Accotink Creek
Watershed Management Plan
DRAFT

Watershed Workbook
October 2008

Fairfax County Department of
Public Works and
Environmental Services

Accotink Creek
Watershed Workbook - DRAFT

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1 Watershed Condition

1.1 Introduction

The Fairfax County Department of Public Works and Environmental Services (DPWES) is in the process of developing Watershed Management Plans (WMPs) for the 30 watersheds that comprise the county. A watershed is an area of land that drains either directly or through tributary streams into a particular river or water body. Watersheds vary greatly in size from only a few acres to many square miles, and are generally defined by topography. Elevated landforms such as ridges or even roads can serve as watershed divides. For this study, each of these watersheds has been further subdivided into watershed management areas (WMAs) averaging four square miles in size. WMAs are subdivided into subwatersheds, generally ranging in size from 100 to 300 acres.

The successful development of a WMP requires the assessment of the interaction between pollutant sources, watershed stressors, and conditions within streams and other waterbodies. Each watershed must be evaluated in light of its unique conditions. Management opportunities should be identified based on the effects of pollutants and stressors on watershed functions, both in the immediate vicinity of these stressors, as well as farther downstream. The purpose of this document is to provide consistent methods for evaluating watershed management needs while ensuring that WMPs are developed with appropriate attention to watershed-specific conditions. The DPWES Stormwater Planning Division will use the information from these plans to prioritize watershed restoration and protection projects.

The county has developed goals and objectives to be applied to all watersheds during the WMP development process. The three main goals are:

1) Improve and maintain watershed functions in Fairfax County, including water quality, habitat, and hydrology.
2) Protect human health, safety, and property by reducing stormwater impacts.
3) Involve stakeholders in the protection, maintenance and restoration of county watersheds.

The countywide objectives are linked to the above goals. These objectives were consolidated from the list of over 50 stakeholder-defined objectives from previous WMPs. The shorter list of objectives allows for a countywide evaluation that addresses stakeholder concerns while providing an efficient and effective means of assessment. The final objectives are presented in Table 1-1. This table also shows how each objective is linked to the three watershed planning goals. The countywide goals and objectives will be applied to all WMP assessments and recommendations. Additional watershed-specific goals and objectives that are recommended by local stakeholders may also be incorporated into the WMP development process. The objectives listed under Category 5 (Stewardship) will be considered during countywide watershed assessment but are not addressed in the subwatershed ranking approach.

Table 1-1 - Fairfax County Watershed Planning Final Objectives

	Objective	Linked to Goal(s)
CATEGORY 1. HYDROLOGY		
1A.	Minimize impacts of stormwater runoff on stream hydrology to promote stable stream morphology, protect habitat, and support biota.	1
1B.	Minimize flooding to protect property and human health and safety.	2
CATEGORY 2. HABITAT		
2A.	Provide for healthy habitat through protecting, restoring, and maintaining riparian buffers, wetlands, and instream habitat.	1
2B.	Improve and maintain diversity of native plants and animals in the county.	1
CATEGORY 3. STREAM WATER QUALITY		
3A.	Minimize impacts to stream water quality from pollutants in stormwater runoff.	1, 2
CATEGORY 4. DRINKING WATER QUALITY		
4A.	Minimize impacts to drinking water sources from pathogens, nutrients, and toxics in stormwater runoff.	2
4B.	Minimize impacts to drinking water storage capacity from sediment in stormwater runoff.	2
CATEGORY 5 STEWARDSHIP		
5A.	Encourage the public to participate in watershed stewardship.	3
5B.	Coordinate with regional jurisdictions on watershed management and restoration efforts such as Chesapeake Bay initiatives.	3
5C.	Improve watershed aesthetics in Fairfax County.	1, 3

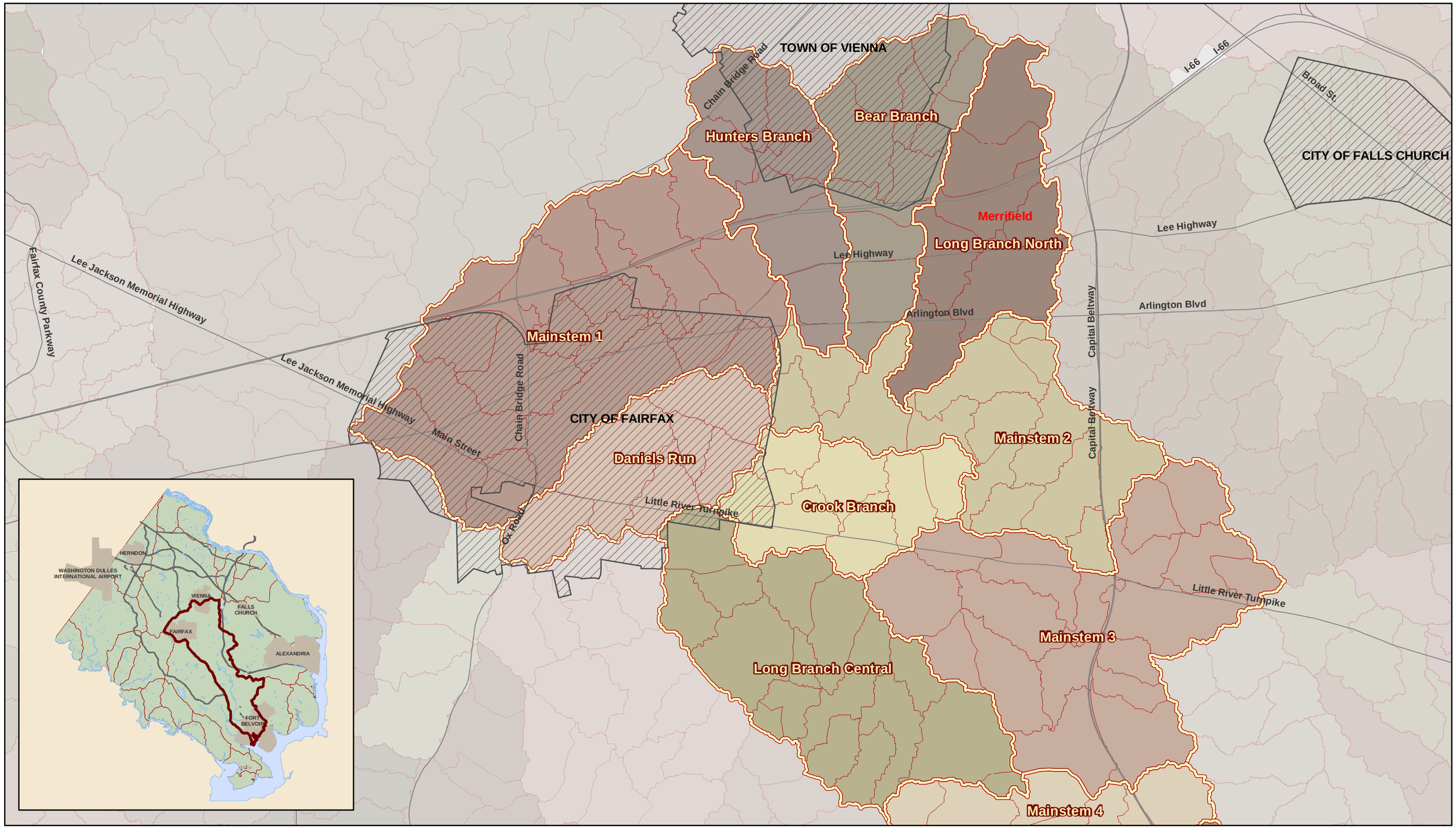
This watershed workbook describes the current and projected conditions for the Accotink Creek watershed, presenting both watershed-wide information and characterization in more detail in Watershed Management Areas (WMAs). The Accotink Creek watershed is located in central and southern Fairfax County, Virginia, as shown on Map 1-1. WMA and subwatershed boundaries are shown on Maps 1-2 and 1-3.The workbook combines information from field assessments of streams and upland areas, water quality monitoring data collected in past years, and watershed modeling conducted for this plan. The information is used to rank problem areas and identify potential sites for improvements.

