Students	83,606
Minority Enrollment	50%
Economically Disadvantaged	15.3%
Racial Breakdown Percentage	<ul style="list-style-type: none"> • White: 46.4% • African American: 6.2% • Asian or Asian/Pacific Islander: 22.8% • Hispanic/Latino: 17.9% • American Indian or Alaska Native: 0.6% • Native Hawaiian or other Pacific Islander: 0.1% • Self-identified as being of 2 or more races: 5.6%

At schools in Loudoun County Public Schools, 15.3% of students are eligible for the federal free and reduced-price meal program and 13.9% of students are English-language learners.

Loudoun County has one of the largest public-school districts in the United States, with 198 prekindergarten through twelve grade schools and centers and a diverse student population of 83,606 students. More than 27% of these students are considered economically disadvantaged, and more than 26% of students learn English as a second language.

In addition to these public and private educational facilities within Loudoun County, there are 35 college and university facilities located within its jurisdictional boundaries, including:

- The Art Institute of Washington: Dulles
- Northern Virginia Community College
- George Washington University: Virginia
- George Mason University: Loudoun Campus
- Shenandoah University: Leesburg Campus
- Shenandoah University: Ashburn Campus
- Virginia Polytechnic Institute and State University: Leesburg Campus

1.4.9. Recreational, Cultural, and Historic Sites and Assets

The Loudoun County Department of Parks, Recreation, and Community Services (PRCS) develops and maintains a system of parks, recreational facilities, and community services. At the same time, the Department protects environmentally sensitive land and resources and areas of historic significance. The Department manages a Capital Asset Preservation Program (CAPP) that provides a consistent means of planning and financing asset maintenance efforts. The program provides the county with the ability to extend the useful life of mature and aging features, including repair, total demolition and replacement. CAPP is designed to address and fund replacement and maintenance of park facilities. Features

¹⁵ U.S. News and World Report, n.d., <https://www.usnews.com/education/k12/virginia/districts/loudoun-co-pblc-sch-105672>

addressed through CAPP can be structural (i.e., structural assessments and replacement of buildings, pavilions, roofs, storage sheds, office building, equipment storage building/maintenance shops, bridges), site-related (i.e., asphalt/concrete, stormwater facilities, channel restoration, playing fields, fences, backstops), mechanical (i.e., outside of buildings), and electrical or plumbing (i.e., boilers, water heaters). CAPP also addresses environmental issues, such as asbestos and lead paint removal and disposal, and the structural integrity of existing and historical buildings which may result in recommendations for removal, replacement, or repair.¹⁶

- **Arcola Park Pavilion:** Roof Replacement
- **Ashburn Park:** Pavilion Repair
- **Bles Park:** Replace the irrigation line and upgrade the power to the electrical panel
- **Claude Moore Park Fence Replacement:** Fields 1, 2 and 3
- **Conklin Park:** Develop conceptual plans for features and trails within the park. This development must go through the legislative process for a Special Exception with a Site Plan Amendment. The park is in major and minor floodplain.
- **Douglass Community Center:** Trails and Sidewalk Repair/Replacement
- **Franklin Park Tennis Courts:** Repair/Replacement including fence replacement
- **Trailside Park Bridges:** Repair one and replace two of the three bridges in collaboration with the Dept. of General Services, including channel restoration and floodplain study. Includes the need for a retaining wall and guardrails.

Loudoun County is also a member of NOVA Parks (formerly **Northern Virginia Regional Park Authority**), an inter-jurisdictional organization that owns and operates over 10,000 acres of woodlands, streams, parks, trails, nature reserves, countryside, and historic sites in Northern Virginia. The group is governed by a 12-member policy board, with representation from three counties—Loudoun, Arlington, and Fairfax—and three cities—Alexandria, Falls Church, and Fairfax.¹⁷

1.4.9.1. Historic and Cultural Conservation Districts

The Historic District Program enables Loudoun County to be a Certified Local Government. This gives the county standing with the State Preservation Office to comment on nominations of property to the national and state registers and allows the county to apply for grant money specifically allocated for local preservation efforts. Loudoun County Historic Districts include Aldie, Beaverdam Creek Historic Roads, Bluemont, Goose Creek, Oatlands, Taylorstown, and Watersford. The Towns of Leesburg, Middleburg, and Purcellville also have locally designated historic districts administered by the town governments.¹⁸

¹⁶ Loudoun County Department of Parks, Recreation, and Community Services (PRCS)

¹⁷ <https://www.novaparks.com/about-nova-parks/about-nova-parks>

¹⁸ Loudoun County Planning and Zoning, Historic & Heritage Resources, County Historic Districts, <https://www.loudoun.gov/2370/County-Historic-Districts>

Loudoun County Historic Districts

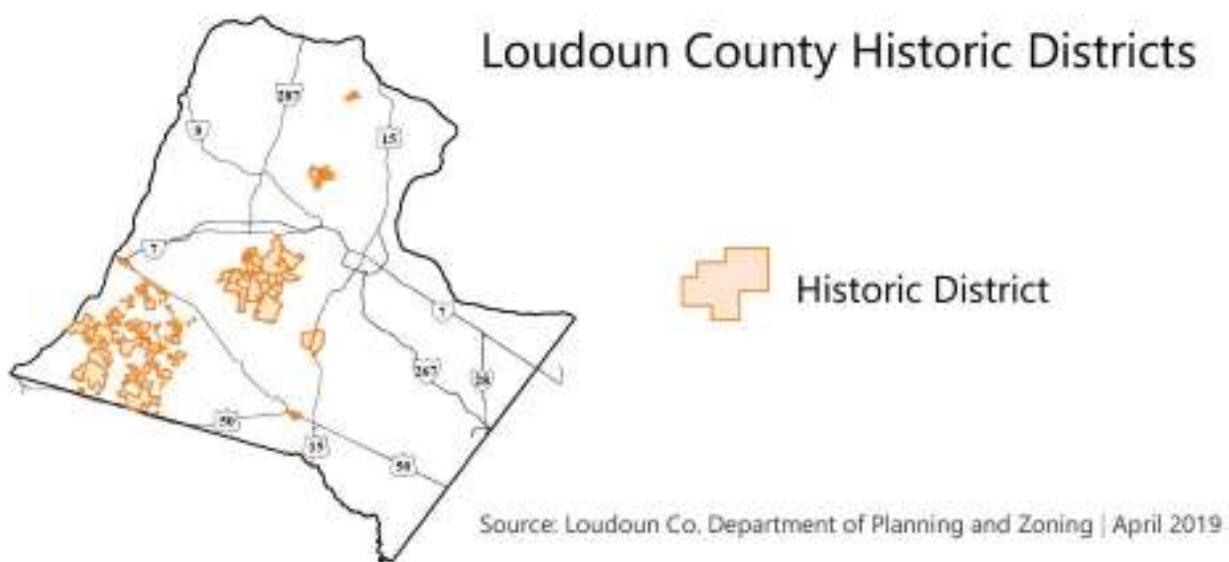


Figure 6: Loudoun County Historic Districts

The Loudoun County Resident Curator Program (RCP) helps preserve the county's historic buildings by rehabilitating and maintaining underutilized historic properties and making them accessible to the public. The county will provide long-term leases to qualified tenants who agree to rehabilitate and maintain these historic resources in accordance with established preservation standards. A curator can be a private citizen, a nonprofit entity, or a for-profit entity. The RCP is part of the county's implementation of its Heritage Preservation Plan, allowing the county to protect and preserve resources through acquisition, maintenance, and public engagement and education related to county-owned properties.

The RCP was designed to reduce the public costs associated with the care and preservation of the properties by enabling groups or individuals to take over the responsibility. In addition to caring for the day-to-day management of the property, the curators are responsible for the rehabilitation and continued maintenance of the property. Properties that are included in the RCP have been deemed historically significant and either meet the county's established criteria of eligibility for curation and/or also may meet the National Historic Register criteria.

Three RCP initiatives support Loudoun County's vision of recognizing its historical past while looking ahead to improving life of and services for its residents.

1. Maintained a Master List of archeology sites

For most types of development applications, an archaeological survey is required to determine if the proposed development will negatively impact significant historic and archaeological sites.

Loudoun County has over 1,500 recorded archaeological sites that include both prehistoric Native American sites and early European domestic and industrial sites. The majority of archaeological investigation that occurs in Loudoun County is directly linked to both county and federal requirements related to land development projects.

2. Developed the African American Survey

In 2002 and 2003, the Loudoun County Board of Supervisors contracted with History Matters, a program of the City of New York (CUNY) and George Mason University, to survey historic resources related to the history of African Americans in Loudoun County, Virginia. As a result of the survey, the Virginia Department of Historic Resources determined that seven of the African-American communities are eligible for listing on the National Register of Historic Places:

Bowmanton, Brownsville, Howardsville, Murphy's Corner, St. Louis, Watson, and Willisville. The county continues its efforts to capture all resources available to understanding the contribution of African Americans to the development of the state and our nation.

3. Created a Heritage Preservation Plan

The Heritage Preservation Plan includes strategies for identifying, preserving and promoting Loudoun County's heritage resources on three fronts: community education, heritage tourism, and resource protection. The plan recommends implementation steps, such as the creation of a Heritage Commission and a Heritage Register.

1.5. Growth and Development Trends

The county's population grew slowly through the 1970s. Until around 1990, the population was under 100,000, but since that time the growth rate has moved from a relatively flat horizontal line to growth spurts between each year from 2000 to the present, when the line becomes vertical.

In recent decades, Loudoun County has transitioned from a residential suburb of Washington, D.C. to a vital commercial, residential, office, and research hub. This substantial change has been reflected in the jurisdiction's land-use pattern, with the vast expansion of nonresidential land uses and, to a lesser extent, growth in residential land use, by acres. Since 1990, the rate of multi-family townhouses and apartments has exceeded single-family detached housing construction at a rate of two to one. As of December 2020, there was a planned 2.7 million square feet of office space under construction in the county.¹⁹

This rate of growth has had a significant impact on public facilities and infrastructure, particularly on transportation capacity and the reduction in the supply of vacant land. The increased demand for future development and infrastructure may result in pressure to build in areas susceptible to impacts from natural hazards such as floods. Land use controls through the county's ordinances and regulations provide some protection against this pressure but should be continuously monitored for new demands that could increase hazard risks in the future.

Despite the overall slowing growth rate, the 2050 forecast for population, housing units, and households indicates slight growth. Much of the population growth is related to continuing development of multi-family housing, including owned and rental properties. For this reason, stakeholders developed the Loudoun County 2019 Comprehensive Plan (Comprehensive Plan). This plan is the culmination of a collaborative multiyear effort and an unprecedented public outreach campaign that brought together Loudoun's citizens, elected and appointed officials, stakeholders, and county staff to create a new comprehensive plan for the county. This planning process, known as Envision Loudoun/Loudoun 2040, encapsulates what residents want to see in the way of future development of Loudoun County while considering growth management; land use; place types; transportation; natural, environmental, and heritage resources; and community facilities. This led to the development of the 2019 Comprehensive Plan, which describes the community's vision.²⁰

¹⁹ [Real Estate Report, Loudoun County Economic Development Authority, Year-End 2020](#), December 31, 2020. (<https://www.Loudouncountyeda.org/wp-content/uploads/2021/07/Yearend2020RealEstateReport.pdf>)

²⁰ Loudoun County, New Comprehensive Plan: The History of the Envision Loudoun Process, <https://www.loudoun.gov/3298/Envision-Loudoun-Process>



Figure 7: Loudoun County Comprehensive Plan

Among the datasets included in the Comprehensive Plan is an estimate of population growth for each five-year period between the years 2021 and 2045.

Table 11: Loudoun County Population Estimates through 2045 by Subregions²¹

Subregion	2025	2030	2035	2040	2045
Ashburn	5,205	5,804	1,952	1,975	1,627
Dulles	4,521	3,086	1,242	529	358
Leesburg	2,021	2,339	1,023	132	15
Northwest	312	365	488	507	507
Potomac	167	120	243	284	196
Route 15 North	210	210	227	226	226
Route 15 South	145	200	150	111	111
Route 7 West	515	420	238	250	80
Southwest	105	125	135	156	156
Sterling	1,282	1,658	1,360	990	409
County	14,483	14,327	7,058	5,160	3,685

The Comprehensive Plan highlights the intent for appropriate residential development of land in relation to flood hazards, as stated in Objective 7, Policy a: “Prohibit new residential structures within flood impact hazard areas.” This objective, in combination with the land-use ordinances and Floodplain Management Plan, provide some controls that limit the increase of flood hazard risk caused by future development. Land development in Loudoun County is monitored and controlled at the county level. Loudoun County will continue to be a planning partner with local jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk. Projected growth trends should be monitored in the next planning cycle with the intent to provide a more detailed statistical analysis of vulnerable populations and how this could potentially impact hazard consequences and mitigation opportunities.

²¹ Source: Loudoun County Department of Budget and Finance

2. Jurisdiction Planning Process

For the 2022 NOVA HMP update, Loudoun County followed the planning process described in **Section 2, Base Plan**. In addition to providing representation to the NOVA HMP Planning Team, the county supported the local planning process requirements by coordinating with representatives from other departments and agencies within its jurisdiction. Participants in the local planning activities are listed in Table 11.

Table 12: Local Planning Participants

Kelly Myers	Assistant Coordinator- Planning	Loudoun County Office of Emergency Management
Joe Dame	Emergency Management Coordinator	Town of Leesburg
Danny Davis	Town Manager	Town of Middleburg
Melissa Hynes	Town Administrator	Town of Round Hill
Harriet West	Town Clerk	Town of Round Hill
Cynthia McAlister	Chief of Police	Town of Purcellville
Ernie Brown	Director	Loudoun County- Department of General Services
Alan Brewer	Director	Loudoun County- Department of Building and Development
Alana Ray	Director	Loudoun County- Department of Planning and Zoning
Monica Spells	Assistant County Administrator-Human Services	Loudoun County Office of the County Administrator
Sam Finz	Town Manager	Town of Lovettsville
John Merrithew	Planning Director	Town of Lovettsville
Joe Betts	Project Manager	Town of Lovettsville
Buddy Rizer	Director	Loudoun County Economic Development

Colleen Kardasz	Assistant Director	Loudoun County Economic Development
Joe Kroboth	Assistant County Administrator-Community Development	Loudoun County Office of the County Administrator
Aj Panebianco	Chief of Police	Town of Middleburg
Alton Echols	Deputy General Manager of Operations & Maintenance and Engineering	Loudoun Water
Maggie Auer	Floodplain Manager	Loudoun County- Department of Building and Development
David Ma	Senior Engineer	Town of Leesburg
Betsey Arnett	Public Information Officer	Town of Leesburg
Gwen Kennedy	Program Manager	Loudoun County- Department of Building and Development
Richard Williams	Director of Parks and Recreation	Town of Leesburg
Russell Chambers	Plant Manager- Water Treatment Facility	Town of Leesburg
Philip Jones	Assistant Director for Capital Projects	Town of Leesburg
Matt Schulz	Assistant Coordinator - Operations	Loudoun County Office of Emergency Management
Andrew Irvine	Emergency Preparedness Specialist	Loudoun County Office of Emergency Management
Glen Barbour	Public Information Officer	Loudoun County Office of Public Affairs
Elizabeth Moore	Emergency Preparedness Specialist	Loudoun County Office of Emergency Management

The list of project meetings in which representatives of Loudoun County and/or its jurisdictions participated show the degree to which the county and its jurisdictions are committed to the hazard mitigation planning process. Shown here are meetings at which the county and towns discussed their specific hazards of concern, though many of the county and town representatives also attended meetings of the full NOVA HMP Planning Team.

Table 13: Schedule of Jurisdiction Meetings

Date	Jurisdiction(s)	Purpose
May 25, 2021	Loudoun County, Town of Leesburg, Town of Purcellville, Town of Middleburg, and Town of Round Hill	Jurisdiction Planning Needs Assessment
June 25, 2021	Loudoun County and Town of Leesburg	Technical Assistance
July 22, 2021	Loudoun County	Capability Assessment
August 2, 2021	Loudoun County, Town of Leesburg, Town of Purcellville, and Town of Middleburg	Action Item review and creation
August 23, 2021	Loudoun County, Town of Leesburg, Town of Purcellville, and Town of Middleburg	Action Item review and creation
August 27, 2021	Town of Lovettsville	Hazard Identification, Community Asset Identification, Jurisdiction Information Collection, Jurisdiction Needs Assessment, and Action Items and Action Plan Completion
September 30, 2021	Town of Lovettsville	Capability Assessment, Hazard Risk Ranking, and Critical Facilities and Historical Information Review
October 29, 2021	Town of Middleburg	Capability Assessment and Critical Facilities and Historical Information Review

The jurisdiction identified its chief hazard mitigation planning responsibility as providing oversight in the planning process through the Emergency Manager's Group and representation in the Emergency Manager's Planning Group. The county also identified the following tasks as part of its mitigation planning responsibilities:

- Jurisdictional Planning Team
- Management support for the planning effort
- Planning Team resource/subject matter expert
- Hazard risk and vulnerability assessment
- Provide technical data and hazard information
- Capabilities assessment
- Mitigation strategy development
- Sponsor mitigation actions
- Review plan drafts and provide input
- Public outreach activities
- Implementing the plan
- Maintaining the plan

Loudoun County planning participants coordinated primarily by means of virtual meetings during the planning process and as needed to carry out independent planning activities completed through a series of worksheets that provided background information on the history of hazard events, hazard risks and vulnerabilities, capabilities, and past mitigation efforts. Additional planning process documentation of the Planning Team meetings is included in the **Base Plan, Appendix A**.

2.1. Public Participation

Several opportunities for public involvement were provided during the planning process, including a Public Hazard Survey <https://www.loudoun.gov/752/Hazards> and access to the draft plan for review and input.

In reviewing both documents, the public was offered the opportunity to provide input to the community hazards of concern and the Draft 2022 Plan update that recommends mitigation strategies to minimize the impact of any and all hazards. Notification of the Draft Plan release was made through the same county web link used to enable residents to participate in the community survey. Documentation of the public survey and draft plan review is included in **Attachment 3** of this annex.

3. Jurisdiction-Specific Hazard Event History

Loudoun County's comprehensive hazard history is described in [Section 5, Base Plan](#). The diversity of the landscape increases the 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 the 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 2015–2016 winter season, which resulted in a Federal Disaster Declaration.

The National Oceanic and Atmospheric Administration (NOAA) National Center for Environmental Information (NCEI) Storm Events Database includes 1,036 recorded natural weather events that took place in the county between January 1, 1950, and May 2021. The county has been included in three Federal Disaster Declarations and emergencies between 2017 and May 2021.

Table 14: Federal Disaster and Emergency Declarations (2017–2021), Loudoun County²²

Declaration	Date	Hazard	Assistance Type
DR-4512-VA	4/2/2020 (continuing)	COVID-19 Pandemic	Individual Assistance, Public Assistance
EM-3448-VA	3/13/2020 (continuing)	COVID-19 Pandemic	Public Assistance (Category B)
EM-3403-VA	9/11/2018	Hurricane Florence	Public Assistance (Category B)

Table 15: Significant Hazard Events Identified by Loudoun County, 2017–2021

Date	Hazard	Event and Description
February 2020	EF0 Tornado	An area of low pressure formed over the area in response to an impressive longwave trough approaching from the west. A line of low-topped showers and thunderstorms formed along the system's cold front, leading to instances of damaging winds and a tornado in Leesburg. Many trees were downed and fell on homes and cars. Property damage totaled \$5,780,000, the largest amount for a hazard event in Loudoun County in the last five years.
February 2019	Winter Weather	Surface high pressure was located over the region, giving way to several waves of low pressure. Intermittent precipitation led to snow accumulations up to around one inch and ice accumulations generally between 0.10 and 0.20 inches, although these figures were as high as 0.50 to 1.0 inch across the higher elevations. The only direct fatality reported by NCEI since 2017 occurred when a 52-year-old woman in northeastern Loudoun County was killed from a falling branch outside of her home due to weight from ice on

²²FEMA

Several significant events were identified by NCEI as taking place in recent years.