0 2.5 5 Miles

Map 1-1

Watershed Location Map

Accotink Creek Watershed



0 0.5 1 Miles

Lakes and Ponds

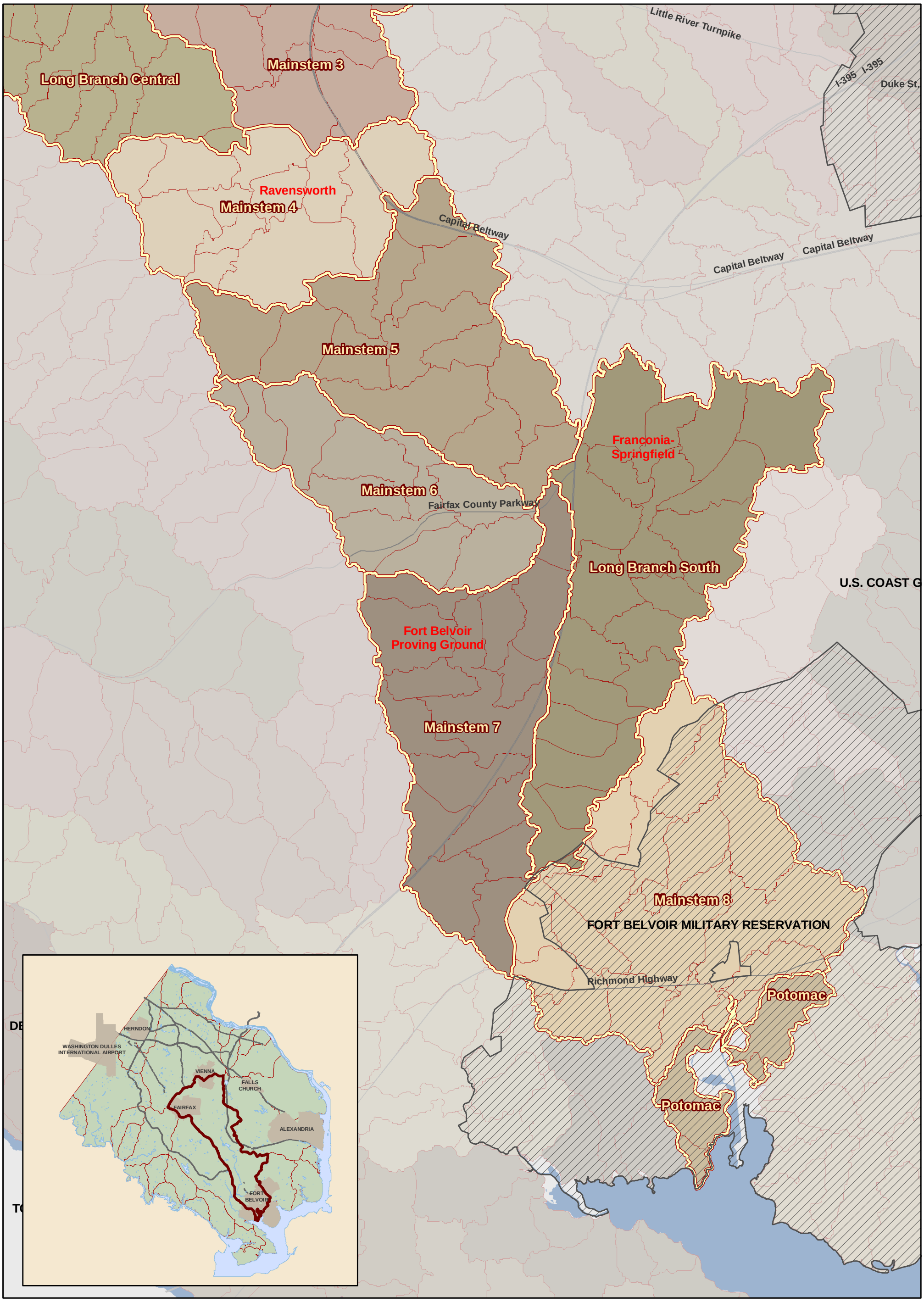
Watershed Management Area (WMA) Boundary

Subwatershed Boundary

Map 1-2

Subwatershed Map

Accotink Creek Watershed - North



0 0.5 1 Miles

Watershed Management Area (WMA) Boundary

Subwatershed Boundary

Lakes and Ponds

Map 1-3

Subwatershed Map

Accotink Creek Watershed - South

1.2 Watershed Characteristics

The Accotink Creek watershed is approximately 52 square miles and is the second largest watershed in the county. Approximately 13.4 square miles (25 percent) of the watershed are located in areas outside of the county jurisdiction in the Town of Vienna (3 percent), City of Fairfax (10 percent), and Fort Belvoir Military Reservation and other U.S. government installations (12 percent). Major roads within the watershed include Shirley Highway (Interstate 95), Interstate 66, Arlington Boulevard (US 50), Lee Highway (US 29-211), Richmond Highway (US 1) and Little River Turnpike (Route 236). A portion of the Capital Beltway (Interstate 495) runs through the northeastern part of the watershed and the Norfolk Southern Railroad and the CSX Railroad traverse the southern portion.

The watershed is part of the Potomac River Basin and contains 111 miles of streams divided among the 16 WMAs listed in Table 1-2 below. The Mainstem 8 and Potomac WMAs are within the boundaries of Fort Belvoir Military Reservation and were not assessed.

Table 1-2 - Total Area and Stream Length by Subwatershed

WMA	WMA Area (ac)	WMA Area (sq mi)	Stream Length (mi)
Bear Branch	1,392	2.2	5.9
Crook Branch	1,099	1.7	3.0
Daniels Run	1,209	1.9	2.6
Hunters Branch	1,202	1.9	3.2
Long Branch Central	2,429	3.8	8.0
Long Branch North	1,487	2.3	3.9
Long Branch South	3,121	4.9	7.6
Mainstem 1	3,653	5.7	11.3
Mainstem 2	2,069	3.2	9.1
Mainstem 3	3,128	4.9	13.3
Mainstem 4	1,812	2.8	6.7
Mainstem 5	2,445	3.8	8.4
Mainstem 6	1,532	2.4	8.4
Mainstem 7	2,391	3.7	9.2
Mainstem 8	3,233	5.1	12.0
Potomac	480	0.8	0.8
Total Watershed	**32,682**	**51.1**	**111.3**

The mainstem (or principal watercourse) of Accotink Creek flows for 23 miles in a southeasterly direction from the City of Fairfax to Accotink Bay near Fort Belvoir. The principal tributaries to Accotink Creek are Long Branch South, which drains into Accotink in Fort Belvoir; Long Branch Central, which drains just downstream of Braddock Road; Long Branch North, which drains upstream of Prosperity Avenue; Cook Branch; Bear Branch; Hunters Branch; and Daniels Run, which lies entirely within the City of Fairfax. Lake Accotink is located in the center of the watershed. It has a surface area of 68 acres and exerts significant influence on the drainage characteristics of the watershed. See Maps 1-2 and 1-3 for WMA boundaries.

Approximately 87 percent of the watershed is developed, mainly north of Lake Accotink. Most of the development took place after the Flood Plain Ordinance of 1959, which preserved stream valleys and floodplains as open space and limited flooding of habitable buildings. Several problems, however, have been caused by development, including increased stream erosion and stream sedimentation due to concentrated points of stormwater runoff.

1.3 Watershed History and Population Growth

The watershed was primarily forested prior to settlement, with three major plant associations making up the forest. The oak-hickory subregions of the Piedmont oak-chestnut forests were present in the northwest, the subzones of the Coastal Plain forest of oak-pine in the southeast, and American beech forests along the fall line.

The City of Fairfax was founded in 1742, and in 1800 became the county seat. The City of Accotink, which is now in the middle of present-day Fort Belvoir, was also settled around this time. At the turn of the 20th century, as Washington, DC was developing into a major city, development pressures increased in the surrounding areas. By the late 1950s, development was beginning and sewer lines were being laid in the Accotink basin for residential development. Additional development followed through the 1960s, and by 1975 the watershed was approximately 69 percent developed. Predicted growth through 2030 can be seen in Table 1-3.

Table 1-3 - Growth Trends in Fairfax County

Year	Population (1,000s)	Percent Change	Households (1,000s)	Percent Change	Employment (1,000s)	Percent Change
1970	454.3	-	126.5	-	-	-
1980	596.9	31.4	205.2	62.2	-	-
1990	818.6	37.1	292.3	42.4	371.7	-
2000	969.7	18.5	353.1	20.8	518.8	39.6
2010	1,133.0	16.8	411.5*	16.5	683.6*	31.8
2020	1,193.4	5.3	462.4*	12.4	782.2*	14.4
2030	1,334.0*	11.8*	482.3*	4.3*	847.6*	8.4*

All population data provided by Fairfax County except * from Metropolitan Washington Council of Governments

1.4 Watershed Development Patterns

The Accotink Creek watershed was relatively undeveloped prior to World War II. Table 1-4 indicates the area of the watershed developed, by decade, based on the date of subdivision for each parcel. (Note that the large areas of Fort Belvoir and the Engineer Proving Ground are excluded from the total for the watershed.) The first significant residential subdivision development began construction in the 1950s in the more northern and eastern areas of the watershed, particularly within the Town of Vienna. The majority of the development took place in the 1960s, and it consisted primarily of medium-density residential housing.

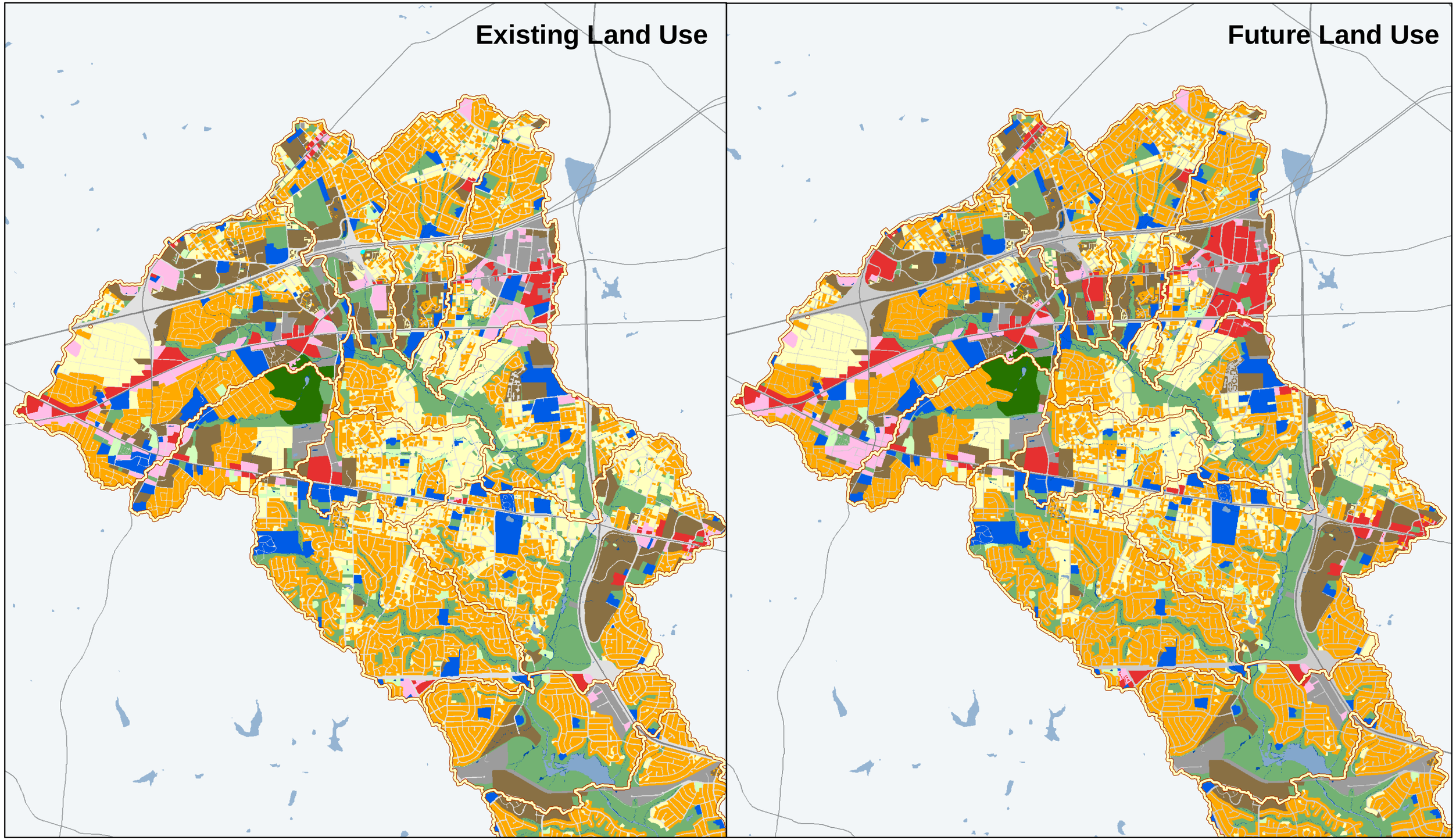
Table 1-4 - Accotink Creek Watershed Development by Decade

Decade	Area (Acres)	Percent
Open, vacant, common areas, City of Fairfax	13,983	42.8
Ft. Belvoir / Proving Ground	3,883	11.9
1900 and earlier	200	0.6
1910s	11	0.0
1920s	41	0.1
1930s	77	0.2
1940s	423	1.3
1950s	2,889	8.8
1960s	5,652	17.3
1970s	2,522	7.7
1980s	1,757	5.4
1990s	1,020	3.1
2000s	247	0.8
Total Accotink Creek Watershed	**32,704**	**100.0**

There are two significant commercial and industrial areas in the watershed. The northeastern portion of the watershed incorporates part of the commercial areas of Tyson's Corner, and the southern portion of the watershed along I-95 consists of industrial development. For the most part, these areas have been developed from the 1980s on.

1.4.1 Land Use

Current land-use mapping shows that the watershed is 87 percent developed, with 13 percent remaining as either open space or water. Table 1-5 and Maps 1-4 and 1-5 show the land use distribution throughout the Accotink Creek watershed. Thirty-nine percent of the watershed is residential and 21 percent is in industrial, commercial or transportation land uses. Fourteen percent of the watershed is in institutional uses; the majority of this area consists of Fort Belvoir and the Engineer Proving Ground, with the remainder in uses open to the public such as schools, churches, libraries and government office buildings. The City of Fairfax makes up another 11 percent of the area, primarily in residential, commercial and industrial uses.