Date	Hazard	Event and Description
		the tree limbs. The elevation of the incident was approximately 680 feet.
March 2018	High Wind	A low-pressure system moved in from the central United States and intensified rapidly as it moved eastward. Winds up to 58 mph were recorded in several locations, including a report from Dulles International Airport, which clocked the wind at 57 mph. Numerous trees were downed, and the wind blew roofing, siding, and doors from residential structures, although no official report of damages is recorded.

4. Hazard Risk Ranking

After developing hazard profiles, the Loudoun County Mitigation Planning Team conducted a two-step quantitative risk assessment for each hazard that considered population vulnerability, geographic extent/location, probability of future occurrences, and potential impacts and consequences. The numerical scores for each category were totaled to obtain an Overall Risk Score, which is summarized as one of these risk and vulnerability classifications:

- **Low:** Two or more criteria fall in lower classifications or the event has a minimal impact on the planning area. This rating is sometimes used for hazards with a minimal or unknown record of occurrences or for hazards with minimal mitigation potential.
- **Medium:** The criteria fall mostly in the middle ranges of classifications and the event's impacts on the planning area are noticeable but not devastating. This rating is sometimes used for hazards with a high extent rating but very low probability rating. The potential damage is more isolated and less costly than a widespread disaster.
- **High:** The criteria consistently fall in the high classifications and the event is likely/highly likely to occur with severe strength over a significant to extensive portion of the planning area.

The two-step hazard risk ranking methodology is detailed in [Section 4, Base Plan](#). The Hazard Risk Ranking scores by individual categories for Loudoun County are provided in [Attachment 2](#) of this annex.

The Overall Risk Score for each hazard served as the basis for determining whether a vulnerability assessment should be conducted. Natural hazard profiles are presented within the hazard subsections in [Section 5, Base Plan](#), and local detail is provided in the Jurisdiction Annexes. Non-natural hazard profiles are presented in [Volume II of the Base Plan](#).

Table 16: Hazard Risk Ranking Summary: Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Winter Weather	3.3	3.5	6.8	High
High Wind/Severe Storm	2.7	3.4	6.1	High
Flood	1.7	4.1	5.8	High
Tornado	1.7	4.1	5.8	High
Dam Failure	1.0	4.4	5.4	Medium
Drought	2.0	3.2	5.2	Medium
Extreme Temperatures	2.3	2.7	5.0	Medium
Earthquake	1.7	3.2	4.9	Medium
Landslide	1.3	2.5	3.9	Low
Wildfire	1.0	2.8	3.8	Low
Karst/Sinkhole/Land Subsidence	1.0	2.5	3.5	Low

Table 17: Hazard Risk Ranking Summary: Non-Natural Hazards

Hazard	Total Probability Score	Total Consequence Score	Overall Risk Score	Hazard Ranking
Infectious Disease/Public Health	2.0	5.3	7.3	High
Terrorism	1.0	6.1	7.1	High
Cyberattack	1.7	4.7	6.4	High
Civil Unrest	1.0	4.9	5.9	Medium
Communication Disruption	1.3	3.7	5.0	Medium
Hazardous Materials	1.0	3.9	4.9	Low
Active Violence	1.0	3.6	4.6	Low

Based on the hazard risk scores, Loudoun County evaluated the level of risk for 18 hazards: 11 natural and 7 non-natural.

Eight natural hazards were identified as high or medium risk hazards to which the jurisdiction is vulnerable:

- **High:** Winter Weather, Flood (riverine/flash flood), and High Wind/Severe Storm
- **Medium:** Dam Failure, Drought, Earthquake, Extreme Temperatures, Tornado

Five non-natural hazards were ranked as high or medium risk:

- **High:** Infectious Disease/Public Health, Terrorism, Cyberattack
- **Medium:** Civil Unrest, Communication Disruption

All other hazards are ranked as “low,” signifying a minimal risk to Loudoun County.

4.1. Additional Hazard Risk Considerations

4.1.1. National Risk Index

The National Risk Index (NRI) is a dataset and online tool developed by the Federal Emergency Management Agency (FEMA) and other partners to help illustrate communities in the United States at risk for 18 natural hazards. Hazard risk is calculated on data for a single hazard type and reflects the relative risk for that hazard type; it should be considered only as a baseline relative risk measurement for comparison with the local hazard risk ranking in the Hazard Risk Ranking section of this annex. In addition, some hazards are defined differently from those in this plan, so a direct hazard-to-hazard risk comparison is not possible.

Based on the NRI findings, the highest hazards by risk rating for Loudoun County are Winter Weather, Strong Wind, Tornado, and Cold Wave (included in this plan as Extreme Cold). Loudoun County was rated as having “very low” risk ratings overall, and those labeled as presenting the most risk are only marginally more threatening than those considered to be of lower risk. Of the 15 hazards for which risk ratings are given, they were all determined to be “very low,” with one hazard (Heat Wave) determined as “relatively low” when compared to the rest of the state and the national average.

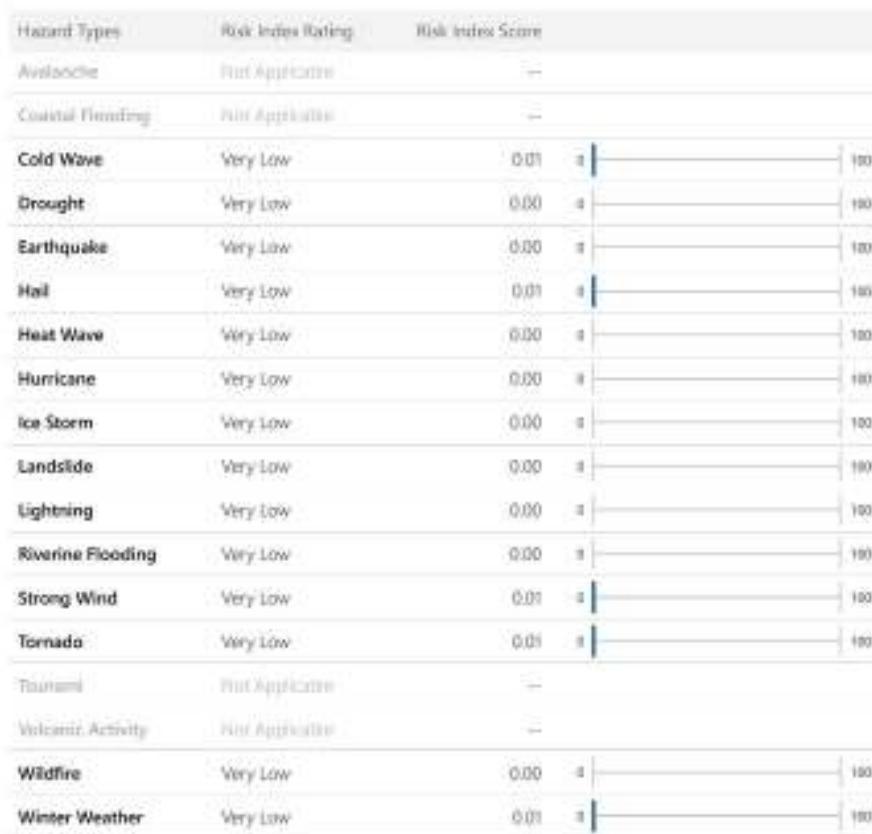


Figure 8: Hazard Type Risk Index, National Risk Index²³

The NRI calculation does not follow the same criteria and formulas used in the hazard risk ranking methodology for this plan but is provided as a comparative measurement tool.

4.1.2. Dam Failure

The USACE National Inventory of Dams lists 99 dams as being in Loudoun County²⁴: 14 are classified as **High Hazard** and 9 are classified as being a **Significant Hazard** due to the consequences of a failure of the structure. USACE data includes dam locations, ownership, pool volume, impoundment capacity, and use.

The 23 high and significant hazard dams in Loudoun County are both publicly and privately owned and used for a variety of purposes, including flood control, stormwater management, and recreation.

²³ National Risk Index, FEMA.

²⁴ Dam Inventory–2021, US Army Corps of Engineers,

Table 18: State-Regulated High Hazard Dams in Loudoun County, as of May 2021²⁵

Dam Name	Classification	Dam Owner/Operator
Arcola Center Dam	Significant	Arcola Limited Liability Company
Creighton Hills Dam	Significant	Creighton Hills, LLC
J.T. Hirst Dam	Significant	Town of Purcellville
Dulles Airport Dam	Significant	Metro-Washington Airport Authority
Red Cedar Lake Two Dam	Significant	Ian S. & Debra J. Foster
Oliver Dam	Significant	Woodmar Farm Conservancy
Daley Dam	Significant	Brian Meyerriecks, Timothy Biddle
Haynes Dam	Significant	Martin Lawrence Family Trust
Precision Dynamics Lake Dam	Significant	Round Hill Owners Association
Richmond Square Dam	High	Exeter Homeowners Association
Moorefield Station East SWM Pond Dam	High	Loudoun County Board of Supervisors
Kalnasy Dam	High	Johnson, Cedric & Cynthia Holgate, Marc Weiner.
Beaverdam Creek Dam	High	Loudoun Water
Goose Creek Dam	High	Loudoun Water
Horsepen Dam	High	Metro-Washington Airport Authority
Ashburn Village Lake #2	High	Ashburn Village Community Association
Brambleton Land Bay 3 Pond 6 Dam	High	Brambleton Group LLC
Ashburn Village Lake #1	High	Ashburn Village Community Association
Gore Dam	High	Jo Ann D. Athey
The Lakes At Red Rock Dam	High	The Lakes at Red Rocks Homeowners Association
Moorefield Station West SWM Pond Dam	High	Claude Moore Charitable Foundation
Sleeter Lake Dam	High	Round Hill Owners Association
Hope Parkway Dam	High	East Stratford Residential Community Association, Inc.

In the year 2017, after the previous mitigation plan was developed, a report titled *A Heightened Focus on Public Safety at Dams Does Not Happen by Accident* was produced by engineering firm Gannett Fleming, Inc., to discuss Loudoun Water's recently developed Public Safety Plan (PSP). It was decided such a plan was needed in the wake of several fatalities and near fatalities occurring at Goose Creek Dam and Beaverdam Creek Dam. Both of these assets are used for water supply, but the county's increased growth makes these and other dams attractive for recreational purposes.²⁶

The report led to Loudoun Water developing guidelines for protecting the public, including methods used to ensure conformity with the public safety plan, public safety education, training and outreach programs implemented by Loudoun Water, and additional public safety improvements planned for Beaverdam Creek. The report also cited publicly available resources about specific incidents that prompted development of the safety plan.²⁷

²⁵ Source: U.S. Army Corps of Engineers, National Inventory of Dams

²⁶ Insert Footnote info

²⁷ Ibid

- Leesburg Today article about teens ignoring the signs and rules about entry and showing them jumping from the handrail on the access bridge into the reservoir.

The screenshot shows the Leesburg Today website homepage. The main title "Leesburg Today" is prominently displayed. Below it, a navigation bar includes links for HOME, NEWS, PUBLIC SAFETY, BUSINESS, OPINION, COMMUNITY LIFE, OBITUARIES, SPORTS, and LOCAL, LEESBURG, ASHBURN, TOWNS & VILLAGES, SCHOOLS, POLITICS, and SUBMIT A TIP. The main content area features a headline "Heat Relief: Despite Rules, Teens Cool Off At Beaverdam Reservoir" with a sub-headline "A group of teenagers ignore safety rules and jump from a bridge into the water". To the right of the headline is a photograph of several young people jumping from a metal pier into a body of water.

- The Associated Press piece describing how a mother and her two children drowned at Beaverdam Reservoir.

The screenshot shows an Associated Press news article. The headline reads "Mother, 2 children drown in reservoir". The article discusses a tragic drowning incident where a mother and her two young children died. It quotes Ed Prior, a Loudoun County Sheriff's spokesman, who says they don't know if the children were swimming or fell in. The article also notes that the mother was not wearing a life vest. To the right of the article is a photograph of a memorial plaque for the three victims. The plaque has three circular portraits and inscriptions: "PATRICK J. LIMA APR. 14, 1991 - APR. 14, 2001", "DRENA LIMA APR. 14, 1991 - APR. 14, 2001", and "OSCAR B. QUINTEROS APR. 14, 1991 - APR. 14, 1997".

- Loudoun Times-Mirror article about drowning in Beaverdam Creek Reservoir.

The screenshot shows a Loudoun Times-Mirror news article update. The headline reads "UPDATE: Man's body found in water day after boat capsizes on Beaverdam Creek Reservoir". Below the headline are social media sharing icons for Facebook, Twitter, Email, and Plus, with a count of 125. At the bottom of the article is a small note: "Sunday, Nov. 27, 2011 by John Odeide and Matt Vecchio | 33 comments | Email this story".

- *Station WVTR-TV* (Richmond, VA) article about family of five being rescued from their boat perched on the crest of Goose Creek Dam.

The screenshot shows a news article from WVTR-TV. The title "Family rescued from boat dangling on edge of Virginia reservoir" is displayed prominently. Below the title is a photograph of a small boat with several people in it, positioned near a large dam or reservoir. The water is turbulent at the dam's edge.



4.1.3. Flood/Flash Flood

The Loudoun County Planning Team noted that the frequency of flash flood incidents has increased in recent years, attributable to more frequent excessive rainfall events combined with aging drainage and stormwater infrastructure designed to lower capabilities. The county is addressing this issue through increased maintenance of drainage systems and capacity upgrades funded through capital improvement projects, but it highlights the need for additional studies to identify potential locations and the extent of future events.



Table 19: Flood/Flash Flood Events in Loudoun County, 1950–May 31, 2021²⁸

Jurisdiction	Flood/Flash Flood Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Loudoun County Including: Town of Leesburg Town of Lovettsville Town of Middleburg Town of Purcellville Town of Round Hill	162	0	0	\$2,018,000	\$170,000	\$2,188,000

4.1.4. High Wind/Severe Storm

Table 23 presents the number of severe storm events documented in the NCEI Storm Events Database, including high wind, hail, and lightning, and the impacts of hazard events on people, property, and crops.

Table 20: High Wind/Severe Storm Events in Loudoun County, 1950–June 30, 2021²⁹

Jurisdiction	High Wind/Severe Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Loudoun County Including: Town of Leesburg Town of Lovettsville Town of Middleburg Town of Purcellville Town of Round Hill	696	1	9	\$10,248,650	\$224,600	\$10,473,250

²⁸ NCEI Storm Events Database

²⁹ NCEI Storm Events Database

4.1.5. Winter Weather

Table 24 presents the number of severe winter storm events documented in the NCEI Storm Events Database, including blizzard, heavy snow, winter storm, and winter weather. Noteworthy is the fact that NCEI does not include in its records any events that took place before December 2014.

Table 21: Severe Winter Storm Events in Loudoun County, 1950–June 30, 2021³⁰

Jurisdiction	Severe Winter Storm Events	Direct Deaths	Direct Injuries	Property Damage	Crop Damage	Total Property and Crop Damage
Loudoun County Including: Town of Leesburg Town of Lovettsville Town of Middleburg Town of Purcellville Town of Round Hill	101	1	0	\$0	\$0	\$0

Other hazard information for Loudoun County is presented in the [Base Plan](#).

³⁰ NCEI Storm Events Database

5. Vulnerability Assessment

The methodology for calculating loss estimates presented in this annex is the same as that described in **Section 4, Base Plan**. Quantitative loss estimates are provided when available. Qualitative measurement considers hazard data and characteristics, including the potential impact and consequences based on past occurrences. Accompanying the data is a discussion of community assets potentially at risk during a hazard event.

The assets at risk were identified during the planning process as potential assets vulnerable to one or more hazards.

5.1. National Flood Insurance Program

Loudoun County and the five towns participating in the 2022 plan update process all participate in the National Flood Insurance Program (NFIP). In addition, the county participates in NFIP's voluntary Community Rating System (CRS) program under the NFIP with a CRS Class of 10 rating. At this class rating, property owners are not able to take advantage of lower flood insurance premium deductions available to those lower classes. As such, Loudoun County is considering ways it could increase its class status and save money for those who choose to purchase flood insurance.

The Flood Risk Report (FRR) for Loudoun County, released on October 15, 2016, included discussion about waterways in unincorporated Loudoun County—the five municipalities participating in the 2022 Northern Virginia HMP update (Leesburg, Lovettsville, Middleburg, Purcellville, and Round Hill), as well as the Town of Hillsboro and the Town of Hamilton. The report provides non-regulatory information to help local or tribal officials, floodplain managers, planners, emergency managers, and others better understand their flood risk, take steps to mitigate those risks, and communicate those risks to their citizens and local businesses. Because flood risk often extends beyond community limits, the FRR provides flood risk data for all of Loudoun County, as well as for each individual community. This approach also includes a focus on flood risk reduction activities that may impact areas beyond jurisdictional boundaries. The report also discusses the types of mitigation actions a community can pursue, including planning and regulatory, structural, natural system protection, and public outreach and education.

Table 22: National Flood Insurance Program Status, Loudoun County³¹

Initial FHB Identified	Initial FIRM Identified	Current Eff Map Date	Reg-Emer Date	CRS Entry Date	Current Eff Date	CRS Class	% Disc SFHA	% Disc Non SFHA
04/25/1975	01/05/1978	02/17/2017	01/05/1978	10/1/1992	05/01/2003	10	0%	0%

Table 23: NFIP Status, Insurance Summary, as of September 14, 2021³²

NFIP Topic	Source of Information	Comments

³¹ FEMA NFIP Community Status Report, September 9, 2021

³² Loudoun County Office of Emergency Management

How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist Community Information System Database	6,615 policies countywide based on information through July 2021. Total premium is \$3,601,181. Approximately 73% of the insured structures are located outside FEMA's designated Special Flood Hazard Areas (SFHAs).
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist Community Information System Database	1,260 claims paid through July 2021; total amount \$13,844,072 . Information on how many of the paid claims were for substantial damage is not available.
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA) Estimate from FEMA	Approximately 2,000 structures are estimated to be in SFHAs.
Describe any areas of flood risk with limited NFIP policy coverage.	Community FPA and FEMA Insurance Specialist	An estimated 10% of the structures in SFHAs do not have NFIP coverage , presumably because their owners do not hold federally backed mortgages.

Table 24: NFIP Status, Staff Resources, as of September 14, 2021³³

NFIP Topic	Source of Information	Comments
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Community FPA/NFIP Coordinator holds Professional Engineer (PE) and Certified Floodplain Manager (CFM) certifications.
Is floodplain management an auxiliary function?	Community FPA	No. Floodplain management is a primary function of the two primary agencies responsible—the Department of Land Development Services (LDS) and the Department of Public Works and Environmental Services (DPWES).
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability).	Community FPA	The full range of NFIP administrative services (permitting, inspections, outreach, GIS, and engineering analysis) is provided by LDS and DPWES.
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	Currently no barriers.