0 0.5 1 Miles

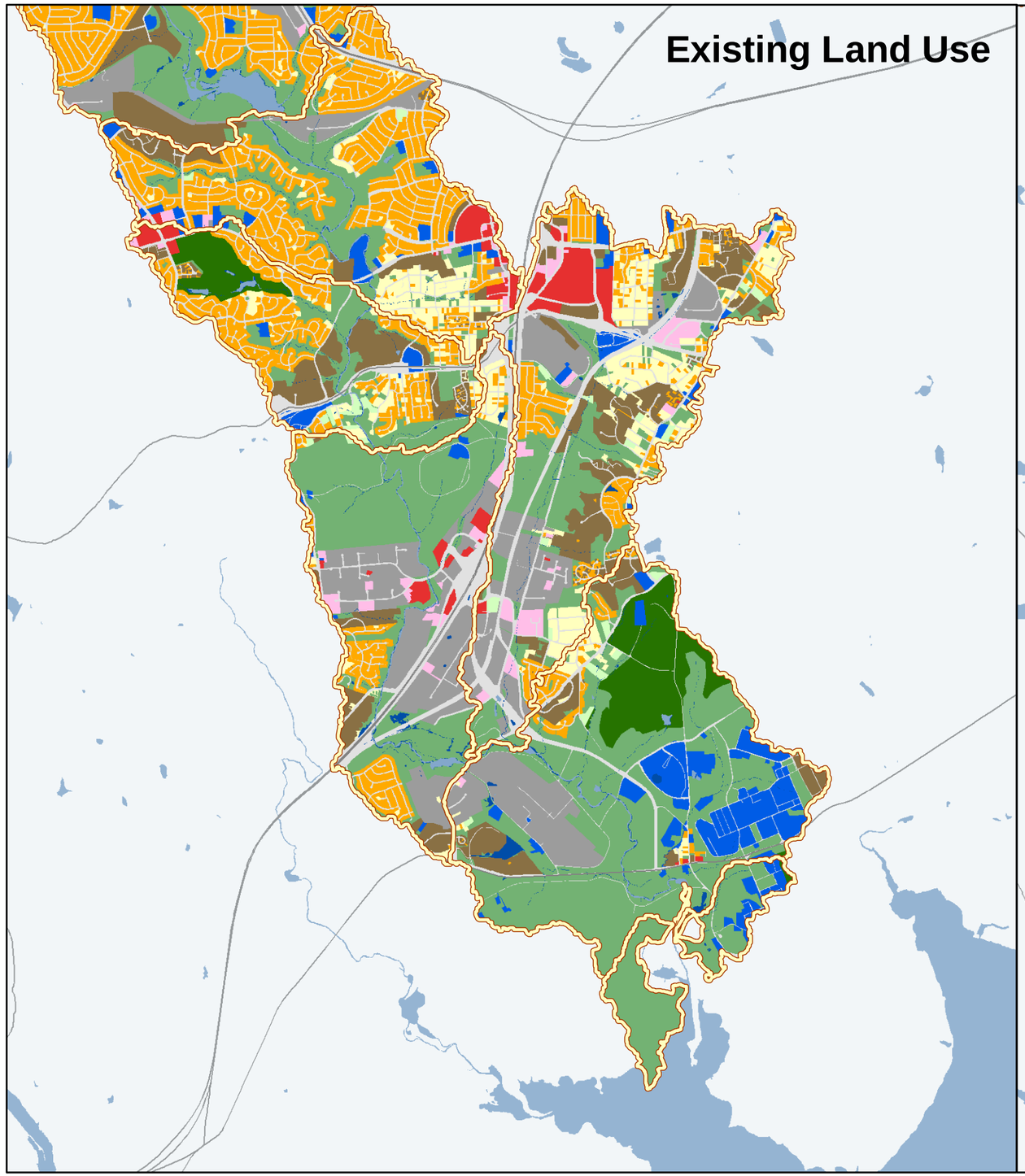
Land Use

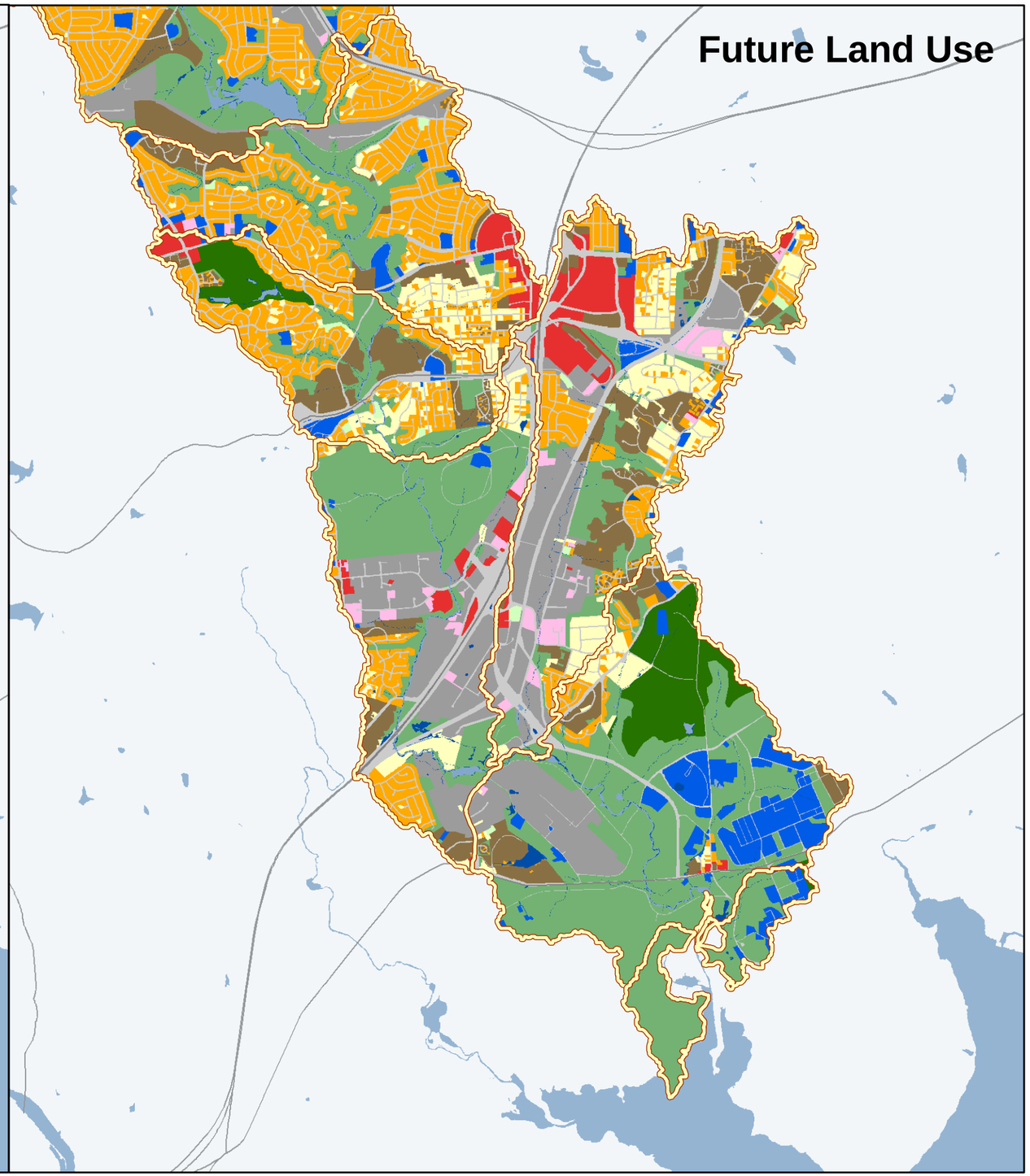
- Estate Residential
- Golf Course
- High Density Residential
- High Intensity Commercial
- Industrial
- Institutional
- Low Density Residential
- Low Intensity Commercial
- Medium Density Residential
- Open Space
- Transportation
- Water
- WMA Boundary

Map 1-4

Land Use Map

Accotink Creek Watershed - North





0 0.5 1 Miles

Land Use

- Estate Residential
- Golf Course
- High Density Residential
- High Intensity Commercial
- Industrial
- Institutional
- Low Density Residential
- Low Intensity Commercial
- Medium Density Residential
- Open Space
- Transportation
- Water
- WMA Boundary

Map 1-5

Land Use Map

Accotink Creek Watershed - South

Future land use, also shown in Table 1-5, was derived from a compilation of zoning and general land use plan information. The existing land use data was used as the base data for future land use. In many cases, the planned land uses corresponded roughly to the zoning for the same parcels. Where the planned land use and the zoned land use differed, the classification that provided the greatest density was used.

Table 1-5 - Accotink Creek Existing and Future Land Use

Land Use Type	Existing		Future		Change	
	Acres	Percent	Acres	Percent	Acres	Percent
Open Space, Parks and Recreational Areas	6,826	21	6,025	18	-801	-12
Golf Course	762	2	762	2	0	0
Estate residential	386	1	266	1	-120	-31
Low-density residential	3,334	10	3,495	11	161	5
Medium-density residential	7,762	24	8,197	25	435	6
High-density residential	3,073	9	3,146	10	73	2
Low-intensity commercial	860	3	651	2	-209	-24
High-intensity commercial	773	2	1,299	4	526	68
Industrial	1,955	6	1,999	6	44	2
Institutional	1,842	6	1,725	5	-117	-6
Transportation	4,748	15	4,756	15	8	0
Water	361	1	361	1	0	0
Total Accotink Creek	**32,682**	**100**	**32,682**	**100**	**0**	**0**

Due to rounding error, total percentages may be slightly greater or lesser than 100.

The table shows that the Accotink Creek watershed is essentially built out. Only 4 percent of the land use, or 1,247 acres, is forecast to change. The major changes are conversion of 801 acres of open space and redevelopment of 209 acres of low-intensity commercial to 435 acres of medium-density residential and 526 acres of high-intensity commercial, nearly doubling the current amount of high-intensity commercial land use.

Along with development and redevelopment at the scale of subdivisions and large commercial parcels, Fairfax County has been experiencing redevelopment of single lots for larger structures and infill development of vacant and larger single-family residential lots to higher density.

In the late 1990s, concerned with potential problems related to these types of impacts on the surrounding areas, the county initiated a study to develop recommendations which would address commonly raised issues of infill and residential development, including lack of compatibility with the existing communities, added traffic and potential congestion, tree and open space loss and stormwater management and erosion control issues (Infill & Residential Development Study, 2000). The study made recommendations to address issues of site compatibility (12 recommendations), added traffic and potential congestion (five recommendations), loss of open space (four recommendations) and stormwater management and erosion control (13 recommendations).

As a result of the Infill Study, the Board of Supervisors approved some of the recommendations and made amendments to the Policy Plan and Public Facilities Manual addressing factors of site design, neighborhood context, environment, tree

preservation, transportation, public facilities, affordable housing, heritage resources, and stormwater management and sediment control. Further details of proposed actions can be found in county Environmental Improvement Program (EIP) documents on the EIP homepage (www.fairfaxcounty.gov/living/environment/eip/).

1.4.2 Impervious Area

As the area of impervious surfaces such as streets, parking lots and driveways increases within the watershed, the amount of rainfall that can be absorbed into the ground is reduced. This can cause more water to quickly run off the land and into the streams in a short period of time. The storm drainage system is designed to direct this excess stormwater runoff into the stream system, and consequently concentrates the flow. Peak flows during storm periods not only cause flooding but can change the shape of the channel by causing accelerated erosion of the stream banks. An increase in the stream channel width can change the aquatic environment within the stream. As the stream channel widens, the water become shallower, and sun protection from tree cover decreases as mature trees are lost due to bank failure. This can cause the water temperatures to rise and add stress to any aquatic life within the stream.

The acres of impervious surface in the watershed by WMA are shown in Table 1-6 and were calculated from geographic information system (GIS) planimetric layers provided by the county. Impervious surfaces include roads, parking lots, buildings, sidewalks and driveways.

Table 1-6 - WMA Imperviousness

WMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious
Bear Branch	1,392	397	29
Crook Branch	1,099	274	25
Daniels Run	1,209	260	22
Hunters Branch	1,202	444	37
Long Branch Central	2,429	640	26
Long Branch North	1,487	610	41
Long Branch South	3,121	1,025	33
Mainstem 1	3,653	1,421	39
Mainstem 2	2,069	434	21
Mainstem 3	3,267	841	26
Mainstem 4	1,673	582	35
Mainstem 5	2,445	694	28
Mainstem 6	1,532	378	25
Mainstem 7	2,391	651	27
Mainstem 8	3,233	304	9
Potomac	480	16	3
Total Accotink Creek Watershed	**32,682**	**8,971**	**27**

Overall, the Accotink Creek watershed is 27 percent impervious. Imperviousness among the WMAs in the watershed ranges from 3 percent in the Potomac WMA to 41 percent impervious in the Long Branch North WMA. Imperviousness across the watershed is

expected to increase by approximately 1.5 percent from future development. This estimate is based on standard land use impervious percentages applied to each expected future land use.

1.5 Aquatic Resources

The Accotink Environmental Baseline study completed in 1975 by Parsons, Brinckerhoff, Quade and Douglass indicated that the faunal quality of the streams in the Accotink Creek watershed ranged from very poor to good, with 11 of the 26 streams in the watershed in the good to fair range. As the Accotink Creek watershed has changed and developed over the years, the quality of the stream system has declined due to increased storm flow, reduced base flow, and pollutants washed off from urban areas.

In 1999, the county developed the Stream Protection Strategy program to:

- determine the extent of stream degradation and identify areas with the greatest need;
- develop strategies to minimize or prevent additional degradation;
- recommend preservation and restoration efforts;
- support comprehensive watershed planning;
- better integrate environmental policies and regulatory requirements; and,
- promote environmental stewardship and public education programs.

The goal of the Stream Protection Strategy is not to restrict new development, but to provide for more ecologically sensitive and sustainable development. Three watershed management categories were developed to provide more efficient watershed planning and future watershed management (Fairfax County Stream Protection Strategy Baseline Study, 2001). Categories apply to areas within the watershed that can be grouped for similar restoration treatments. Each category includes goals and recommendations to be implemented for watershed protection and restoration. The entire Accotink Creek watershed is categorized as Watershed Restoration Level II. The primary goal for Restoration Level II watersheds is to prevent further degradation and to implement measures to improve water quality.

The results of the data collected from the 12 sampling sites within the Accotink Creek watershed for the SPS Baseline Study are shown in Table 1-7 (listed generally upstream to downstream). Locations are shown on Figure 1, on the following page, with SPS monitoring locations labeled. The streams in the watershed are substantially degraded and most of the tributary streams exhibit poor habitat, poor biological conditions and a lack of fish diversity. Benthic macroinvertebrate community health was also poor throughout the watershed and nearly all of the insects collected were those tolerant of degraded conditions.

Geomorphological assessments also indicated poor conditions throughout most of the watershed, with severely incised stream channels and active stream widening in most of the smaller tributaries. Unstable habitat and sediment bars, eroded banks, tree falls and log jams are widespread throughout the watershed. The poor and very poor overall rankings are consistent with the fact that beginning at the headwaters, the stream flows through heavily urbanized areas with greater than 25 percent imperviousness.

In addition to monitoring conducted by the county, the Northern Virginia Soil and Water Conservation District (NVSWC) maintains a volunteer monitoring program throughout

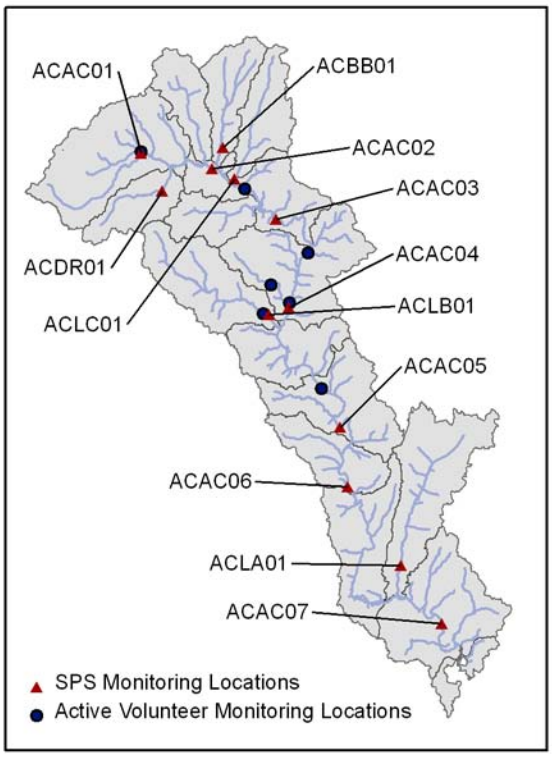


Figure 1 - SPS and Volunteer Monitoring Locations in Accotink Creek Watershed

Fairfax County. All seven active volunteer monitoring sites in the Accotink Creek watershed received ratings of unacceptable in 2006, the most recent available data. Five of these monitoring sites are located on the mainstem of Accotink Creek. Two additional sites are located on tributaries that flow into the mainstem (one tributary in southern Long Branch Central WMA and one tributary in southwestern Mainstem 3 WMA).