Table 255: NFIP Status, Compliance History, as of September 14, 2021³⁴³³ Loudoun County Office of Emergency Management³⁴ Loudoun County Office of Emergency Management

NFIP Topic	Source of Information	Comments
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes
Are there any outstanding compliance issues (i.e., current violations)?		No
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		October 6, 2014

5.2. Population

Loudoun County is somewhat less densely populated than other counties near Washington, D.C., given that a large portion of its land is used for agricultural purposes, while there are denser population clusters elsewhere in the county. U.S. Census Bureau figures show that, of the 366,827 persons over the age of five, 31.6% speak a language other than English, and 9.8% speak English “less than very well.” This situation highlights the challenge of communicating emergency information and educating residents about hazard risks and vulnerabilities and the benefits of hazard mitigation.

The Census Bureau also reports that approximately 5.8% of the population, or 24,455 residents, is identified as non-institutionalized disabled persons due to access or functional needs.

Estimates of the number of residents in Loudoun County vulnerable to each hazard are presented in the various hazard sections in the [Base Plan](#).

The Centers for Disease Control and Prevention’s (CDC) Social Vulnerability Index (SVI) is a tool that can be used to identify specific vulnerable populations. The CDC SVI categorizes the vulnerability of communities at the census tract level, by county, into fifteen census-derived factors grouped into four themes—socioeconomic status, household composition/disability, race/ethnicity/language, and housing type/transportation. Social vulnerability refers to a community’s capacity to prepare for and respond to the stress of hazardous events ranging from natural disasters, such as tornadoes or disease outbreaks, to human-caused threats, such as toxic chemical spills.

The Overall CDC SVI illustrated in Figure 10 indicates the locations of highest overall vulnerability are in more urbanized areas, such as the Jefferson, Loudoun, Mt. Vernon, and Upper Potomac Planning Districts, and along major transportation routes.

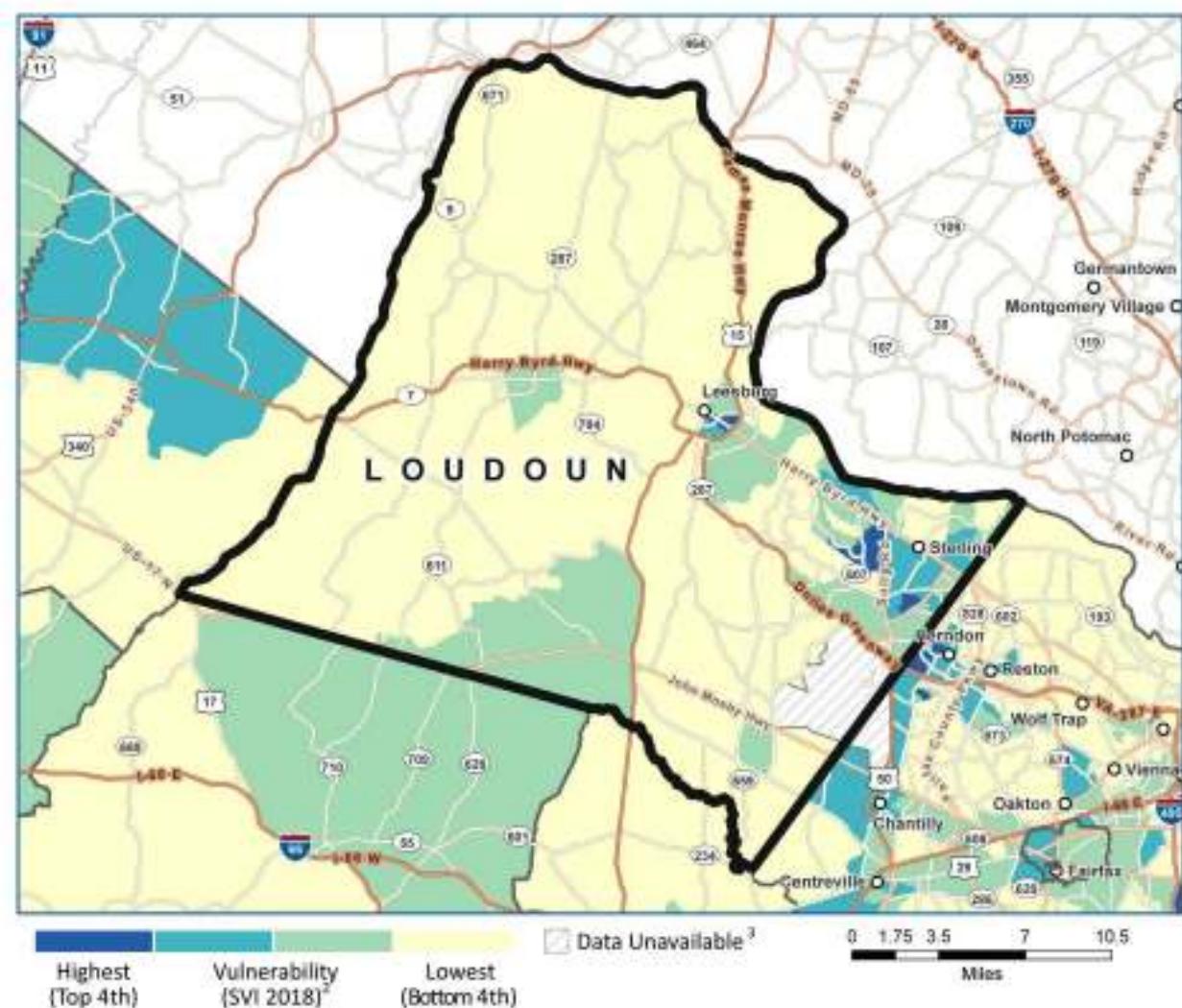


Figure 9: Overall Social Vulnerability (2018), Loudoun County³⁵

When examined by vulnerability theme, one can see that the planning districts with highest vulnerabilities vary widely across the county.

- **Socioeconomic Status:** Countryside Cascades, Sterling, Middleburg, Purcellville
 - **Household Composition/Disability:** Loudoun Heights, Dulles Town Center, Leesburg
 - **Race/Ethnicity/Language:** Belmont, Dulles Town Center, South Riding, Conklin, Arcola
 - **Housing Type/Transportation:** Leesburg, Potomac Falls, Broadlands, Moorefield Station

³⁵ Centers for Disease Control and Prevention (<https://svi.cdc.gov/map.html>)

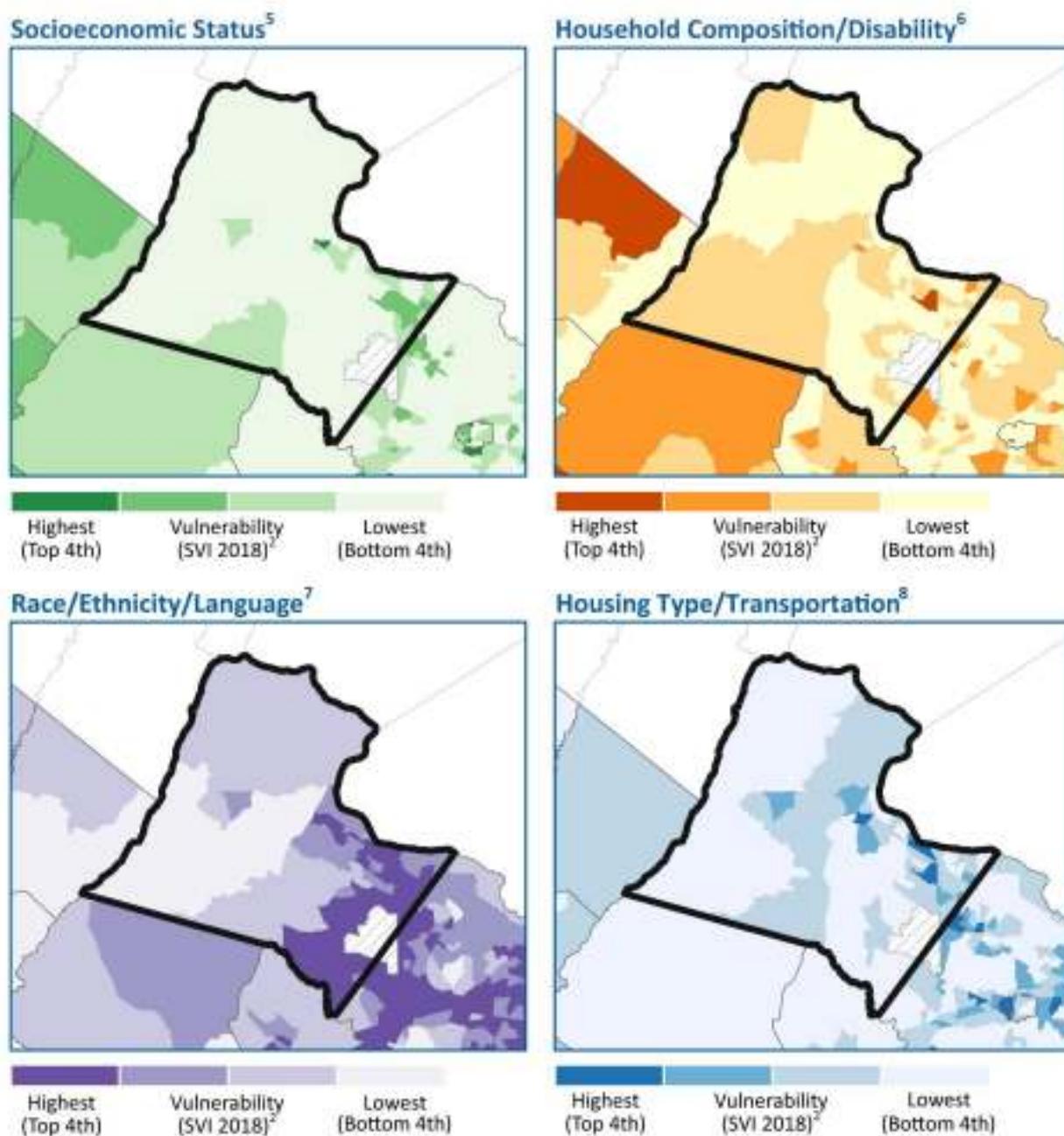


Figure 10: Social Vulnerability, by Theme, Loudoun County³⁶

The themed maps illustrate the county's higher level of vulnerability within the race/ethnicity/language theme, demonstrating the importance of communicating essential hazard mitigation, preparedness, response, and recovery information to the public in alternate formats and multiple languages.

³⁶ Centers for Disease Control and Prevention (<https://svi.cdc.gov/map.html>)

5.3. Built Environment

Based on data currently available through Hazus, the tables presented in this section provide a total number of exposed facilities and properties in relation to earthquake, flood, and hurricane wind.

Table 26: Building Stock Exposure by General Occupancy³⁷

Type	Amount
Residential	\$144,188,703,000
Commercial	\$20,116,524,000
Industrial	\$2,464,611,000
Agricultural	\$272,032,000
Religion	\$1,827,947,000
Government	\$579,222,000
Education	\$1,378,119,000
TOTAL	\$170,827,158,000

Loudoun County has more than \$170.8 million in exposure to buildings within the 100-year floodplain. Using the 100-year flood scenario, Hazus identified a total of 357 structures that would be damaged, with 44 being at least 50% damaged and 88 sustaining substantial damage.

5.4. Community Lifelines and Assets

Loudoun County reviewed its community lifelines and assets to identify critical facilities, systems, and infrastructure that have the most significant risks and exposure. Vulnerabilities include structures, systems, resources, and other assets defined by the community as susceptible to damage and loss from hazard events.³⁸ The vulnerability of critical infrastructure is presented within the lifeline sector categories identified by FEMA.

Table 27: Vulnerable Community Lifeline Assets (in Thousands of Dollars)³⁹

Sector	Dollar Exposure (in thousands)
Safety and Security	Undetermined
Food, Water, Shelter	\$1,487,248
Health and Medical	Undetermined
Energy	\$837,534
Communications	\$744
Transportation	\$2,411,988
Hazardous Materials	Undetermined

³⁷ Hazus-MH

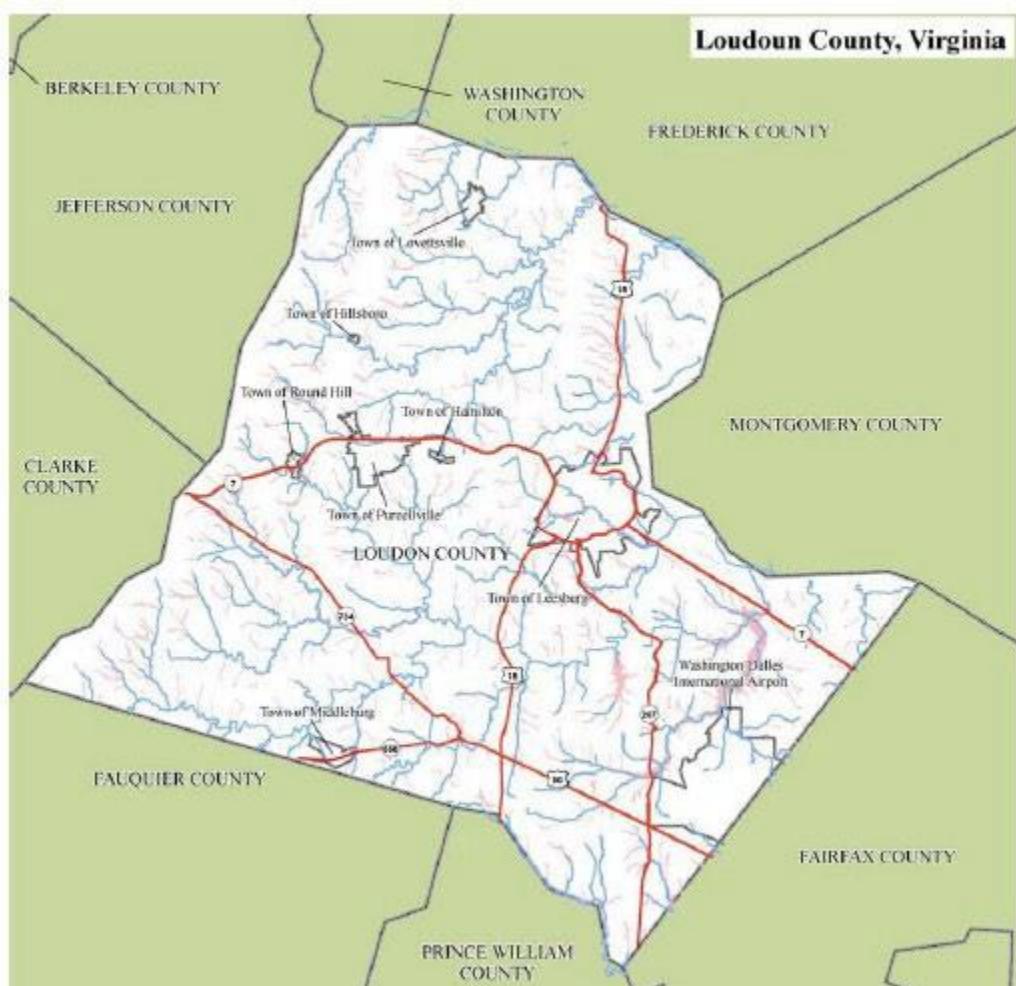
³⁸ Although Loudoun County maintains a separate critical facilities inventory, information used in this analysis is extracted from the Hazus-MH critical facilities database to maintain consistency with other jurisdictions.

³⁹ Hazus-MH

Table 28: Critical Facilities Exposed to FEMA Floodplains, Loudoun County⁴⁰

Type of Critical Facility	Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
Wastewater Treatment Plants	20	6	0
Ferries	1	1	0
Fire Stations	20	1	0
Highway Bridges	364	127	9
Highway Segments	32	15	0
Natural Gas Pipelines	10	9	0

A map on page 23 of the Loudoun County *2016 Flood Risk Report* illustrates the many rivers and streams that course through the region. Almost all segments of both unincorporated Loudoun County and within its towns are located relatively near a water body.

**Figure 11: Location of Loudoun County Rivers and Streams**⁴⁰ Ibid.

5.5. Environment

Information related to environmental vulnerability is presented in the hazard-specific sections of the [Base Plan](#).

Additional environmental concerns for Loudoun County are related to the Potomac Watershed Waterways and potential for flooding. The county also has a high number of public parks, outdoor sporting facilities, and National Park Service trails and parks. The county identified Huntley Meadows as a critical habitat due to its forests, meadows, and wetlands.

5.6. Economy

Information related to economic vulnerability is presented in the hazard-specific sections of the [Base Plan](#). Specific direct economic losses (in thousands of dollars) related to a 2,500-year 6.5 magnitude earthquake event are identified by Hazus for specific assets.

Table 29: Direct Economic Losses Related to Earthquake, Flood, and Hurricane Wind⁴¹

Hazard	Buildings (Capital Stock and Income)	Transportation	Utilities
Earthquake	\$441,720	\$4,977	\$30,872
Flood	\$434,725	\$0	\$96,696.45
Hurricane Wind	\$30,325	\$0	\$0

Additional economic concerns for Loudoun County are related to the area's economic base which relies on government, information technology, and finance. Major employers include Fortune 500 companies, the federal government, and the military.

5.7. Cultural/Historical

Information related to vulnerability of cultural and historical assets is presented in the hazard-specific sections of the [Base Plan](#).

Loudoun County holds significant historical and cultural landmarks linked to the founding of our nation, many of which are National Trust Historic Sites or locally designated landmarks.

Table 30: Significant Historical and Cultural Landmarks

Historic/Cultural Site	Location
Amos-Goodin House	Loudoun County
Arcola Elementary School	Arcola
Arcola Quarters for the Enslaved	Arcola
Edward Nichols House (Seacrest)	Leesburg
General George C. Marshall House, Dodona Manor	Leesburg
Hamilton Masonic Lodge	Hamilton
Home Farm	Loudoun County

⁴¹ Hazus-MH (2,500-year, 6.5 magnitude Earthquake scenario, 100-year Flood scenario, 2,500-year Hurricane event)

Historic/Cultural Site	Location
Leeland and Lawrence Lee House (Ellwood)	Loudoun County
Locust Grove House	Purcellville
Lucketts School	Lucketts
Morrison House and Janney Hill (Janney House)	Hamilton
Mount Zion Old School Baptist Church	Loudoun County
Mt. Olive Methodist Episcopal Church	Leesburg
Much Haddam House	Middleburg
Purcellville Train Station	Purcellville
Red Fox Inn	Middleburg
Rock Spring Farm	Leesburg
Spring Hill Farm	Hamilton
Waverly Mansion	Leesburg
William Virst House (Uriah Beans House)	Loudoun County
Woodgrove	Round Hill

Historic structures and sites and other types of facilities are frequently more vulnerable to flood hazards due to the typical development of a city or town along waterways. Because removing historic structures from their original site affects their historical value, there are challenges to protecting these fragile sites while following historic preservation standards and guidelines.

Table 31: Cultural and Historic Properties Exposed to FEMA Identified Floodplains⁴²

Total Facilities	In 100-Year Floodplain	In 500-Year Floodplain
99	28	1

Table 32: Loudoun County Critical Assets Located in FEMA Identified Floodplains⁴³

Critical Facilities	Total Facilities	In 100-year Floodplain	In 500-year Floodplain
Wastewater Treatment Plants	20	6	0
Ferries	1	1	0
Fire Stations	20	1	0
Highway Bridges	364	127	9
Highway Segments	32	15	0
Natural Gas Pipelines	1	9	0

The location of these and other assets are shown in the map and legend that follow.

⁴² Loudoun County, Hazus

⁴³ Loudoun County, Hazus

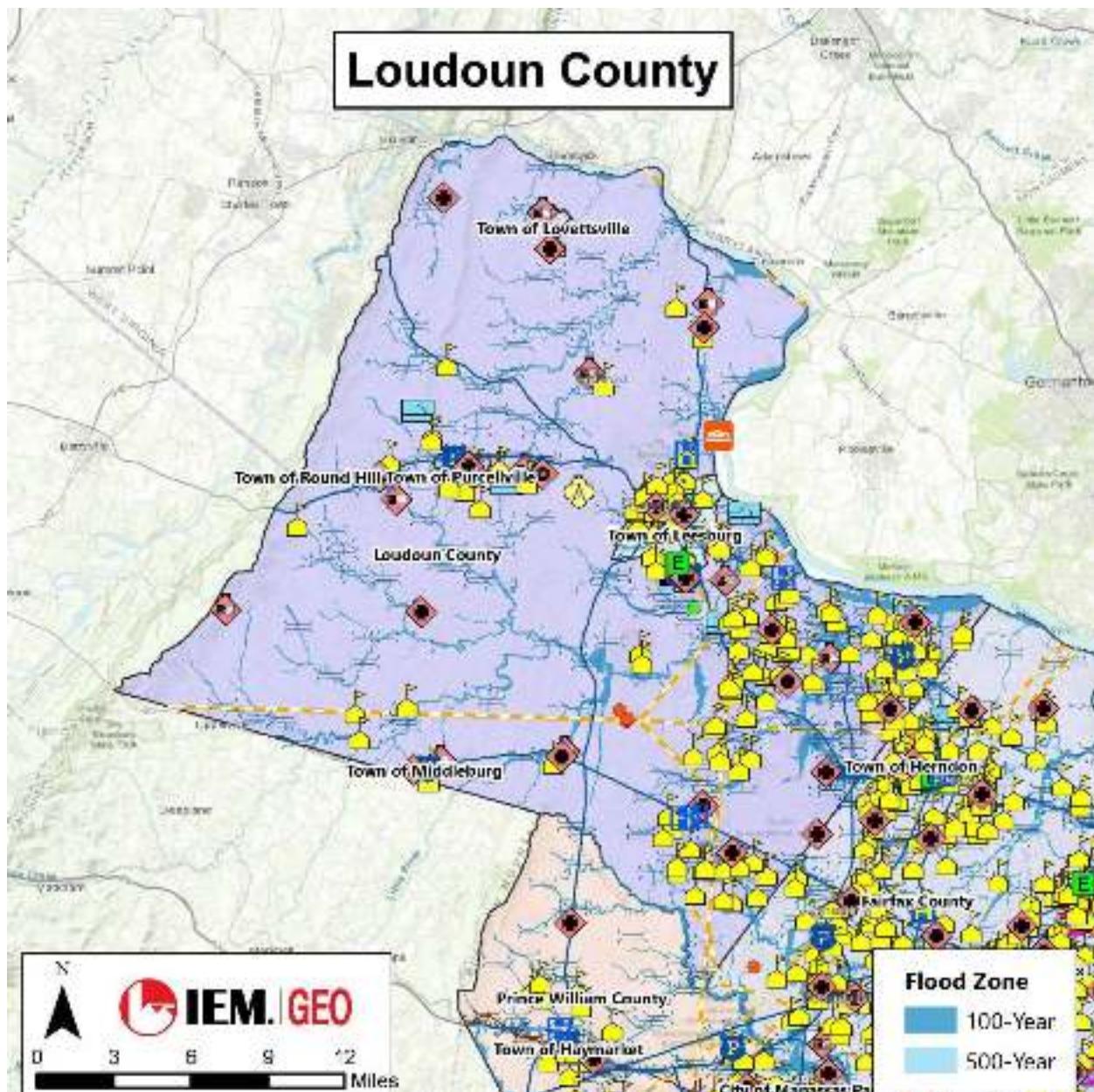


Figure 12: Loudoun County Critical Assets Located in the Flood Zone



Figure 13: Legend to Figure 12 - Loudoun County Critical Assets Located in the Flood Zone

6. Capability Assessment

Loudoun County reviewed its legislative and departmental capabilities to identify resources, strengths, and gaps for implementing hazard mitigation efforts. Using a Capabilities Assessment Worksheet, the community documented existing institutions, plans, policies, ordinances, programs, and resources that could be brought to bear on implementing the mitigation strategy. The capabilities in relation to hazard mitigation were assessed in the following categories:

- Planning and regulatory
 - Implementation of ordinances, policies, site plan reviews, local laws, state statutes, plans, and programs that relate to guiding and managing growth and development
- Administrative and technical
 - County, city, and town staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions
- Safe growth
 - Use of community planning through comprehensive plans as hazard mitigation to increase community resilience
- Financial
 - Resources that a jurisdiction has access to or is eligible to use to fund mitigation actions
- Education and outreach
 - Programs and methods that could be used to implement mitigation activities and communicate hazard-related information

In addition to the Capabilities Assessment Worksheet, Loudoun County completed a Jurisdiction Needs Identification Questionnaire that summarized changes in and enhancements of capabilities since the last plan. This information is integrated into the summaries in this section.

6.1. Capability Assessment Summary Ranking and Gap Analysis

The jurisdiction ranked the level of capability in relation to each assessment category as a means of identifying where elements could be strengthened or enhanced. Capabilities were ranked on a qualitative basis as demonstrated by the jurisdiction's authorities, programs, plans, and/or resources:

- **Limited:** The jurisdiction has limited capabilities within this category and is generally unable to implement most mitigation actions.
- **Low:** The jurisdiction has some capabilities within this category and can implement few mitigation actions.
- **Moderate:** The jurisdiction has some capabilities within this category, but improvement is needed in order to implement some mitigation actions.
- **High:** The jurisdiction has significant capabilities within this category as demonstrated by its authorities, programs, plans and/or resources and can implement most mitigation actions.

Assessment of Loudoun County Community Assets and Potential Hazard Impacts⁴⁴ Loudoun County evaluated different assets in the community to determine which are potentially at risk to hazards.

Natural Environment: What assets may be impacted by which hazard(s)?

- Water resources: In the Loudoun Plain, six rivers and creeks course through the county: Broad Run River, Bull Run River, Catoctin Creek, Goose Creek, Little River Creek, and Piney Run River. Beaverdam Reservoir, the Potomac River, wetlands, groundwater, drainage systems, and karst terrain are important natural assets.
- Recreation Areas: Forty-seven parks, plus three adult day centers; seven community centers; seven historical sites located within parklands; twenty-five neighborhood parks; and parks with significant ponds/lakes (including three managed dam systems). Any of the structures or outdoor assets could be damaged during a hazard event and the impact may be worsened if staff and residents are using facilities, trails, or waterways.
- Critical Habitat: Forest cover along Blue Bridge, Short Hill, and Catoctin Mountain ranges have zoning ordinances that require reservation.
- **Hazards:** All Hazards

Economy: What assets may be impacted by which hazard(s)?

- Major Employers include Loudoun County Public Schools, Loudoun County Government, Verizon, Northrop Grumman, United Airlines, Raytheon, Inova Loudoun, Walmart, US Postal Service, Dynaletric, Harris Teeter, Bowers
- Primary economic sectors include data centers, information, and communications Technology, Federal Government Contracting, Aerospace and Defense, Aviation and Transportation, Health Innovation and Technology, Agriculture and Related Business.
- **Hazards:** All Hazards

Population: What assets may be impacted by which hazard(s)?

- Loudoun County has a population of 421,636, an increase of approximately 35% since 2010. The population density is 810 persons per square mile, significantly lower than other Northern Virginia counties.
- **Hazards:** All hazards

Built Environment: What assets may be impacted by which hazard(s)?

- The Loudoun County Government Center And other public facilities provide services to residents.
- Critical Facilities include public safety facilities such as Fire-Rescue Stations, Emergency Operations Center, Sheriff's Office Substations, hospitals (Leesburg, Lansdowne, Ashburn, and Stone Springs), Loudoun Water facilities, data centers, government facilities, schools, and long-term care facilities.
- Loudoun County contains numerous historic properties; natural preservation sites; artifacts and archeology assets. These are discussed in greater detail in 1.4.9.1.

Loudoun County addresses future development in the Loudoun County 2019 Comprehensive Plan.

Hazards: Natural disasters; fire; vandalism; pandemic impacts to staffing, economic loss of funding

⁴⁴ Loudoun County, Community Assets Worksheet 3

Climate Change: Which assets are at risk of future conditions related to climate change?

- The built environment, natural environment, infrastructure, economy and those who live and work in Loudoun County all face risks related to climate change.

Table 33: Capability Assessment Summary Ranking for Loudoun County

Capability	Ranking
Planning and Regulatory	High
Administrative and Technical	High
Safe Growth	High
Financial	Moderate
Education and Outreach	Moderate

6.1.1. Planning and Regulatory Capabilities Summary

The Loudoun County Office of Planning and Zoning takes an all-hazards approach when developing any jurisdictional plans—including emergency operations—and continuity of operations, as well as the hazard mitigation plan.

The following plans have been newly developed or updated since the 2017 HMP:

- Loudoun County 2019 Comprehensive Plan
- 2019 Transportation Plan (part of the 2019 Comprehensive Plan)
- Fiscal Years 2021-2026 Capital Improvement Plan
- Loudoun Water 2021-2030 Capital Improvement Plan
- 2017 Economic Growth and Diversification Plan
- July 2019 Emergency Operations Plan
- Loudoun County Small Municipal Separate Storm Sewer System (MS4) Stormwater Management Program Plan, July 2018-June 2023
- Loudoun Health District, Pandemic Response Plan, March 2020
- FEMA Flood Insurance Rate Maps, 2019

Capability Analysis: High

Loudoun County is mindful of the need to develop plans, codes, and regulations that minimize the likelihood that hazard events will negatively affect people, property, crops, and farm animals. These include natural hazard-specific ordinances (stormwater, steep slope, wildfire), and the Mountainside Development Overlay District and Steep Slope Standards of the County Zoning Ordinance.

6.1.2. Administrative and Technical Capabilities Summary

Loudoun County identified the following departments and agencies as key stakeholders in its hazard mitigation planning process and implementation of the plan:

- Planning/Engineer: Planning Department, Zoning, Building and Development
- Building and Public Works engineers trained in construction practices related to buildings and infrastructure
- Planners/engineers with an understanding of natural and/or man-made hazards
- GIS and Fire and Rescue Departments with personnel skilled in GIS and Hazus
- Scientists familiar with community hazards
- Emergency Management personnel
- Grant writers in all departments

Capability Analysis: High

The Loudoun County staff across the board is trained in how to maintain current systems for managing all business, societal, and economic sectors and improves staffing needs as is necessary.

6.1.3. Safe Growth Capabilities Summary

Loudoun County departments cover safe growth on many levels. The 2019 Loudoun County Comprehensive Plan includes policies and guidance to cover or reinforce best practices in the following areas:

- Land Use
- Transportation
- Environmental Management
- Public Safety
- Zoning
- Subdivision Development
- Historic Preservation

Capability Analysis: High

The Safe Growth Capabilities in the Plan show that Loudoun County is proud of its illustrious past and tries to maintain a balance between honoring historic assets while taking advantage of future opportunities available to a community located near the nation's capital.

6.1.4. Financial Capabilities Summary

Loudoun County is able to take advantage of financial mechanisms in place to generate funding for current and future opportunities.

- Capital Improvements Project funding
- Authority to levy taxes for specific purposes
- Community Development Block Grants
- Public/Private Partnerships
- State Funding

Capability Analysis: Moderate

While Loudoun County takes full advantage of current financial capabilities, it looks forward to addressing new funding opportunities, including the use of federal grants from FEMA and other agencies.

6.1.5. Education and Outreach Capabilities Summary

Several departments and agencies conduct education and outreach to make citizens aware of resources available to them.

- Sheriff's Office: Adult Crime Prevention Unit offers classes to the public on crime prevention topics
- Loudoun County Public Schools Outreach Services includes a Parent Liaisons program, Language Assistance Service, and a Community Schools Initiative to provide mental health resources and afterschool opportunities to socialize or receive academic assistance.
- The Loudoun Education Foundation provides multicultural educational information and conducts direct outreach to promote interchange between diverse groups.

6.1.5.1. Capability Analysis: Moderate

Loudoun County is well positioned to build on its current education and outreach programs to promote hazard awareness and mitigation efforts that can be practiced by businesses, community groups, individuals, households, and other stakeholders. Its ten public libraries and array of facilities under the Department of Parks, Recreation, and Community Services (PRCS) all provide locations where staff and volunteers regularly interact with the public. These physical structures and the array of print, web-based, and broadcast media show that "the sky's the limit" for the number of ways to create community awareness about hazards and their impact on the community.

6.2. Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

As a component of the capability assessment, Loudoun County identified activities related to each natural hazard that support risk reduction. They are listed in Table 32.

Table 34: Capability Summary – Activities that Reduce Natural Hazard Risk or Impacts

Hazard	Activity
Dam Failure (including Levees)	<ul style="list-style-type: none"> • All but three dams classified as being high or significant hazard dams in Loudoun County have Emergency Action Plans for potential incidents. Per National Dam Inventory, USACE
Drought	<ul style="list-style-type: none"> • Public education and operational plans address preparedness and response to reduce risk. • Land use and environmental policies acknowledge the importance of protecting the natural environment.
Earthquake	<ul style="list-style-type: none"> • State and international building codes provide for seismic design regulations. • Public education and operational plans address preparedness and response to reduce risk.
Extreme Temperature	<ul style="list-style-type: none"> • Public education and operational plans address preparedness and response to reduce risk.

Hazard	Activity
Flood/Flash Flood	<ul style="list-style-type: none"> Floodplain administration and regulations ensure that inappropriate activities and future development in the floodplain are prohibited. Stormwater management program and projects address flood prevention and risk reduction.
High Wind/Severe Storm	<ul style="list-style-type: none"> State and international building codes provide for wind and seismic design regulations.
Karst/Sinkhole/Land Subsidence	<ul style="list-style-type: none"> Land use and environmental policies acknowledge the importance of protecting the natural environment.
Landslide	<ul style="list-style-type: none"> Land use and environmental policies acknowledge the importance of protecting the natural environment.
Tornado	<ul style="list-style-type: none"> Public education and operational plans address preparedness and response to reduce risk.
Wildfire	<ul style="list-style-type: none"> Public education and operational plans address preparedness and response to reduce risk.
Winter Weather	<ul style="list-style-type: none"> Public education and operational plans address preparedness and response to reduce risk.
Non-Natural Hazards	<ul style="list-style-type: none"> Public education and operational plans address preparedness and response to reduce risk. Beginning with the 2022 NOVA HMP, hazard mitigation planning is being integrated into existing planning and risk reduction activities for technological and human-caused hazards.
Climate Change	A chapter of the Loudoun County 2019 Comprehensive Plan addresses Land Use and how to develop a resilient built environment. The chapter on Natural, Environmental and Heritage Resources discusses the need to consider how best to maintain a fragile ecosystem and historic resources in the face of current and future climate change.

7. Resilience to Hazards

The National Risk Index (NRI) provides an overview of hazard risk, vulnerability, and resilience. The designation of “low risk” is driven by lower loss due to natural hazards, lower social vulnerability, and higher community resilience.

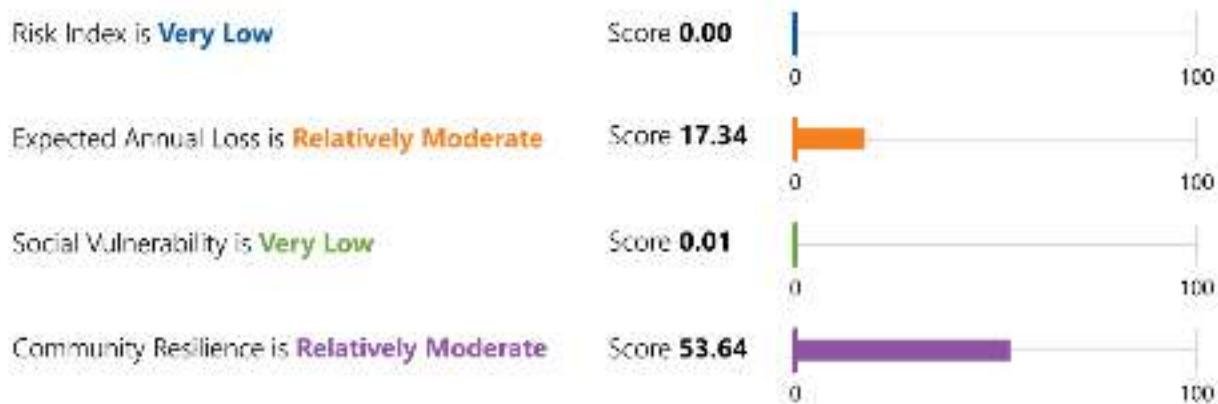


Figure 14: Summary of National Risk Index Findings, Loudoun County⁴⁵

Table 35: Comparison of Loudoun County Scores with Virginia and National Average⁴⁶

Index	Loudoun County	Virginia Average	National Average
Risk	3.26	6.62	10.70
Expected Annual Loss	17.34	9.35	13.47
Social Vulnerability	0.01	35.32	38.35
Community Resilience	53.64	54.92	54.59

Table 36: Loudoun County Risk Ranking⁴⁷

Index	Rank
Risk	Very Low
Expected Annual Loss	Relatively Moderate
Social Vulnerability	Very Low
Community Resilience	Relatively Moderate

⁴⁵ National Risk Index

⁴⁶ Ibid.

⁴⁷ Ibid.

Loudoun County's NRI Community Resilience score of 53.64 represents a relatively low ability to prepare for anticipated natural hazards, adapt to changing conditions, and withstand and recover rapidly from disruptions when compared to the rest of the United States.

7.1. Community Resilience Estimate

The Community Resilience Estimate (CRE) is a data product produced by the U.S. Census Bureau that can be utilized to estimate potential community resilience to disasters by combining data from several sources to analyze individual and household-level risk factors.

The index produces aggregate-level (census tract, county, and state) small-area estimates that provide a tool for understanding how much risk a specific neighborhood might face as a result of characteristics that may render certain segments of the population more vulnerable to the impacts and consequences of disasters. These risk factors⁴⁸ include the following:

1. Income-to-poverty ratio
2. Single or zero caregiver household
3. Unit-level crowding
4. Communication barrier
5. Aged 65 years or older
6. Lack of full-time or year-round employment (household)
7. Disability
8. No health insurance coverage
9. No vehicle access (household)
10. No broadband internet access (household)

In 2021, the U.S. Census Bureau released data estimates showing the counties and states with the highest percentage of residents who are considered vulnerable to a disaster or other emergency. The percentages were mapped by *U.S. News and World Report*.⁴⁹

⁴⁸ The Community Resilience Estimates are developed by the U.S. Census Bureau (initial release date August 10, 2021). Methodology is described at the [U.S. Census Bureau Community Resilience Methodology page](https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html) (<https://www.census.gov/programs-surveys/community-resilience-estimates/technical-documentation/methodology.html>).