To supplement the biological and habitat data collected by the Stream Protection Strategy Baseline Study, beginning in the fall of 2002, field crews conducted a detailed Stream Physical Assessment (SPA) on approximately 801 miles of streams throughout Fairfax County, including the Accotink Creek watershed. The results of the assessment will be used in the watershed planning process to develop management strategies. As part of the SPA, field crews conducted a physical habitat assessment, a geomorphologic assessment and collected infrastructure information for all streams in the watershed with a drainage area greater than 50 acres.

Table 1-7 - Stream Protection Strategy Baseline Data Summary

Stream Name (Site Code)	Composite	Environmental Variables				Projected Percent Impervious
	Site Condition Rating	Index of Biotic Integrity	Habitat Score	Fish Taxa Richness	Current Percent Impervious	
Accotink Creek 1 (ACAC01)	Very Poor	Poor	Very Poor	Low	35.2	35
Daniels Run (ACDR01)	Very Poor	Very Poor	Poor	Very Low	25.5	25
Accotink Creek 2 (ACAC02)	Very Poor	Fair	Very Poor	Moderate	31.3	37
Bear Branch (ACBB01)	Very Poor	Very Poor	Poor	Low	25.1	43
Long Branch North (ACLC01)	Very Poor	Very Poor	Poor	Low	37.6	44
Accotink Creek 3 (ACAC03)	Very Poor	Poor	Poor	Moderate	29.7	36
Accotink Creek 4 (ACAC04)	Poor	Poor	Poor	Moderate	28.6	35
Long Branch Central (ACLB01)	Poor	Poor	Fair	Moderate	23.6	24
Accotink Creek 5 (ACAC05)	Poor	Very Poor	Good	Moderate	27.4	34
Accotink Creek 6 (ACAC06)	Poor	Poor	Good	Moderate	27.1	35
Long Branch South (ACLA01)	Poor	Poor	Good	Low	30.3	49
Accotink Creek 7 (ACAC07)	Poor	Poor	Poor	Moderate	26.3	36

Source: SPS Baseline Study Report, 2001. Sites are generally ordered from upstream to downstream.

1.5.1 Stream Habitat

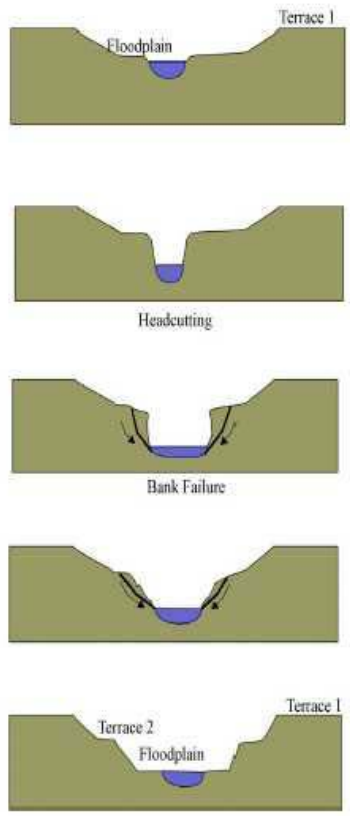
Habitat was assessed on 85 of the 111 miles of stream within the Accotink Creek watershed. In comparison with the rest of the county, the Accotink Creek watershed is in the lower middle range of quality. Of the assessed reaches, 1.5 miles (2 percent) of stream were rated as excellent, 18 miles (21 percent) as good, 23 miles (27 percent) as fair, 33 miles (39 percent) as poor, and eight miles (9 percent) as very poor for habitat conditions.

1.5.2 Stream Geomorphology

Stream geomorphology describes how a stream channel adjusts to changes in its watershed. Stream erosion is a natural process which occurs slowly in an undeveloped setting, with the stream forming a dynamically stable channel. The size and shape of the stream channel are dependent on the type of soils, the steepness of the grade and the amount of water that flows into the channel. If one of these conditions is changed, the channel will adjust itself to accommodate the new conditions and find a new stable size and shape. The most significant change that occurs with development in a watershed is an increase in the amount of water flowing in a channel during storm events because of concentrations of flow from impervious surfaces.

The geomorphologic assessment of the stream channels in the Accotink Creek watershed is based on the Channel Evolution Model (CEM) (Schumm et al. 1984), which

gives insight into how stream channels change after a disturbance such as a change in watershed land use. The CEM classifies streams into the five categories shown below in Figure 2, and can be useful for predicting future conditions:



Type I – This represents pre-disturbance condition, with well-vegetated streambanks.

Type II – This is the first stage after disturbances to the watershed. The dominant physical process in this stage is bed degradation, with the beginning stages of stream incision (downcutting).

Type III – At this stage bed degradation has led to overly steep banks, and bank failure is common. This stage is the most unstable of all CEM stages. Channel widening is the dominant physical process in a Type III channel.

Type IV – The dominant physical process in a Type IV channel is sediment aggradation. This stage is considered the beginning phase of stream stabilization after disturbance.

Type V – Type V channels are similar to the stream's Type I channel in dimension and capacity. The new channel is lower than the original channel and the original flood limit is now a terrace.

Figure 2 - CEM Categories

CEM stream channel evaluations resulted in classifying 91 percent of the channels in the Accotink Creek watershed as being Type III, indicating an unstable channel experiencing severe bank erosion.

1.5.3 Infrastructure Inventory

The infrastructure inventory conducted by field crews for the 2002 SPA study includes all structures and conditions that may have potential impacts on the stream, such as sources of contamination or pipes, ditches, stream obstructions, dump sites, head cuts, utilities, erosion problem areas, stream crossings and areas of deficient buffer.

An assessment of the infrastructure in the watershed was also conducted. Of the 1,211 inventory points, the most significant problems were 15 deficient buffers, four head cuts, two exposed utility lines and one pipe with an impact score of 10, indicating the pipe is causing severe erosion.

There are over 90 major stream crossings in Accotink Creek, including steel and wooden bridge overpasses and reinforced concrete and corrugated metal culverts.

1.5.4 Wetlands

According to National Wetland Inventory (NWI) data shown in Table 1-8, Accotink Creek watershed contains 1,043 acres of wetlands. Of this, approximately 880 acres are freshwater emergent and forested wetlands. These types of palustrine wetlands are often dry for at least part of the year.

Another 39 acres are riverine wetlands, which occur in floodplains and along stream corridors and are heavily influenced by stream flooding. There is generally water flowing in a riverine system.

The remaining 123 acres are either unclassified or are lacustrine wetlands associated with open water bodies such as lakes, reservoirs and other water impoundments.

There are approximately 239 wetlands in the watershed. Of these, 177 are less than three acres, 43 are between three and 10 acres, and 19 are greater than 10 acres. The largest of these are the marshes located near Lake Accotink and at Accotink Bay on the Potomac River.

Table 1-8 - NWI Wetlands by WMA in Accotink Creek watershed

WMA	Freshwater Emergent Wetland	Freshwater Forested/ Shrub Wetland	Freshwater Pond	Lake	Other	Riverine	Total
Bear Branch	-	13.8	0.6	-	-	-	14.3
Crook Branch	-	13.6	0.8	-	-	-	14.5
Daniels Run	-	3.4	7.2	-	-	-	10.5
Hunters Branch	-	9.9	0.3	-	-	-	10.2
Long Branch Central	2.4	42.5	2.7	-	-	-	47.6
Long Branch North	-	22.8	2.4	-	-	-	25.2
Long Branch South	0.2	61.3	3.3	-	2.0	0.3	67.1
Mainstem 1	-	2.9	0.9	-	0.2	-	4.1
Mainstem 2	2.2	179.8	1.3	-	-	-	183.3
Mainstem 3	11.8	84.4	9.0	-	-	-	105.2
Mainstem 4	17.7	90.8	2.6	61.0	4.2	8.2	184.7
Mainstem 5	-	112.0	2.0	0.4	-	13.2	127.6
Mainstem 6	-	51.6	8.1	-	-	8.4	68.1
Mainstem 7	-	56.0	5.5	-	0.1	3.9	65.5
Mainstem 8	11.0	74.1	8.4	-	-	3.1	96.6
Potomac	1.5	14.3	0.2	-	-	2.4	16.0
Total	**46.8**	**833.3**	**55.4**	**61.3**	**6.6**	**39.6**	**1,043.0**

1.5.5 Water Quality

The streams of the Accotink Creek watershed are regulated by water quality standards set by the Virginia State Water Control Board (SWCB). Waters in the Accotink Creek watershed are designated as Class III waters (Nontidal Waters Coastal and Piedmont Zones), with regulated criteria for dissolved oxygen (4.0 mg/L minimum), pH (6.0 – 9.0), and maximum temperature (32° C). Fecal coliform is also regulated with an allowable geometric mean limit of 200 fecal coliform bacteria per 100 ml of water for two or more samples in a calendar month with no more than 10 percent of monthly samples collected

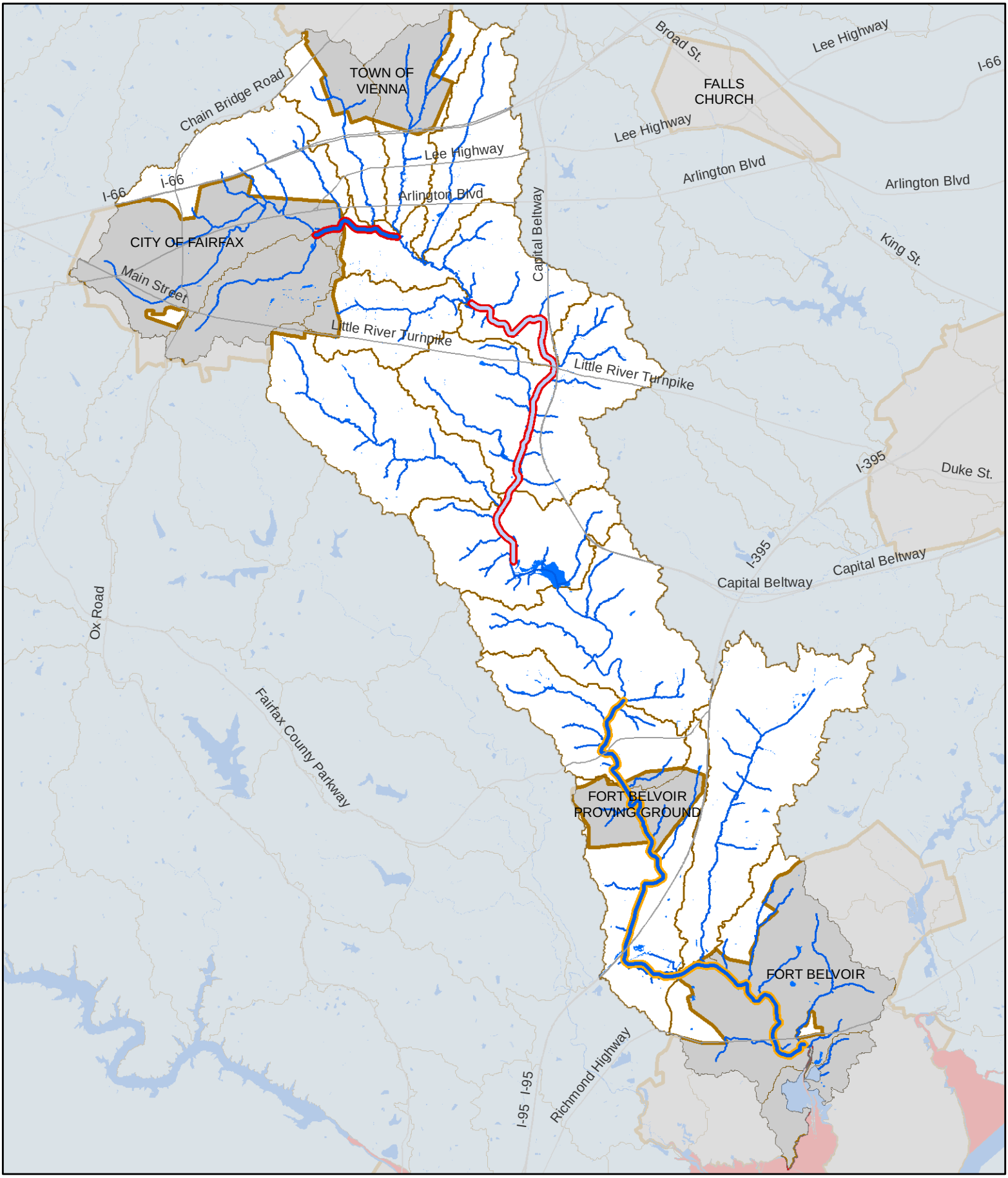
exceeding 400 colonies per 100 ml of water. *Escherichia coli,* a type of fecal coliform bacteria, is also regulated with an allowable geometric mean limit of 126 colonies per 100 ml freshwater sample for two or more samples take during any calendar month, and a single sample maximum of 235 colonies per 100 ml freshwater sample.

Fairfax County Sampling – Water quality data is collected through ongoing monitoring conducted by the county and various volunteer organizations. Available county data within the Accotink Creek watershed, ranging from June 1999 to March 2007, including SPS Baseline and more recently collected data, indicate one site with a pH below the acceptable range of 6.0 and one site with dissolved oxygen below the acceptable range of 4 mg/L.

The Fairfax Department of Health's Division of Environmental Health has been sampling the waterways throughout Fairfax County since 1969. For data collected between 2000 and 2002 at the 14 sampling sites in the Accotink Creek watershed, pH was outside of criteria limits for only one percent of over 700 samples. Criteria exceedance for dissolved oxygen and temperature were also low, with 5 percent of samples below the allowable dissolved oxygen limit and no sample above the allowable temperature. However, fecal coliform samples exceeded the maximum allowable limit of 200 bacteria per 100 ml of water for 80 percent of the samples collected between 2000 and 2002.

303(d) List and TMDL – Section 303(d) of the Clean Water Act requires the state to identify and report water bodies for which water quality standards are not being met. The list of impaired waters is compiled into the 303(d) Impaired Waters Report (this is often referred to as the 303(d) List). This report specifically describes the locations of the listed water body and the cause and source of pollutants causing the impairment. Once a water body is listed as impaired, a plan is developed to restore the water. This plan takes into account the total amount of pollution a water body can assimilate, or a total maximum daily load (TMDL). The restoration plan is often referred to as a TMDL and is accompanied by a target year for restoration. Impaired waters for which a TMDL is required is listed under Category 5 in the Impaired Waters Report.

Portions of the Accotink Creek watershed have been listed as impaired (Category 5) waters for benthic macroinvertebrate bioassessment (streams), fecal coliform and *E. coli* (see Map 1-6). Accotink Creek, from the confluence with Calamo Branch to the tidal waters of Accotink Bay, was first listed for benthic macroinvertebrate bioassessments in 1998 and has a Total Maximum Daily Load (TMDL) schedule of 2010. This same segment was listed in 2004 for a fecal coliform impairment, with a TMDL schedule of 2016. Also in 2004, the segment of Accotink Creek from its confluence with Daniels Run in the City of Fairfax to its confluence with Bear Branch was listed as impaired for *E. coli* with a TMDL schedule of 2014.