⁴⁹ Alex Leeds Matthews, [U.S. News and World Report](https://www.usnews.com/news/health-news/articles/2021-10-13/counties-where-americans-are-most-vulnerable-to-disaster), 10-13-2021. Where Americans Are Most Vulnerable to Disaster, <https://www.usnews.com/news/health-news/articles/2021-10-13/counties-where-americans-are-most-vulnerable-to-disaster>

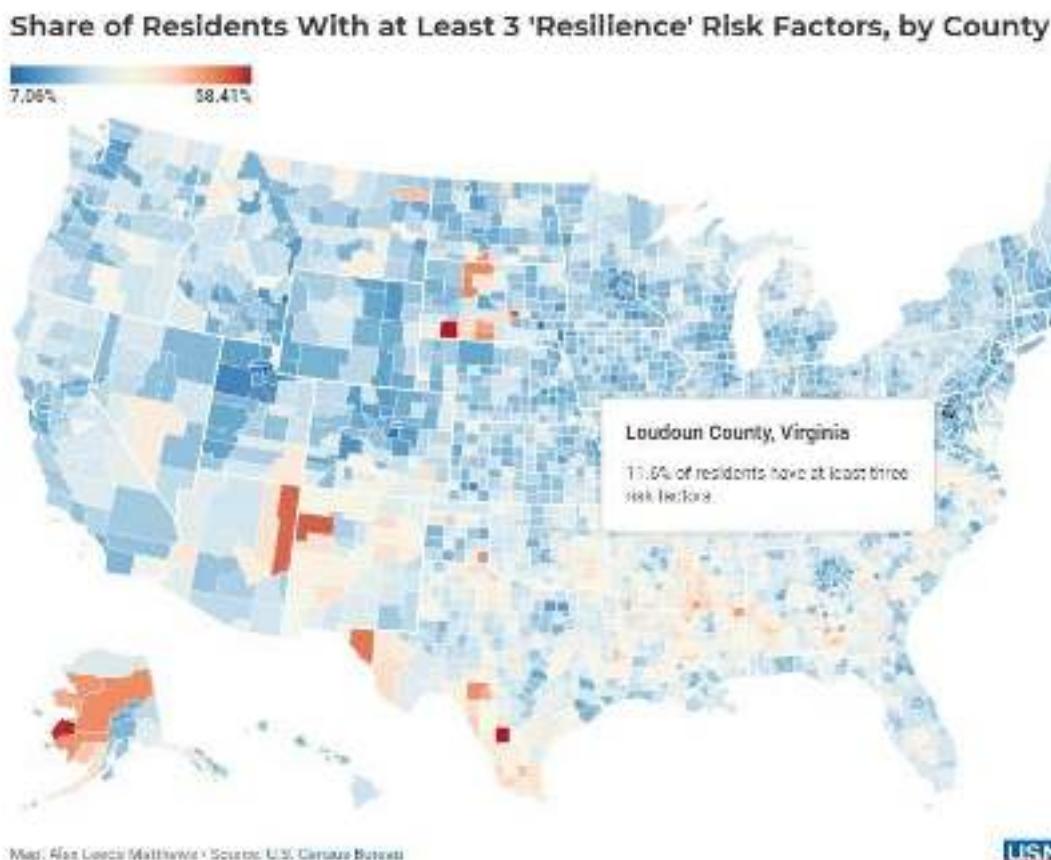


Figure 15: Community Resilience Estimate for Loudoun County⁵⁰

The combination of data and analysis described in this section provides a comprehensive representation of Loudoun County's risk, vulnerability, and resilience to all hazards.

7.2. New Hazard Risk Challenges or Obstacles

The Loudoun County Planning Team identified specific hazard challenges and obstacles to be monitored in the next planning cycle:

- The risk of cyber-related incidents on Critical Infrastructure and Key Resource sites
- Climate change
- Increases in the number of excessive rainfall events that impact areas currently identified as flood zones, as well as new areas of flooding that emerge as stormwater management events.

⁵⁰ Community Resilience Estimates, U.S. Census Bureau

8. Mitigation Actions

8.1. Goals and Objectives

The Loudoun County Planning Team adopted the regional goal statement presented in **Section 8, Base Plan**. In addition, the *Loudoun County Emergency Operations Plan (EOP)*, dated June 2019, outlines the need to conduct Threat and Hazard Identification and Risk Assessment (THIRA), a strategic analysis of hazards that pose a significant threat to the community. The THIRA evaluates and analyzes past experience, historical information, probability, projected impacts, and resource availability—all elements of the hazard mitigation planning process. The EOP states, “By recognizing and understanding the risks that the community faces, Loudoun County places itself in a position to make better resource management decisions” (*Loudoun County EOP*, p. 1-12, Base Plan). The link between the goals of the *NOVA HMP* and the *EOP* increases the likelihood of success in implementing mitigation actions.

8.2. Status of Previous Actions

Loudoun County monitors actions and tracks progress through the periodic review, evaluation, revision, and update of the NOVA HMP. Some projects that contribute to risk reduction have been completed or are currently in progress but have not been included in this plan for one of the following reasons:

- Project funding has been approved, received, or identified, and additional resources are not needed to complete the project.
- The project scope is inconsistent with the hazard mitigation planning goals defined in this plan.
- The responsible department, agency, or organization maintains an internal tracking system that documents progress and resulting risk reduction.

The Loudoun County Mitigation Actions list includes previously identified actions from the 2006, 2010, and 2017 plans. Four actions from the 2006 plan were carried forward for the 2022 NOVA HMP update. Twelve actions from the 2010 plan were carried forward, and one was noted as completed and removed from the list. Nine actions from the 2017 plan were carried forward and three were noted as complete. The comprehensive list of previous mitigation actions, including descriptions of progress made and current status, is presented in **Attachment 4** of this annex.

8.3. New Mitigation Actions

In addition to the actions carried forward from previous plans, the Loudoun County Planning Team identified two new mitigation actions to be included in this plan. These actions address the expansion and strengthening of the Office of Emergency Management continuity program by increasing the resilience of county operations; they also facilitate coordination with FEMA to re-evaluate flood zones and update Flood Insurance Rate Maps (FIRMs) as a basis for future National Flood Insurance Program Activities. **Attachment 4** of this annex includes a table that summarizes each new and continued action, describing the proposed activity, priority level, estimated cost, and lead agency.

8.4. Action Plan for Implementation and Integration

The Loudoun County Office of Emergency Management (OEM) is responsible for coordinating county departments and agencies participating in hazard mitigation activities. The OEM-designated mitigation coordinator (Assistant Coordinator- Planning) is responsible for implementing the mitigation plan on two levels: the jurisdictional level and the multi-jurisdictional regional level. Tasks to ensure the implementation of the jurisdiction's actions are integrated into the *Action Plan for Implementation and*

Integration (which includes the prioritized list of Mitigation Actions), and plan maintenance procedures are described in the next section.

The *Loudoun County Emergency Operations Plan (EOP)*, dated June 2019 (p. 82), defines criteria for project eligibility under the Hazard Mitigation Grant Program (HMGP); it states that a project must meet the following requirements:

- Conform to the State Hazard Mitigation Plan.
- Conform to environmental, historical, and economic justice issues.
- Provide a long-term solution.
- Demonstrate cost effectiveness.
- Comply with program regulations.
- Be consistent with overall mitigation strategies.

The Action Plan for Implementation and Integration describes how the county's hazard mitigation risk assessment and goals will be incorporated into its existing plans and procedures.

Table 37: Action Plan for Implementation and Integration, Loudoun County

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Integrate goals into local comprehensive plan.	Continue to coordinate with departments to incorporate current and emerging risks and actions into planning efforts.
Review/update land development regulations for consistency with mitigation goals.	Continue coordinating with Planning and Zoning and Building Development on future land use projects.
Review/update building/zoning codes for consistency with mitigation goals.	Work with Planning and Zoning and Building and Development to ensure county zoning ordinances are consistent with mitigation goals.
Maintain regulatory requirements of floodplain management program (NFIP).	Support the Department of Building and Development sectors of Natural Resources and Water and Hydrology to ensure compliance with NFIP floodplain management regulations.
Enhance floodplain management through Community Rating System (CRS).	Work with applicable departments on floodplain management and mapping.
Review/update economic development plan and policies for consistency with mitigation goals.	Work with Loudoun County Department of Economic Development to ensure consistency and integration between the mitigation plan and plans for future development.
Continue public engagement in mitigation planning.	Continue to promote awareness of hazards and incorporate public feedback into planning processes for resident feedback.
Identify opportunities for mitigation education and outreach.	Identify opportunities to conduct community outreach to promote the importance of mitigation projects.

Existing Plan or Procedure	Description of How Mitigation Will Be Incorporated or Integrated
Review/update stormwater plans and procedures for consistency with mitigation goals.	Work with Department of General Services Stormwater Division to discuss plans and procedures on a more frequent basis.
Review/update emergency plans to address evacuation and sheltering.	Continue to work with partner agencies listed in the EOP and the Shelter Operations Plan.
Maintain ongoing enforcement of existing policies.	Support Department of Planning and Zoning with any applicable enforcement policies.
Monitor funding opportunities.	Continue to monitor funding sources and coordinate with departments on projects that support mitigation actions.
Incorporate goals and objectives into day-to-day government functions.	Incorporate the concept of mitigation into day-to-day government functions, including continual monitoring of the action items identified in the 2022 update.
Incorporate goals into day-to-day development policies, reviews, and priorities.	Continue work with Department of Planning and Zoning and Building and Development to incorporate mitigation into day-to-day activities.

9. Annex Maintenance Procedures

The point of contact for the NOVA HMP Planning Team is the facilitator for the process of monitoring, evaluating, and updating the **NOVA HMP, Base Plan** and is responsible for initiating the annual activities, convening the Planning Team, and providing follow-up reports to designated entities defined in the method and schedule for the plan maintenance process, as outlined in **Section 3, Base Plan**.

Table 38: Loudoun County Plan Maintenance Responsibilities for the Northern Virginia Hazard Mitigation Plan, 2022 NOVA HMP Base Plan

Activity	Responsibilities
Monitoring the Plan	<ul style="list-style-type: none"> • Represent the jurisdiction during the monitoring process. • Collect, analyze, and report data to the NOVA HMP Planning Team • Maintain records and documentation of all jurisdictional monitoring activities. • Assist in disseminating reports to stakeholders and the public. • Promote the mitigation planning process with the public and solicit public input.
Evaluating the Plan	<ul style="list-style-type: none"> • Represent the jurisdiction during the evaluation process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional evaluation activities. • Assist in disseminating information and reports to stakeholders and the public.
Updating the Plan	<ul style="list-style-type: none"> • Represent the jurisdiction during the planning cycle, including plan review, revision, and update process. • Collect and report data to the NOVA HMP Planning Team. • Maintain records and documentation of all jurisdictional plan review and revision activities. • Help disseminate reports to stakeholders and the public.

9.1. Maintenance of the Jurisdiction Annex

In addition to maintenance of the **NOVA HMP, Base Plan**, the Loudoun County mitigation planning coordinator (Assistant Coordinator- Planning) will facilitate the method and schedule for maintaining the **Jurisdiction Annex**.

9.1.1. Plan Maintenance Schedule

- **Monitor:** Annually and/or following major disaster(s)
- **Evaluate:** Annually and/or following major disaster(s)
- **Update:** Annual tasks over the five-year planning cycle; planning process in fifth year

Table 39: Loudoun County Jurisdiction Annex Maintenance Procedure

Activity	Procedure and Schedule	Outcome
Monitoring the Annex	<ol style="list-style-type: none"> 1. Schedule the annual plan review with jurisdiction planning team. 2. Review the status of all mitigation actions, using the <i>Mitigation Action Implementation Worksheet</i> (Section 3, Attachment A, NOVA HMP Base Plan). 	<p>Produce an annual report that includes the following:</p> <ul style="list-style-type: none"> • Status update of all mitigation actions • Summary of any changes in hazard risk or vulnerabilities and capabilities • Summary of activities conducted for the Action Plan for Implementation and Integration
Evaluating the Annex	<ol style="list-style-type: none"> 1. Schedule the annual plan evaluation with jurisdiction planning team. 2. Evaluate the current hazard risks and vulnerabilities and hazard mitigation capabilities, using the <i>Planning Considerations Worksheet</i> (Section 3, Attachment C, NOVA HMP Base Plan). 	<p>Submit the annual report to the NOVA HMP Planning Team Point of Contact.</p>
Updating the Annex	<ol style="list-style-type: none"> 1. Coordinate with Northern Virginia jurisdictions to identify the method and schedule for the five-year update of the NOVA HMP. 2. Participate in the planning process. 3. Provide input related to the plan components. 4. Following FEMA Approvable Pending Adoption (APA) designation, adopt the updated plan. 	<p>Adoption of the FEMA-approved plan every five years will maintain the jurisdiction's eligibility for federal post-disaster funding.</p>

Mitigation actions presented in the Loudoun County Jurisdiction Annex may be reviewed, revised, and updated at any time. In addition, the *Loudoun County EOP*, p. 83, stipulates that “OEM will contact all agencies for post-disaster mitigation activities and notify them of their role in these operations.” This will ensure that mitigation actions remain current and positioned for potential funding as it becomes available.

Loudoun County will continue to be a planning partner with multiple jurisdictions and regional entities to identify hazard mitigation opportunities that reduce risk of the hazards identified in this plan.

10. Annex Adoption

The Loudoun County Jurisdiction Annex will be adopted simultaneously with the adoption of the *Northern Virginia Hazard Mitigation Plan (2022 NOVA HMP)*.

11. Loudoun County Attachments

- Attachment 1: Adoption Resolution
- Attachment 2: Documentation of the Planning Process
- Attachment 3: Documentation of Public Participation
- Attachment 4: Mitigation Actions

11.1. Attachment 1: Adoption Resolution

[This page is a placeholder for the Adoption Resolution for this jurisdiction.]

11.2. Attachment 2: Planning Worksheets and Documentation

Capability Assessment

Jurisdiction: Loudoun County

Date: 9/22/21

Participants:

Name	Position/Title	Department/Agency
Kelly Myers	Assistant Coordinator-Planning	Loudoun County
Joe Dame	Emergency Management Coordinator	Town of Leesburg
Elizabeth Moore	Emergency Preparedness Specialist	Loudoun County
Nancy Freeman	Senior Mitigation Planner	IEM
Jessica Mason	Hazard Mitigation Planner	IEM

Planning and Regulatory

Planning and regulatory capabilities are the plans, policies, codes, and ordinances that prevent and reduce the impacts of hazards. Please indicate which of the following your jurisdiction has in place.

Plans	Yes or No? Year	Does the plan address natural and/or non-natural hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan: Loudoun County 2019 Comprehensive Plan https://www.loudoun.gov/4957/Loudoun-County-2019-Comprehensive-Plan	Yes, 2019	<ul style="list-style-type: none"> Describes land-use trends and population growth, expected growth, and development patterns (Chapter 2, p. 7) Land-use planning framework policy areas: urban, suburban, transition, rural and towns, and Joint Land Management Areas Use plan to implement mitigation actions?
Capital Improvement Plan FGOEDC Item 05 Quarterly Report Capital Improvement Projects Q3 FY21 (3).pdf	Yes, 2021-2030	
Economic Development Plan: Economic Growth and Diversification Plan, August 24, 2017, GO Northern Virginia Regional Council https://www.dhcd.virginia.gov/sites/default/files/Docx/gova/region-seven/region-7-growth-diversification-plan.pdf	Yes—regional plan	<ul style="list-style-type: none"> Does not address natural or non-natural hazards
Impact fees for new development: Regulatory authority https://law.lis.virginia.gov/vacode/title15.2/chapter22/section15.2-2329/ Land-Development-Application-Fees (loudoun.gov)	Yes—2016	<ul style="list-style-type: none"> Allowed under Code of Virginia, §15.2-2329, Imposition of Impact Fees Economic Development Support Fund: one-time seed money for projects that provide economic benefits to the county for capital development projects, purchasing real estate, programming support for activities identified in the Economic Success Plan
Local Emergency Operations Plan: Loudoun County Emergency Operations Plan, July 2019 https://www.loudoun.gov/DocumentCenter/View/115801/Emergency-Operations-Plan?bidId=	Yes	<ul style="list-style-type: none"> “All-hazards” (p. 1-9) 25 natural, technological and human-caused hazards listed on p. 1-12 Operational plan, does not include projects

Plans	Yes or No? Year	Does the plan address natural and/or non-natural hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Continuity of Operations Plan	Yes	Currently updating
Transportation Plan: Countywide Transportation Plan (2019 Comprehensive Plan) https://www.loudoun.gov/DocumentCenter/View/152287/CTP---Combined-with-small-maps-bookmarked	Yes	<ul style="list-style-type: none"> Projects are not hazard-oriented Chapter 8 describes multiple funding sources Chapter 9 describes implementation strategies
Stormwater Management Plan: Loudoun County Code, Chapter 1096, Stormwater Management Ordinance, adopted in 2003 https://codelibrary.amlegal.com/codes/1oudouncounty/latest/loudounco_va/0-0-0-9717 Loudoun County Small Municipal Separate Storm Sewer System (MS4) Stormwater Management Program Plan, July 2018-June 2023	Yes	<ul style="list-style-type: none"> Purpose includes “control of flooding and standing water” Program Plan references erosion and sediment control (p. 4) Public education and outreach program and public involvement requirements described
Community Wildfire Protection Plan	No	
Other special plans (e.g., brownfields redevelopment, disaster recovery, Local Waterfront Redevelopment Plan, climate change adaptation, etc.): <i>Loudoun Health District, Pandemic Response Plan</i> , March 2020 https://www.loudoun.gov/DocumentCenter/View/179/Loudoun-Pandemic-Response-Plan?bidId=	Yes	<ul style="list-style-type: none"> Pandemic Response Plan, Attachment H: Educational Outreach Activities

Building Code, Permitting, and Inspection	Yes or No?	Are codes adequately enforced?
Building Code: https://www.loudoun.gov/5012/Building-Codes-Regulations	Yes–2015	Virginia Uniform Statewide Building Code
Building Code Effectiveness Grading Schedule (BCEGS) Score	Yes	We received a score of 4 in 2020. That was a regression from 2013 when we were scored a 3. This past June, I requested an appeal, and we were granted a score of 3 based on the new code going in effect July 1. I have not received the final score in writing yet. However, I do have an

Building Code, Permitting, and Inspection	Yes or No?	Are codes adequately enforced?
		email stating the adjustment will be made. I will follow up with ISO to get the final report and score.
Fire Department ISO rating: Public Protection Class (PPC) Ratings Changes Loudoun County, VA: Official Website	Yes	5–Rural 2–Suburban 10–No Fire Station Within 5 Mile Drive
Site Plan review requirements https://www.loudoun.gov/1315/Site-Plans	Yes	Website describes review requirements and process

Land Use Planning and Ordinances	Yes or No?	Is the ordinance an effective measure for reducing hazard impacts?
		Is the ordinance adequately administered and enforced?
Zoning ordinance https://www.loudoun.gov/zoningordinance	Yes–1993	<ul style="list-style-type: none"> Goals include adequate safety from crime, disaster evaluation, civil defense, transportation, water, sewage, flood protection, etc., and protect against loss of life, health, or property from fire, flood, panic and other dangers
Subdivision ordinance: Land Subdivision and Development Ordinance, Chapter 1241 https://www.loudoun.gov/DocumentCenter/View/18047/Land-Subdivision-and-Development-Ordinance?bidId=	Yes–2006	<ul style="list-style-type: none"> Does not address hazards or include mitigation actions related to the HMP hazards
Floodplain ordinance: Floodplain Management https://www.loudoun.gov/1505/Floodplains and Revised 1993 Loudoun County Zoning Ordinance, Section 4-1500, Floodplain Overlay District https://www.loudoun.gov/DocumentCenter/Home/Index/1524	Yes	<ul style="list-style-type: none"> Major Floodplain (SFHA), and Minor Floodplain, which continues upstream from the Major Floodplain Publishes the phone number for the County Department of Building and Development Floodplain Help Line
Natural hazard specific ordinance (stormwater, steep slope, wildfire): Mountainside Development Overlay District and Steep Slope Standards of the County Zoning Ordinance https://www.loudoun.gov/1378/Steep-Slopes-Mountainsides	Yes	<ul style="list-style-type: none"> Delineates safety hazards on this topography Reference to erosion and downstream flooding
Flood insurance rate maps	Yes, 2017	Yes

Land Use Planning and Ordinances	Yes or No?	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Acquisition of land for open space and public recreation uses	Yes	Plans in the County Comprehensive Plan
Other <ul style="list-style-type: none"> • Home Improvement Programs Loudoun County, VA: Official Website • FY 2022 Adopted Budget: Volume Two (loudoun.gov) 	Yes	<ul style="list-style-type: none"> • Loans and grants to help homeowners who meet certain criteria to make home repairs focusing on code violations and health and safety issues • Additional projects (Capital Improvement Projects listed FY 2022 Budget Vol. 2 Capital Improvement Program)
How can these capabilities be expanded and improved to reduce risk?		

Administrative and Technical

Identify whether your community has the following administrative and technical capabilities. These include staff and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. If your jurisdiction does not have local staff resources, please indicate if these are available through agreement with other entities or at the county level to provide the services or technical assistance.

Staff/Personnel Resources	Have Capability Y/N	Department/ Agency and Position	Effective Coordination?	Adequate Staffing?	Integrated into Mitigation Planning?
A. Planner(s) or engineer(s) with knowledge of land development and land management practices	Yes	Building and Development	Yes	Yes	Yes
B. Engineer/professionals trained in construction practices related to buildings and/or infrastructure	Yes	Building and Development General Services	Yes	Yes	Yes
C. Planners/Engineer(s) with an understanding of natural and/or manmade hazards	Yes	Building and Development	Yes	Yes	Yes
D. Floodplain manager	Yes	Building and Development	Yes	Yes	Yes
E. Surveyor(s)	No				
F. Staff with education or expertise to assess the community's vulnerability to hazards	Yes	Office of Emergency Management and the Department of Building and Development	Yes	Yes	Yes
G. Personnel skilled in GIS and/or Hazus	Yes	Fire and Rescue, Mapping Office, Office of Emergency Management	Yes	Yes	Yes
H. Scientist familiar with hazards of the community	No				
I. Emergency manager	Yes	Office of Emergency Management	Yes	Yes	Yes
J. Grant writer(s)	Yes	County Administration	Yes	Yes	Yes
K. Warning systems or services (automated callout, sirens, etc.)	Yes	DIT, Office of Emergency Management,	Yes	Yes	Yes

Staff/Personnel Resources	Have Capability Y/N	Department/ Agency and Position	Effective Coordination?	Adequate Staffing?	Integrated into Mitigation Planning?
		Department of Fire and Rescue, Sheriff Office			
How can these capabilities be expanded and improved to reduce risk?					

Safe Growth

This worksheet identifies potential gaps in your community's growth guidance instruments and improvements that could be made to reduce vulnerability to future development.

Comprehensive Plan	Yes	No
Land Use		
1. Does the future land-use map clearly identify natural hazard areas?	X	
2. Do the land-use policies discourage development or redevelopment within natural hazard areas?	X	
3. Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?	X	
Transportation		
1. Does the transportation plan limit access to hazard areas?	X	
2. Is transportation policy used to guide growth to safe locations?	X	
3. Are movement systems designed to function under disaster conditions (e.g., evacuation)?	X	
Environmental Management		
1. Are environmental systems that protect development from hazards identified and mapped?	X	
2. Do environmental policies maintain and restore protective ecosystems?	X	
3. Do environmental policies provide incentives to development that is located outside protective ecosystems?	X	
Public Safety		
1. Are the goals and policies of the comprehensive plan related to those of the FEMA-approved Local Hazard Mitigation Plan?	X	
2. Is safety explicitly included in the plan's growth and development policies?	X	
3. Does the monitoring and implementation section of the plan cover safe growth objectives?	X	

Comprehensive Plan	Yes	No
Zoning Ordinance		
1. Does the zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas?	X	
2. Does the ordinance contain natural hazard overlay zones that set conditions for land use within such zones?	X	
3. Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?	X	
4. Does the ordinance prohibit development within wetlands, floodways, and floodplains or enable fines for such development?	X	
Subdivision Regulations		
1. Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?		X
2. Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?	X	
3. Do the regulations allow density transfer where hazard areas exist?		X
Capital Improvement Program and Infrastructure Policies		
1. Does the capital improvement program limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?	X	
2. Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?	X	
3. Does the capital improvement program provide funding for hazard mitigation projects identified in the FEMA-approved Local Hazard Mitigation Plan?	X	
Other		
1. Do small area or corridor plans recognize the need to avoid or mitigate natural hazards?	X	
2. Does the building code contain provisions to strengthen or elevate construction to withstand hazard forces?	X	
3. Do economic development or redevelopment strategies include provisions for mitigation of natural hazards?	X	

Comprehensive Plan	Yes	No
4. Is there an adopted evacuation and shelter plan to deal with emergencies from natural hazards?	X	

Financial

Identify whether your jurisdiction has access to or is eligible to use the following funding resources for hazard mitigation.

Funding Resource	Access/Eligibility (Y/N)	Has the funding resource been used in the past and for what type of activities?	Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Yes, for general projects	Yes
Authority to levy taxes for specific purposes	Yes, as allowed by law	Yes, for special assessments and special tax districts that fund a specific community need, usually water/sewer	Yes, but must meet certain requirements
Fees for water, sewer, gas or electric services	No		
Impact fees for new development	Y	Yes	Yes
Storm water utility fee	Yes	Yes, one-time fee for potential failure of alternative septic systems that do not get repaired by the landowner	Yes
Incur debt through general obligation bonds and/or special tax bonds	Yes	Yes, for general projects	Yes, must meet certain requirements, such as having been through referendum, fall within debt limits, approved by board
Incur debt through private activities	No		
Community Development Block Grant	Yes	Yes	Yes
Other federal funding programs	Yes	Yes, FEMA Public Assistance (PA). Flood mitigation is an area where FEMA offers assistance; we recently applied but were not selected for funding. Other funding based on law, i.e., ARPA, CARES Act	Yes, when a federal emergency is declared for FEMA PA, others may be competitive or enacted by law
State funding programs	Yes	Yes	Yes, if available. Could be competitive
Public/private partnership funding sources	Yes	Yes, to build soccer stadium and garage	Yes
How can these capabilities be expanded and improved to reduce risk?			

Education and Outreach

Identify education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information.

Program/Organization	Yes/No	Describe program/organization and how it relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizens groups or nonprofit organizations focused on environmental protection, emergency preparedness, access, and functional needs populations, etc.	Yes	Blue Ridge Center for Environmental Stewardship - ©2021 Loudoun Environmental Education Alliance (loudounnature.org) Loudoun Senior Interest Network Resources for the Elder Care Community in Loudoun County (loudounseniors.org) Awareness, Connections, Education, Solutions Accessible Community
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education, household recycling, etc.)	Yes	Fire and Life Safety Programs Loudoun County, VA - Official Website
Natural disaster or safety-related school programs	Yes	School Programs Loudoun County, VA - Official Website
StormReady certification	Yes	The county has the certification. INOVA Health System and Leesburg Corner Premium Outlets are supporters. StormReady® and TsunamiReady® in Virginia (weather.gov)
Firewise Communities certification	No	
Public-private partnership initiatives addressing disaster-related issues		Loudoun Cares Salvation Army Loudoun Watershed Watch - Overseeing the Water Resources of Loudoun County, VA
Other		
How can these capabilities be expanded and improved to reduce risk?		

National Flood Insurance Program (NFIP) Survey Form

Jurisdiction: Loudoun County

Floodplain/NFIP Administrator: Maggie Auer

Phone: 703-777-0222

Date: 9/22/2021

Email: Maggie.Auer@loudoun.gov

Jurisdiction Participants: Towns of Hamilton, Leesburg, Middleburg, Lovettsville, Purcellville, Round Hill, Unincorporated Areas of Loudoun County

Please provide the information below to document your community's participation in and continued compliance with the NFIP, as well as to identify areas for improvement that could be potential mitigation actions. Indicate the source of information if different from the one included.

NFIP Topic	Source of Information	Comments
Insurance Summary		
How many NFIP policies are in the community? What is the total premium and coverage?	State NFIP Coordinator or FEMA NFIP Specialist	664, \$402,839 (as of 05/2020)
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	FEMA NFIP or Insurance Specialist	93, \$1,839,126, N/A (as of 05/2020)
How many structures are exposed to flood risk within the community?	Community Floodplain Administrator (FPA)	550 building footprints, 150 w/addresses in SFHA
Describe any areas of flood risk with limited NFIP policy coverage	Community FPA and FEMA Insurance Specialist	Unknown
Staff Resources		
Is the Community FPA or NFIP Coordinator certified?	Community FPA	Yes, Certified Floodplain Administrator (CFM)
Is floodplain management an auxiliary function?	Community FPA	No, full-time position
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Community FPA	Permit & Plan Review, Zoning Enforcement, Review Engineering Analysis
What are the barriers to running an effective NFIP program in the community, if any?	Community FPA	None
Compliance History		
Is the community in good standing with NFIP?	State NFIP Coordinator, FEMA NFIP Specialist, community records	Yes

NFIP Topic	Source of Information	Comments
Are there any outstanding compliance issues (i.e., current violations)?		Yes
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?		2014–2015

11.3. Attachment 3: Documentation of Public Participation

Loudoun County residents were invited to participate in a survey asking for their experience with local hazards. *Loudoun Now*, a community news source, published an article requesting community input.



A Loudoun County Fire-Rescue technical rescue crew trains at the Panda Stonewall Energy Center in the fog Thursday, Oct. 22. [Renss Greene/Loudoun Now]

Loudoun Residents Asked to Take Hazard Survey

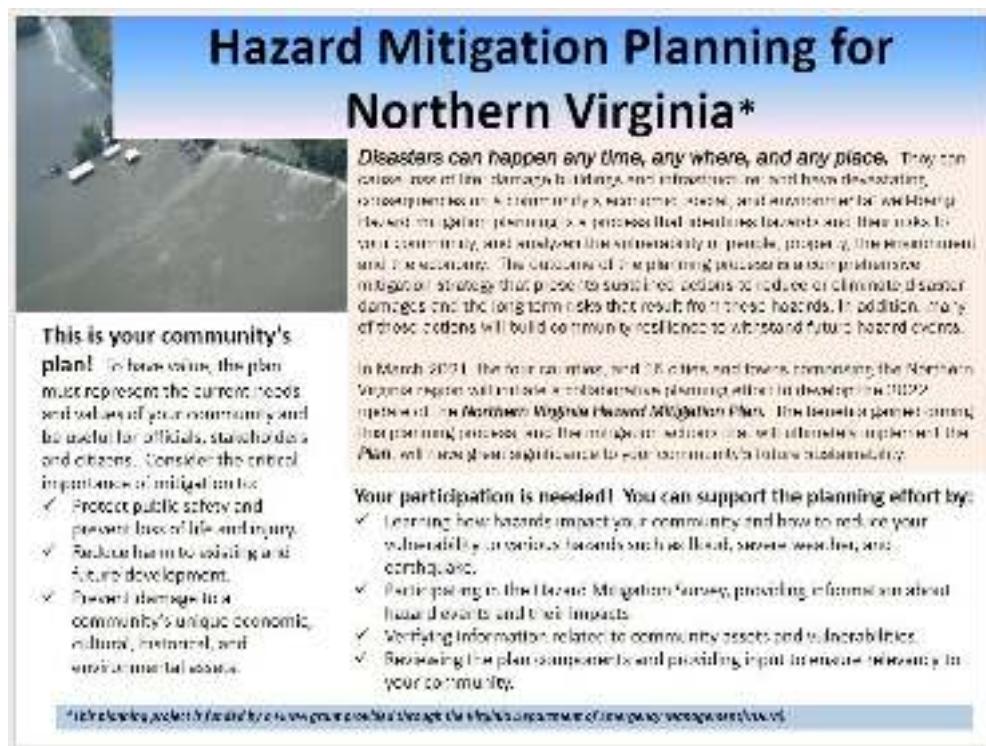
[2021-08-20 Loudoun Now](#)

County officials are encouraging Loudoun residents and business owners to help build community resilience to disasters by participating in the Northern Virginia Hazard Mitigation Survey.

Loudoun County and its towns are part of a regionwide effort to update the Northern Virginia Hazard Mitigation Plan. The plan identifies strategies for reducing or eliminating loss of life, injury, and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires, and winter weather.

In addition to preventing loss of life, injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social, and environmental well-being.

The survey asks questions about natural hazards they are concerned about or have directly experienced in the past five years, as well as for opinions on proposed mitigation strategies...



2022 Northern Virginia Hazard Mitigation Plan Update

- Who is participating?
 - 4 counties and their towns
 - 5 cities in Northern Virginia
 - How to participate –
 - Kick-Off meeting
 - Jurisdiction Meeting
 - Provide information
 - Review draft plan and provide input
 - Timeline –
 - March 2021 to January 2022
-
- What information do we need?
 - How have hazard events impacted your jurisdiction?
 - What new hazards should be considered in this update?
 - What assets in your community are vulnerable?
 - What projects will reduce the level of risk?
 - What are your risk concerns for the future?

Figure 16: Promotional Flyer Distributed throughout the Planning Area

Below is a copy of the news release that Loudoun County sent out. It was shared with all the Towns was disseminated through other channels.

For Immediate Release Media Contact: Glen Barbour, Public Affairs and Communications Officer
September 12, 2022 703-771-5086, Glen.Barbour@loudoun.gov

Loudoun Community Encouraged to Comment on Regional Hazard Mitigation Plan

The [Loudoun County Office of Emergency Management](#) encourages residents and business owners in Loudoun County to help build community resilience to disasters by providing comments on the proposed [Northern Virginia Hazard Mitigation Plan](#).

The plan is a multi-jurisdictional plan that includes Loudoun County and its incorporated towns as well as other Northern Virginia jurisdictions, including Arlington, Fairfax and Prince William counties.

The plan identifies strategies for reducing or eliminating loss of life, injury and property damage caused by disasters as well as the long-term risks that result from hazards such as floods, severe storms, tornadoes, wildfires and winter weather.

In addition to preventing loss of life and injury and damage to buildings and infrastructure, hazard mitigation can prevent damage to a community's economic, social and environmental well-being.

Members of the community can participate in the mitigation planning process by submitting their comments on the plan by 5:00 p.m., October 8, 2022, by email at NOVA2022PublicComment@iem.com.

11.4. Attachment 4: Mitigation Actions

Table 40: Previous Mitigation Actions

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2006-8	Maintain high quality aerial photography of the County	Office of Mapping/ Office of Emergency Management	All Hazards	Department of Homeland Security grants, UASI funding, County Funding	Ongoing	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)	Complete-- but still a priority to maintain	Complete but still a priority to maintain	Need to Maintain	Continuation
2010-1	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	Flood/High Wind/Severe Storm	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	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	Since 2010, we have met with VDOT and increased signage capability available for deployment notifying the public of road closed due to "high water". We have initiated conversation with VDOT regarding the installation of gates, but those conversations are in the infancy stage.	Complete but still need to maintain	Need to Maintain	Continuation

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2010-2	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 FEMA HMA programs where appropriate	Office of Emergency Management	Flood/High Wind/Severe Storm	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	Since 2010 Loudoun County has participated in the Risk Map program and have preliminary discussed these options in a variety of settings. Given the results of the Risk Map project, we will need to develop and implement strategies that continue the discussions and look at ways to minimize risk.		Need to Maintain	Continuation
2010-3	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. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filling form FEMA AW-501	Office of Emergency Management	Flood/High Wind/Severe Storm	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	This is part of the Risk Map project, which will yield additional requirements associated with this mitigation action.		Need to Maintain	Continuation

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2010-4	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	Flood/High Wind/Severe Storm/Tornado/Winter Storm	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	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	Medium	Through a partnership with VDOT, we have deployed mobile variable message boards to several strategic locations to enhance the ability of public messaging VDOT has increased the number of traffic cameras throughout the eastern portion of the County, which allows for collecting situational awareness. We are presently working through the County Attorney's Office regarding an agreement with VDOT through the Secure Partner's initiative	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	Continuation
2010-5	Research possible vulnerable population registration systems to better identify and serve at risk citizens	Office of Emergency Management	All Hazards	Department of Homeland Security grants, UASI funding, County Funding	Ongoing	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	Loudoun County implemented the County of Loudoun Evacuation Assistance Registry, which allows for the identification of those individuals at risk and needing assistance during an evacuation.	Complete but still need to maintain	Department of Homeland Security grants, UASI funding, County Funding	Continuation
2010-6	Determine feasibility of developing a drought preparedness and response plan	Office of Emergency Management	Drought	Department of Homeland Security grants, UASI funding, Internal County Funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan	Medium	This initiative has not commenced as of yet and will be continued in the next planning cycle	Ongoing	Need to Maintain	Continuation

Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2017-1	Continue working with VDOT regarding the development and implementation of gates to prevent drivers from crossing known flood prone roadways	Office of Emergency Management	Flood/High Wind/Severe Storm	Department of Homeland Security grants, TIGER grants, Transportation Grants, Commonwealth of Virginia	Ongoing	Upon approval of the plan we will convene representatives to discuss current progress and to further develop the project concept	High		Department of Homeland Security grants, TIGER grants, Transportation Grants, Commonwealth of Virginia	Need to Maintain	Continuation
2017-2	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 FEMA HMA programs where appropriate	Office of Emergency Management	Flood/High Wind/Severe Storm	FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map Process	High		FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Need to Maintain	Continuation
2017-3	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. Additionally, conduct annual review of repetitive loss and severe repetitive loss property list requested of VDEM to ensure accuracy. Review will include verification of the geographic location of each repetitive loss property and determination if that property has been mitigated and by what means. Provide corrections if needed by filling form FEMA AW-501	Office of Emergency Management	Flood/High Wind/Severe Storm	FEMA Unified Hazard Mitigation Assistance Grants, Hazard Mitigation Grant Program Repetitive Flood Claims Severe Repetitive Loss	Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map Process	High		Ongoing	Further timeframe will be identified as Loudoun County continues our participation in the Risk Map Process	Continuation