Impairments for benthic macroinvertebrates (listed 1996, TMDL schedule 2010) and E. coli (listed 2004, TMDL schedule 2016)

Impairment for E. coli (listed 2004, TMDL schedule 2014)

Impairment for E. coli (listed 1998, TMDL approved 2002)

0 0.5 1 Miles

Map 1-6

Impaired Waters Map

Accotink Creek Watershed

In 2006, Accotink Bay was listed as impaired for aquatic plants (macrophytes), with a TMDL schedule of 2010. Several causes of the impairment include atmospheric deposition of nitrogen, industrial and municipal point source discharge, internal nutrient recycling, loss of riparian habitat, sediment resuspension and wet weather discharges.

The tidal waters of Accotink Creek near the confluence with the tidal waters of Pohick Bay/Gunston Cove were first listed in 2002 as impaired for PCB in fish tissue. This listing included a PCB fish consumption advisory based on the Virginia Department of Health, Division of Health Hazards Control standards.

USGS Bacteria Source Tracking – In 1998, a 4.5-mile segment of Accotink Creek from the confluence of Crook Branch and Accotink Creek to the start of Lake Accotink was placed on the Section 303(d) list of impaired waters due to elevated levels of fecal coliform bacteria. In order to develop a TMDL for this stream segment, a study was conducted by the United States Geological Survey (USGS) in cooperation with Virginia Department of Conservation and Recreation (DCR). This study was a bacteria source tracking (BST) study which would identify the sources of fecal coliform in the streams using genetic fingerprinting.

Waters that contain fecal coliform bacteria levels above the state water quality standard can pose an increased health risk for anyone coming into contact with that water. A study in the Accotink Creek watershed, with data collected between March 1999 and October 2000, used a type of BST called ribotyping to identify the most significant sources of fecal coliform bacteria as geese, humans, dogs, cats, sea gulls and raccoons. Source identification using ribotyping is precise enough as to be used in the development of a fecal coliform TMDL.

The results of the BST study were used in combination with the Hydrological Simulation Program – FORTRAN (HSPF) watershed model to simulate streamflow and bacterial transport in the Accotink Creek watershed. According to the results of this second study, in order for the watershed to meet state water quality standards and the associated TMDL, an 89 percent reduction in fecal coliform bacteria load would need to occur.

1.6 Terrestrial Resources

1.6.1 Forests

Forests provide many benefits for aquatic systems. Vegetation and fallen leaves slow overland flow, reducing soil erosion. Nutrients are taken up by vegetation that might otherwise enter the stream system. Streamside forest canopy, or riparian buffers, provide shade and cool the water allowing for a higher dissolved oxygen concentration, which is needed by fish and aquatic macroinvertebrates. Additionally, aquatic habitat depends on the input of woody debris and stream bank root mats. Forest cover is also required for terrestrial fauna. However, various species require forest of a certain size and spatial distribution to provide adequate habitat. Today, open space occupies only 13 percent of the Accotink Creek watershed, primarily along stream corridors. Roadways and development have effectively fragmented much of the remaining forest, compromising its ability to provide viable habitat. Stream corridors and the associated Chesapeake Bay Resource Protection Areas (RPAs), a 100-foot forested riparian buffer around all perennial streams in the county, provide some connection between forest

cover and stream valleys, however upland forest cover does not have direct connectivity in most parts of the watershed.

1.7 Stormwater Management

1.7.1 History of Stormwater Management in Fairfax County

In the early 1900s, the population of Fairfax County was only slightly over 12,000 and development was basically unregulated. Stormwater controls consisted primarily of digging ditches or using pastures to prevent flooding.

By 1964, with the adoption of the first Policy and Guidelines Manual, the main goal of stormwater management was flood prevention. Stormwater management only consisted of maintaining adequate drainage through curb-and-gutter construction leading to concrete pipes or channels, which emptied into the nearest stream. Several large storms, including Hurricane Agnes, occurred during this time creating intense peak flows in receiving streams causing erosion and damage to homes built in the floodplain. Consequently, costly flood control structures were required which prompted the county to set strict limits on new construction within any 100-year floodplain.

During the 1970s, the population of Fairfax County grew to 900,000 residents. The associated development increased runoff and flooding potential downstream. During this time, stormwater detention, with the primary focus of controlling water quantity, began to be implemented to reduce peak flows downstream. In 1976, Fairfax County became one of the first jurisdictions in the U.S. to adopt stormwater management as a development requirement when it was required by the Army Corps of Engineers as part of their agreement for flood control improvements in the Four Mile Run watershed. The regulations were extended to manage stormwater quality in 1993. These “best management practices,” or BMPs, are used to reduce or even prevent the discharge of pollutants into waters downstream of the BMP. BMPs can be either structural (such as ponds, designed wetlands or bioretention facilities) or non-structural (such as public education, preserving open space and managing development). See Table 1-9 for BMP treatment types in the Accotink Creek watershed by WMA.

Table 1-9 - BMP Treatment Types by WMA

WMA	Current Treatment Types			
	Quantity (acres)	Quality (acres)	Quantity/ Quality (acres)	None (acres)
Bear Branch	13	33	48	1,298
Crook Branch	38	18	25	1,017
Daniels Run	1	0	0	1,207
Hunters Branch	9	29	111	1,054
Long Branch Central	38	8	61	2,321
Long Branch North	5	70	106	1,306
Long Branch South	103	199	334	2,485
Mainstem 1	163	44	155	3,291
Mainstem 2	44	24	18	1,983
Mainstem 3	106	56	55	2,911
Mainstem 4	6	17	1	1,413
Mainstem 5	11	42	14	1,844
Mainstem 6	122	63	38	1,309
Mainstem 7	129	129	55	1,708
Mainstem 8	89	29	35	3,081
Potomac	0	0	0	479
WS Totals	**878**	**763**	**1,056**	**28,707**

Note: Ultimate condition values are estimates and will be revised when better data is available.

1.7.2 Chesapeake Bay Preservation Ordinance

In 1993, 100-foot buffers around perennial stream corridors were designated as Resource Protection Areas (RPAs) and the rest of the county was designed as a Resource Management Area (RMA). These designations governed the type and amount of new development and redevelopment that could occur in the environmentally sensitive areas of the county.

1.8 Flooding and Drainage Complaints

A total of 5,031 complaints were received throughout the Accotink Creek watershed. Five of these records had no associated complaint with them and were removed from the count, leaving a revised total of 5,026 complaints.

Complaints were organized into eight categories. Some of the comments that were received contained several different complaints, so it is possible for one comment to be placed into more than one category. The eight categories include: Erosion, House Flooding, Road Flooding, Yard Flooding, Miscellaneous Flooding, Blockage/Clog, Cave In/Sink Hole and Other. The 5,026 complaints are broken down and summarized in Table 1-10.

Table 1-10 - Summary of Drainage Complaints

Category	Number of Complaints	Percentage of Complaints
Erosion	443	8.8
House Flooding	184	3.7
Road Flooding	39	0.8
Yard Flooding	489	9.7
Miscellaneous Flooding	487	9.7
Blockage/Clog	1,206	24.0
Cave In/Sink Hole	578	11.5
Other	1,976	39.3

The Miscellaneous Flooding category includes those comments regarding standing water, overflows and flooding which were not designated as a specific type (i.e. house, road or yard). The Other category includes those complaints such as lost items in the storm drain, maintenance or repair needs or requests for more information.

As can be seen in Table 1-10, the majority of the complaints were regarding storm drains which were clogged up or blocked by debris. The second most common complaint was sink holes or caved-in areas throughout the watershed.