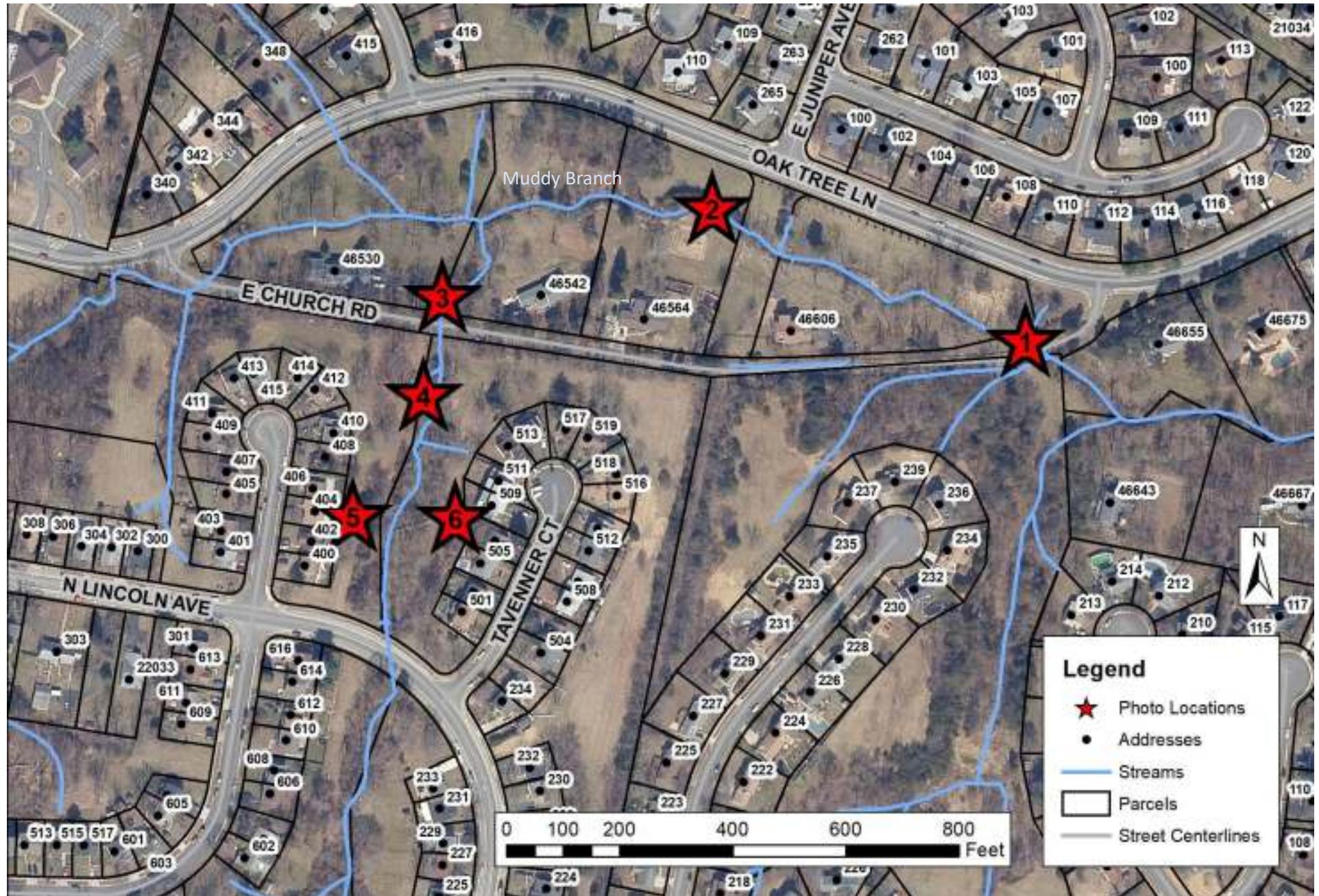
Project No.	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Hazard Type	Funding Source	Target Completion Date	Interim Measure of Success	Priority	Comments	Current Status	Comments to Justify Current Status	Projected Completion
2017-4	Collaboration with VDOT and transportation officials to continue expanding the traffic cameras to maintain the ability for situational awareness	Office of Emergency Management	Flood/High Wind/Severe Storm/Tornado/Winter Storm	Internal county funding, Federal Highway Administration grants, Tiger Grants	Ongoing	Upon approval of the plan convene a meeting of stakeholders to determine status and to develop the project scope	Medium		Need to Maintain	Continuation	Continuation
2017-5	Determine feasibility of developing a drought preparedness and response plan	Office of Emergency Management	Drought	Department of Homeland Security grants, UASI funding, Internal County Funding	Ongoing	Research and identify applicable funding mechanisms to develop the plan	Medium		Need to Maintain	Continuation	Continuation

Table 41: Non-Natural Hazard Mitigation Actions for County and Participants

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Active Violence	Civil Unrest	Communications Disruption	Cyberattack	Hazardous Materials	Pandemic/Public Health	Terrorism	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
LC-1	Cybersecurity Assessment: Improvements	Loudoun Water				x				Loudoun Water Capital Improvement Plan	Ongoing	Cybersecurity assessment program has recently matured. Assessments will be conducted every 3 years to maintain optimal cybersecurity.	Medium	Continued assessment/implementation of a multi-faceted cybersecurity program, including a cybersecurity master plan, cybersecurity awareness training, continuity of operations planning and exercises, cybersecurity policies and procedures, intrusion detection and prevention technology, data loss prevention technology, and advanced persistent threat detection.
LC-2	Community Systems Risk Assessment	Loudoun Water				x			x	Loudoun Water Capital Improvement Plan	2025	2-3 Community Risk Assessments will be completed every year for 4 years. Ongoing, on target.	Medium	Risk assessment for the community systems like the water risk and resiliency assessment that was completed in 2020. This will include scoring and analyzing likelihood and consequences of failure of critical wastewater assets and providing a risk score. Threats analyzed will include both natural hazards and malevolent acts. Ideas for mitigation of risk will also be included.
LC-3	Wastewater Risk Assessment	Loudoun Water					x	x	x	Loudoun Water Capital Improvement Plan	2023	Design is being completed. Not started- on target.	High	Risk assessment for the central wastewater system like the water risk and resiliency assessment that was completed in 2020. This will include scoring and analyzing likelihood and consequences of failure of critical wastewater assets and providing a risk score. Threats analyzed will include both natural hazards and malevolent acts. Ideas for mitigation of risk will also be included.
LC-4	Public Safety Radio Town Coverage Sites	Department of Fire and Rescue, Sheriff's Office, Department of Information Technology	x	x	x	x	x	x	x	Loudoun Water Capital Improvement Plan	Ongoing	Phase I included a study to identify where and how many additional towers are needed to provide optimal coverage and has been completed. Quotes are being requested to begin Phase II (construction of new towers). Construction of new towers is expected continue every two years.	High	This project consists of two phases. Phase I will conduct a study which will identify how many and where additional towers may be needed, and if existing tower locations should be relocated for optimal coverage. Phase II will construct new towers or relocate existing towers.

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Active Violence	Civil Unrest	Communications Disruption	Cyberattack	Hazardous Materials	Pandemic/Public Health	Terrorism	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
LC-5	Public Safety School Emergency Radio Coverage	Public Schools, Sheriff's Office, Department of Information Technology	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2026	Phase I (Coverage Study) has been completed. Phase II will install and replace the Bi-Directional Amplifiers (BDA) identified in the study.	Medium	This project consists of two phases. Phase I will conduct a coverage study to determine needs and identify schools that need additional equipment to meet coverage requirements. Phase II will install and replace the BDAs identified in the study. This project provides funding to purchase and install BDAs in public school buildings to provide Public Safety radio coverage for the school resource officers. Funding is based on a coverage study that was administered by the Department of Information and Technology which identified the location of schools that needed boosters and determined the proper replacement schedule of existing BDAs. The project budget was revised during the FY 2022 CIP budget development process to include planned funding for the remaining phases of project implementation for FY 2022, FY 2023, FY 2024, FY 2025, and FY 2026.
LC-6	Backup Emergency Communications Center	Department of Fire and Rescue, Sheriff's Office, Building and Development	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2025	Schedule a kickoff meeting.	Medium	This project provides funding for relocation of the Backup Emergency Communications Center (ECC) to a modern, technically redundant, secure facility. This migration could be a step whereby the technology and operations are moved to a data center. The existing ECC facility is aging and has been identified on the county's Technology Roadmap as a key backup facility that must be migrated to a modern data center due to the critical nature of the work performed in the facility.
LC-7	Data Center and Fiber Plant Relocation	Department of Information Technology (DIT)	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2023	Continue migration of data center. Once complete, ensure the stability of the new center before collapsing existing facilities	High	This project provides funding to continue the migration of the county's data center facilities to a private, fit-for-purpose data center within Loudoun County. Once complete, DIT will collapse the existing, aging data center facilities which present a significant risk to continuity of operations.

#	Agency/ Department Mitigation Action	Lead Agency/ Department/ Organization	Active Violence	Civil Unrest	Communications Disruption	Cyberattack	Hazardous Materials	Pandemic/Public Health	Terrorism	Funding Source	Target Completion Date	Interim Measures of Success	Priority	Comments
LC-8	Public Safety: 911 Phone Switch Replacement	Department of Fire and Rescue, Sheriff's Office, Department of Information Technology (DIT)	x	x	x	x	x	x	x	Capital Improvement Projects	FY 2024	Develop scope of the plan and schedule kickoff meeting.	High	This project provides funding to replace the county's current E-911 phone switch. All emergency communications in the county transmit through the E-911 phone switch, which makes it an essential piece of equipment for the health and safety of Loudoun's citizens. The current E-911 phone switch was installed in the ECC and became fully operational in July 2015. The estimated lifespan for this mission-critical system is seven years.
LC-9	Public Safety: Radio Tower Expansion Program	Department of Fire and Rescue, Sheriff's Office, Department of Information Technology (DIT)	x	x	x	x	x	x	x	Capital Improvement Projects	Ongoing	The first phase, identifying locations for additional towers, has been completed. Installation of new towers will be ongoing every two years.	High	This project provides funding for the installation of additional Public Safety Radio Towers to provide required radio coverage for First Responders, based on the findings of a coverage study that was managed by the DIT. The first phase of this project identified the need for nine additional towers in various locations throughout the county. The second phase includes the installation of the new towers as identified in the coverage study which will begin in FY 2021 and continue every two years. Due to population growth within the county, it is expected that additional Public Safety Radio Towers are needed to provide the required radio coverage for First Responders. Future funding for this program will be re-evaluated based on updated requirements.
LC-10	Broad Run Farms Waterline Extension	Department of General Services					x					Currently in design and bidding phase	High	EPA is using Federal Funds to extend water service to 142 parcels in the Broad Run Farms community in Sterling. Capital Improvement Funds are extending water mains to the remaining 311 parcels. The Hidden Lane Landfill is an Environmental Protection Agency (EPA) Superfund Site in Broad Run Farms. The Board of Supervisors has authorized an extension of public waterlines throughout the subdivision in response to groundwater contamination from the Hidden Lane Landfill.



CID#510090 Loudoun County – Location of Photographs 1-6 in Muddy Branch and Muddy Branch Watersheds.



CID#510090 Loudoun County – Photograph 1. Muddy Branch Overtopping Public Road at 46643 E. Church Road on August 12, 2019.
Photograph Courtesy of Neighboring Property Owner



CID#510090 Loudoun County – Photograph 2. Muddy Branch Flowing Outside of Stream Banks in Unmapped Floodplain at 46564 E. Church Road on August 12, 2019. Photograph Courtesy of Property Owner.



CID#510090 Loudoun County – Photograph 3. Tributary to Muddy Branch Topping E. Church Road at 46542 E. Church Road on August 12, 2019.
Photograph Courtesy of Property Owner.



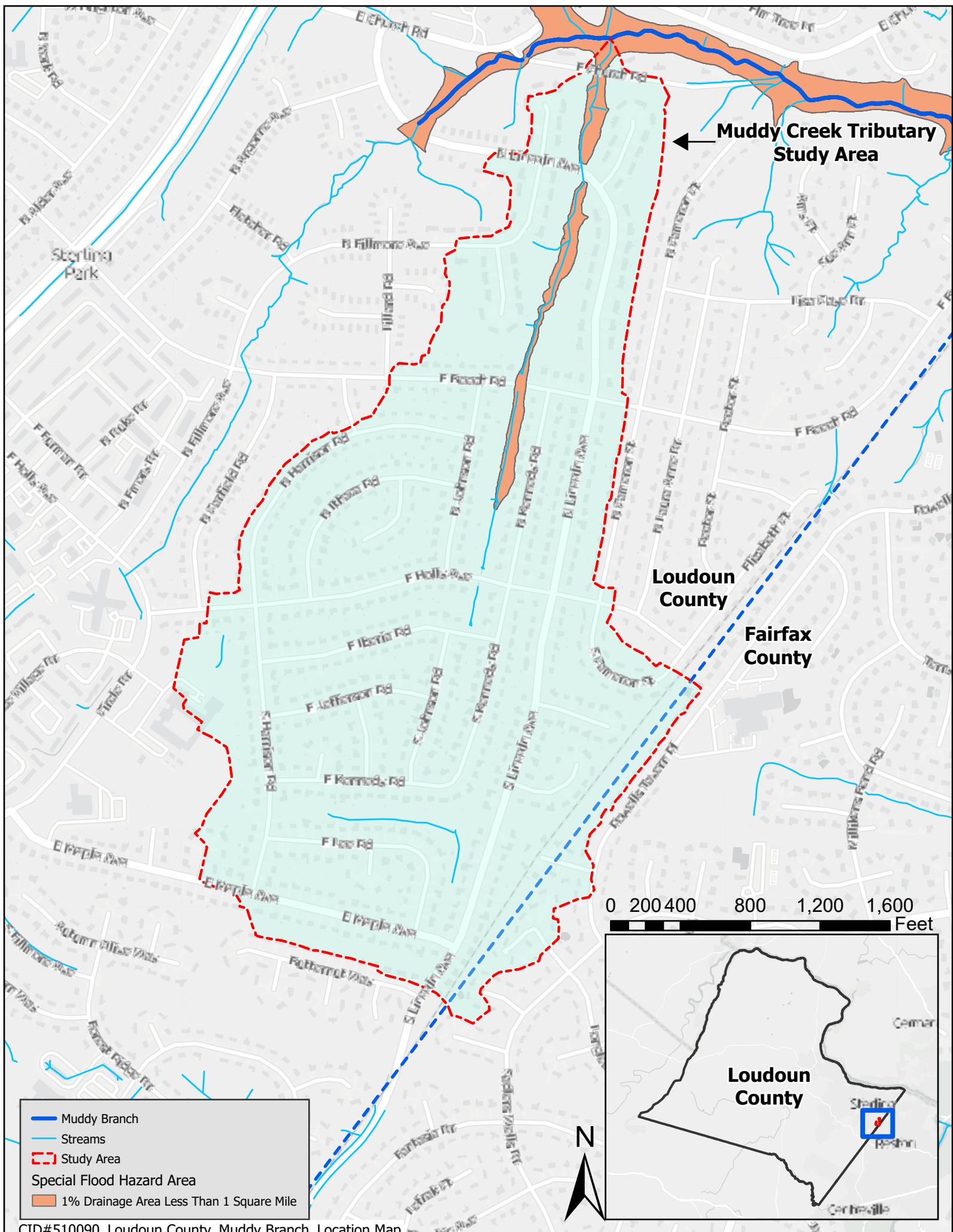
CID#510090 Loudoun County – Photograph 4. Muddy Branch Tributary Streambank Erosion Threatening Private Property Upstream of E. Church Road.
Photograph Taken September 25, 2023.



CID#510090 Loudoun County – Photograph 5. Historic Flow Attenuation Structure On Muddy Branch Tributary Located North of N. Lincoln between Harding Court and Tavener Court on September 25, 2023.



CID#510090 Loudoun County – Photograph 6. Historic Check Dam On Muddy Branch Tributary Located Just North of N. Lincoln between Harding Court and Tavener Court. Photograph taken September 25, 2023.





0 250 500 1,000 1,500 2,000 Feet

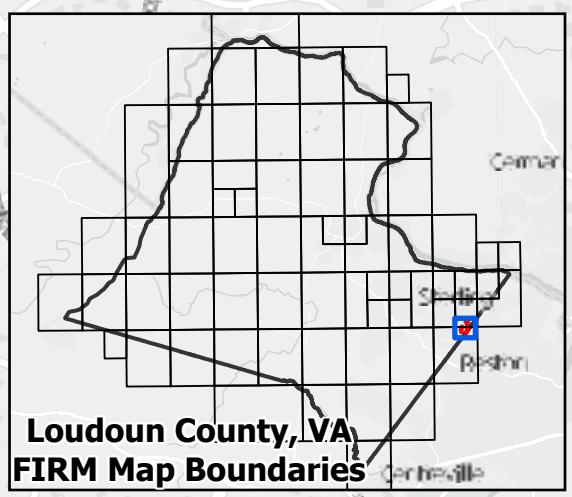
FIRM Map #
51107C0269E

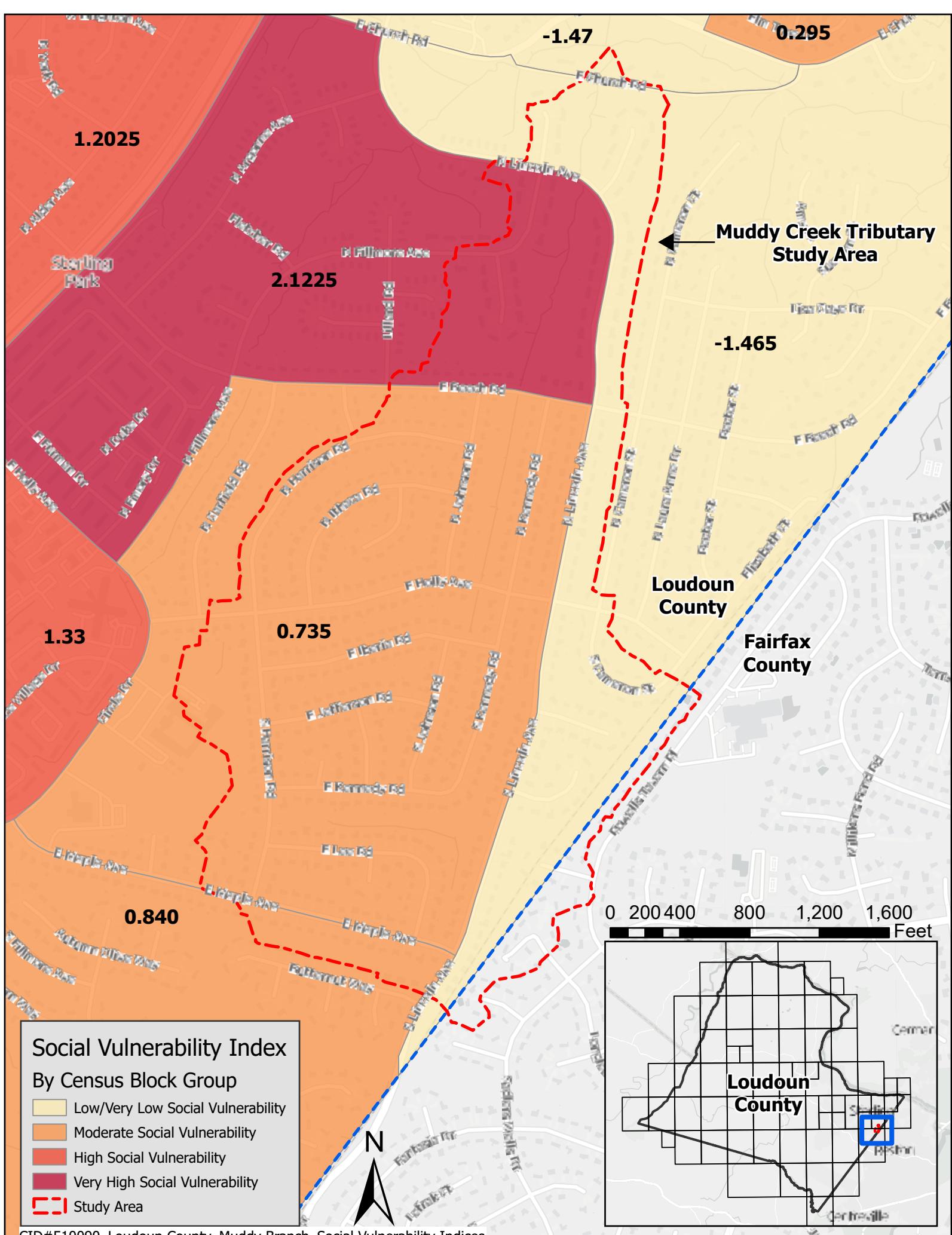
FIRM Map #
51107C0385E

**Muddy Creek Tributary
Study Area**

**Loudoun
County**

**Fairfax
County**





Grant Application Summary Form

Muddy Branch Tributary

Basic Information

Name of grant: Community Flood Preparedness Fund Grant (CFPF) Dept. name: General Services

Dept. Head signature Ernest N. Brown  Digitally signed by Ernest N. Brown
Date: 2023.10.06 17:00:05 -04'00' Date 06OCT2023

Name of grant program manager/staff contact: Dennis Cumbie Ext. 8699

Amount of grant funding \$100,000 Grant application due by: 11/12/2023

Grantor: VA DCR State Federal Grant Type: x New Continuation

Local match required?: x yes no Type and amount of local match: \$100,000 cash in-kind

Describe the authorized uses of funds: (Salary & benefits, Supplies, Contractual Services Travel, Other)
Contractual services to develop detailed Hydrologic and Hydraulic modeling for a tributary channel in the Muddy Branch Watershed to design a maintenance and repair project for the tributary.

Local match funds available in existing department appropriations: x yes, index code 106421 (C00003)

Does this grant involve the receipt or purchase of equipment? yes x no

If so, briefly describe: _____

Grant time period: 1/01/2024 to 01/01/27

Are there any provisions to renew beyond this time period? X yes no

If yes, what are they and how will they be funded? The grant can be extended with DCR approval..

Are there any special conditions or provisions related to "maintenance of effort" (conditions or provisions that require the County to maintain this program after grantor funding is no longer available)? yes x no

If yes, what are they? This is a modeling effort an maintenance is not required.

Are there any other special conditions or provisions? yes x no
If yes, what are they? _____

of FTE funded through the grant: 0 Preliminary job classifications: _____

Grant Program Information

Brief narrative of program to be provided using grant funds: This grant and matching funds will go toward development of a detailed hydrologic and hydraulic analysis for a tributary in the Muddy Brach watershed. The modeling effort is need to develop a design and maintenance strategy for the tributary that not increase flooding on private property.

Is this grant an expansion of an existing program, if so what index codes are associated? No If this is a new grant, identify the program code/ user code where the new index codes will be setup. _____

How does this program fit in the context of your department's management plan? By helping to develop a design and maintenance strategy that will not impact private property.

Is this (or a similar) program provided by any other County or school agency? _____ yes _____ No _____ no

Impact on and Need for Resources

How will the grant program manager's workload be affected by this grant? This will be one additional project to track. However, implementation of the grant will be done by General Services staff.

What staff in other departments will be needed to implement or support this program?

Have you contacted those departments to discuss this grant? _____ yes _____ NA _____ no

Is your existing office space sufficient to accommodate the new staff? _____ yes _____ no

Will additional office space be needed? _____ yes _____ x _____ no

If yes, how much office space? _____

Will you need any reconfiguration of existing office space? _____ yes _____ x _____ no

Will any new or additional systems furniture be needed? _____ yes _____ no

Will a County vehicle be needed: _____ yes _____ x _____ no If yes, how often? _____

What new or additional office equipment or furniture is needed? _____ none _____ x _____

How many new telephones and/or phone lines are needed? _____ none _____ x _____

What additional computer hardware or software will be needed? _____ none _____ x _____

Will the hardware or software be supplied through the grant? _____ yes _____ x _____ no

If yes, will the hardware/software be updated/replaced (using grant funds) as needed or required? _____ yes _____ no

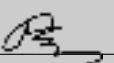
Will any reconfiguration of existing computer hardware be needed? _____ yes _____ x _____ no

Will any of the following be needed:
Mainframe access? _____ yes _____ X _____ no
E-mail? _____ yes _____ x _____ no
Voicemail? _____ yes _____ x _____ no

Do not write in this space

Budget Analyst Recommendation: approve _____ disapprove

Budget Analyst Comments: Confirmed no concerns from Stormwater Capital Budget Analyst (Chris Hetland).

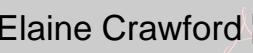
Budget Analyst Signature:  Date: October 19, 2023

Grants Analyst Recommendation: approve _____ disapprove

Grants Analyst Comments: _____

Grants Analyst Signature: ___ Barb Lawrence _____ Date: ___ 10/20/23 _____

County Administrator Decision: approve _____ disapprove

County Administrator Signature:  Digital signature by Elaine Crawford
Date: 2023.10.23 15:06:13 -04'00' Date: 10/23/23

Appendix F: Cost Narrative Form

Applicant Name: Loudoun County Department of General Services

Community Flood Preparedness Fund & Resilience Virginia Revolving Loan Fund

Detailed Cost Narrative

Period of Performance: Jan-24 through Jan-25

Submission Date: 11/15/2023

								Grand Total State Funding Request	\$180,000
								Grand Total Local Share of Project	\$20,000
								Federal Funding (if applicable)	\$0
								Project Grand Total	\$ 200,000.00
								Locality Cost Match	10%
Breakout by Cost Type	Personnel	Fringe	Travel	Equipment	Supplies	Contracts	Indirect Costs	Other Costs	Total
Federal Share (if applicable)	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Local Share	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$20,000.00	\$0.00	\$0.00	\$ 20,000.00

State Share	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$180,000.00	\$0.00	\$0.00	\$ 180,000.00
Total	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$200,000.00	\$0.00	\$0.00	\$ 200,000.00

CID#510090 Loudoun County

Muddy Branch Tributary CFPF Grant Application – Scope Narrative

Needs and Problems:

Specific problem being solved (not just that flooding exists or may occur in the future).

Residential property owners near the confluence of Muddy Branch and the tributary of interest in this study have documented repeated out-of-bank flooding events threatening life and causing property damage, including the loss of a dog that drowned during one flooding event. Further, community members have noted that the tributary's overtopping of East Church Road has interrupted transportation routes, hindering emergency responders and others from providing essential services during high-flow events. Recently, the County completed a hydrologic and hydraulic analysis of Muddy Branch that identified a lack of analytical data regarding the tributary's contribution to the current downstream flooding issues or its potential contribution during potential future storm events with intensified precipitation as a result of climate change. This study will model the current impact of runoff from the tributary watershed to identify the contribution of the tributary to Muddy Branch flooding and identify potential actions designed to improve the safety and welfare of downstream properties and owners. Additionally, the study will analyze the potential future impacts resulting from intensified storm events.

Factors which contribute to the identified problem.

The area in question is identified in FEMA mapping as an Other Area of Flood Hazard, rather than a Special Flood Hazard Area, as a result of its total drainage area being less than one square mile. Much of the tributary watershed was developed before modern stormwater management in Virginia. A project in the late 1990s attempted to minimize existing issues by implementing in-stream flow management through the use of check dams and flow control structures. The County has little information regarding the effectiveness of these historical structures in controlling current and future flow given the changing rainfall patterns, additional watershed development, and the realization that the flow control structures are reaching the end of their effective lifespan. This concern is amplified by the County's identification of both active tributary bed and bank erosion, indicating the existence of high volume and high velocity stormwater flows.

Why the project is needed either locally or regionally.

This study involves an unincorporated portion of Loudoun County that still maintains affordable housing in Northern Virginia. The skyrocketing cost of home ownership has made it important that the County attempt to maintain the viability of these neighborhoods for low- and middle-income families.

How the project decreases the risk to public safety through flood risk reduction.

Understanding the existing conditions of the tributary channel will inform potential improvement design choices, which will inform the actual construction of flood-mitigating measures, if applicable. The primary goal of the study is to identify potential solutions for the attenuation of flow from the tributary to lower the water surface elevation and flow velocity at the confluence of the tributary and Muddy Branch.

How the project protects or conserves natural resources.

Rather than flushing more flow downstream more quickly – as is sometimes the goal in flood mitigation projects – the potential improvement scenario will focus on storage upstream of the flooded area, in tune with the intention of the original control structures. This way, flow rates, and velocities are expected to decrease along the length of the tributary, reducing or eliminating the damaging erosion occurring along the tributary streambank and the stream bed.

Who is protected?

This study will lay the groundwork for future projects designed and constructed to protect downstream property owners and public infrastructure including East Church Road; thereby, reducing the risk of loss of life, structural damage, and debris scatter while increasing mobility for emergency services and residents.

The safety threats, or environmental concerns related to flood risk.

Community reports have noted several threats and concerns related to flood risk in this area. The County has fielded reports of drowning of family pets, structural damage to property, impassable roadways, uprooted trees, and specific cases of first responders having difficulty reaching homes during real emergencies, all due to flooding conditions at the downstream end of the tributary.

Groups to be targeted who might directly benefit from this flood risk reduction effort.

The primary beneficiaries are those mentioned under “Who is Protected?”, but this study will also provide valuable information regarding the viability of two-dimensional (2D) PCSWMM flood modeling to identify flood resilience opportunities. Similarly, actions such as this undertaken by the County to preserve affordable housing in Northern Virginia will directly benefit low- and middle-income families.

What would happen (or not happen) if the applicant does not receive funding?

Without funding for the study, any work related to the study and its goals will be delayed until alternative funding is identified and secured.

Alternatives analysis of the viability of the project, and how selected project reduces risk to populations at risk of flooding. Provide examples of current or previous related projects, data, outcomes, etc. that justify the approach chosen. Include how long and how much protection to be achieved.

The goals of this study are designed to identify viable solutions to existing and future flooding issues through the use of two-dimensional (2D) flood modeling. The 2D flood modeling offers several benefits over traditional Storm Water Management Model (SWMM) and master drainage plan methodologies. The primary advantage stems from the use of precise terrain data to compute flooded areas and overland flow hydraulics directly. It gives very good indications of the depths of flooding everywhere in the watershed—overcoming a fundamental shortcoming of one-dimensional SWMM modeling. The software to be used in completing this study is capable of modeling extensive underground drainage networks in addition to overland flows; thereby, providing a significant advantage over other models. Because of this, the tools to be used, including the County’s new LiDAR data, will be more beneficial for determining flood mitigation options than any alternative.

Goals and Objectives:

Goals should be listed as an outcome or result and solve the problem or need to be identified.

There are three primary goals of this study:

- Characterize the tributary's current and future impact on flooding near its confluence with Muddy Branch by modeling the existing flow rates and ponding depths around the structures of interest.
- Develop a potential improvement scenario that could help safely pass large storm events, mitigating community flood risk and minimizing tributary erosion.
- Supplement the County's work to incorporate climate resilience into their stormwater projects, as the potential improvement scenario will be evaluated using increased rainfall amounts to simulate the effect of climate change.

Objectives must be specific, measurable, and timebound.

When modeling the existing conditions, model results can be compared directly to citizen reports and photos/videos from large storm events. This is useful for both quantitative analysis (measuring water surface elevations and flood extents) and qualitative analysis (interacting with community members to anecdotally verify the results). This is how the engineers will know that the model is a good tool for understanding the tributary's current contribution to the Muddy Branch flooding. When modeling potential improvements, peak water surface elevations, flow velocities, and other results can be compared directly to the existing conditions, demonstrating the effectiveness of the proposed design with current rainfall standards. Then, increased rainfall amounts can be applied to compare the results under different climate change scenarios using the same metrics.

Time-wise, the County recognizes the urgency for the study to be completed. All efforts will be made to complete the required work as efficiently and effectively as possible by the schedule described below.

Objectives be achievable within the agreement period.

The County anticipates the study to take approximately one year once it receives award notification. To meet this schedule, the County will utilize a consulting firm previously awarded a Basic Order of Agreement contract originating from its Engineering Services for the Loudoun County Stormwater Management Program.

Work Plan:

What are the major activities and tasks?

The County plans to utilize an on-call consulting engineer contracted through the County's Engineering Services for the Loudoun County Stormwater Management Program contract. The major activities and tasks for this project are as follows:

- **Review existing information** – Under this task, the consulting engineer will thoroughly review the original design plans for the tributary, citizen flooding reports, adjacent watershed models, and other materials that Loudoun County staff provide related to the project. This task also includes gathering information necessary for the consulting engineer to build the tributary model from scratch, including data on land cover classifications, imperviousness, soils, and others that will be incorporated into the model. Overall, the goal is to gain the necessary understanding of the project to efficiently proceed with subsequent tasks, as well as to develop any initial questions or concerns for the County that will inform the hydrologic and hydraulic modeling effort.

- **Storm infrastructure survey** – Under this task, a subcontractor will survey the storm structures and hydraulic crossings within the watershed, and the deliverable will detail the type of structure, top-of-structure and invert elevations, pipe materials, and sizes, and profiles of all structures surveyed. This information is necessary to create the most accurate model possible, especially given the lack of existing information on the infrastructure available in public databases.
- **Existing conditions PCSWMM modeling** – Under this task, the consulting engineer will construct a PCSWMM 1D-2D combined model of the watershed using the data gathered under previous tasks. The model will include hydraulic structures representing the existing weir wall and check dams and will incorporate tailwater effects using point inflow hydrographs generated in existing watershed models. Engineers will ensure that stable runs are achieved for each modeled storm event, and once this is done, a detailed analysis of the tributary's hydraulic behavior will be performed. The analysis will inform the specific potential improvements that will be developed subsequently. The model will be calibrated to the community photos/videos to the extent possible, and it is anticipated that community feedback will be heard to anecdotally verify the results. One historical storm event will be modeled during this task. The existing conditions will be modeled with increased rainfall amounts as a baseline “do nothing” scenario accounting for climate change.
- **Proposed conditions PCSWMM modeling** – Under this task, the consulting engineer will develop a new model that incorporates the proposed design to mitigate flooding downstream. After running the model, the consulting engineer will investigate the impact of the potential improvement on the downstream flooding conditions, and the reduction will be recorded. As in the previous task, community feedback will be incorporated as the proposed scenario develops. Once the design and results have been agreed upon by the County, the consulting engineer will model the same scenario with a variety of rainfall amounts (such as the 10- and 100-year storms) to better understand the response to larger and smaller rainfall events. Like the existing conditions, the proposed scenario will be modeled with increased rainfall amounts to assess its response to large storms accounting for climate change.
- **Documentation and production of deliverables** – Under this task, the consulting engineer will produce a written memorandum documenting the entire study, including a narrative description of the modeling process, the results, and the conclusions, as well as supporting maps, figures, tables, and photos to illustrate that the goals have been achieved. The consulting engineer will ensure that the deliverable is accessible enough to be understood by community members or others who have little background in stormwater engineering but also detailed enough to provide technical backing for all assumptions and design choices.

Who is responsible for completing the activities and tasks?

The County will oversee the selected consulting engineer. The consulting engineer will be responsible for completing the study, including the coordination with any subcontractors, such as a surveyor, needed to complete the tasks associated with the study. Loudoun County is responsible for leading stakeholder interaction and outreach, coordinating data exchange, and managing the overall task.

What is the timeframe for accomplishing activities and tasks?

The County proposes an overall schedule of one year for this study upon award notification and issuance of a purchase order. We have proposed what we believe to be a reasonable timeline for all parties; however, some events and durations, such as the time needed for the complete storm infrastructure survey, are out of the County's control. Therefore, the schedule below is the County's best plan for executing the work and shall not be construed as a guaranteed timeline. The anticipated schedule for the entire study is as follows:

Task Description		Weeks 1-2	Weeks 3-4	Weeks 5-6	Weeks 7-8	Weeks 9-10	Weeks 11-12	Weeks 13-14	Weeks 15-16	Weeks 17-18	Weeks 19-20	Weeks 21-22	Weeks 23-24	Weeks 25-26	Weeks 27-28	Weeks 29-30	Weeks 31-32	Weeks 33-34	Weeks 35-36	Weeks 37-38	Weeks 39-40	Weeks 41-42	Weeks 43-44	Weeks 45-46	Weeks 47-48	Weeks 49-50	Weeks 51-52	
	Project Begins																											
1	Meetings and Coordination																											
2	Review Existing Information																											
3	Storm Infrastructure Survey																											
4	Existing Conditions PCSWMM Modeling																											
5	Proposed Conditions PCSWMM Modeling																											
6	Documentation and Production of Deliverables																											
	Review of Deliverables																											
	Deliverable Revisions																											
	Final Deliverable																											

Identify the required partners to ensure success and where they are represented in the work plan.

The County will utilize existing Engineering Services for the Loudoun County Stormwater Management Program contract to partner with a professional engineering firm familiar with the County's expectations. The County will also coordinate input from the stakeholder community to ensure their needs are incorporated into the study.

Deliverables

Deliverables for the study will include the final models of the existing and proposed conditions, each modeled with several standard rainfall amounts, as well as the written memo described in the "Documentation and Production of Deliverables" task above.

More broadly, this project will deliver a clearer understanding of the tributary's contribution to the Muddy Branch flooding as well as an understanding of potential flood mitigation options.

Maintenance plan tied to the identified viability of the project. Plan for sustaining the project after the agreement period (if applicable).

A maintenance plan is not required for this study.

Evaluation:

Indicators of success.

There will be a variety of indicators of success throughout the project. As the existing conditions modeling progresses, the first major milestone is achieving model stability and reasonable results. This will indicate that the geometry of the hydrology and hydraulics is set up properly. Then the downstream results can be compared to photos, videos, and anecdotes from citizens living along the channel, and tweaks made as necessary until the results qualitatively match the available data. This will indicate that the results are reliable within the study area. Once this is done, the engineering team can use the model results to determine the magnitude of the tributary's impact on the Muddy Branch flooding conditions as described above.

Once the proposed modeling begins, the goal is to reduce flooding at the vulnerable homes along the Muddy Branch by remodeling the tributary channel in keeping with the purpose of the original control structures. Indicators of success include decreased peak water surface elevations and lower flow rates at the confluence with Muddy Branch, and volume of storage within the tributary channel.

The climate change analysis will help to inform future work in stormwater planning as a case study in climate resiliency planning.

Data that will be collected and how the data will be used to measure success.

Model outputs will be the basis of all success measurements. Specific model results include water surface elevations, flooding extents, flow velocities, and other characteristics of the watershed behavior, all of which are easily accessible and communicable using model processing tools.

How was cost-effectiveness evaluated and measured against the expected outcomes?

County staff considered several modeling approaches to this project, including HEC-RAS 2D-only modeling. HEC-RAS models are the best option in some stormwater projects, but they lack functionality critical to the outcome of this study. HEC-RAS cannot route flow through underground pipe networks, so almost all precipitation is routed only over the terrain surface. While this is useful in some cases, it would only approximate (at best) the inflow hydrographs to the tributary channel, around which there are hundreds of hydraulic structures and conduits. Because of this, it was determined that PCSWMM was the best option, as PCSWMM has substantial underground and overland routing capabilities.

What products, services, meetings, outreach efforts, etc. will be conducted and how will success be measured?

The County plans to coordinate with an on-call engineering consultant to complete this project. Meetings and tasks will be conducted following the schedule shown previously to the maximum extent possible. Outreach will also be necessary with community members.

Project progress monitoring plan to ensure the project meets the requirements of the agreement and is delivered on time. Outline how delays or other findings may be used to modify or improve outcomes/deliverables.

Regular check-ins will be held with the consulting engineer to ensure that progress is consistent and that any immediate questions or concerns are addressed as quickly as possible. Unforeseen challenges are not uncommon in this type of study, and all parties will actively communicate regarding the nature of and solutions to such challenges as they arise.

CID#510090 Loudoun County CFPF Grant Application

Muddy Branch Tributary Modeling

List of Repetitive Loss Properties

There are no repetitive loss properties within the project area, but the primary impetus for this study is the repeated reports from a group of seven (7) homeowners regarding dangerous and damaging flooding issues. They have noted loss of pet life, property damage, environmental damage, and lack of access for emergency services among other issues during flooding events.