

# 1. Introduction

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Fairfax County is located in the northeastern part of the state of Virginia, bordering the Potomac River. The county is bordered by Arlington County, and the Cities of Falls Church and Alexandria to the east. The Potomac River borders the county to the northeast and southeast. The land border with Loudon County lies to the north, and the Bull Run/Occoquan rivers form the southern border with Prince William County. Within the borders of Fairfax County are three incorporated towns (Vienna, Herndon, and Clifton) and one city (Fairfax City).

Fairfax County today is highly urbanized and approaching ultimate build-out conditions, as envisioned in the county's Comprehensive Plan. The total land area of Fairfax County, including incorporated towns is 395 mi<sup>2</sup>. It is the most populous jurisdiction in Virginia as well the Washington D.C. metropolitan area, with the 2005 population estimated to be 1,047,500 with 387,700 households. Most land in the county is devoted to residential, commercial, recreational, and open-land uses, with heavy industry essentially nonexistent.

## 1.1 Watersheds and Physiographic Setting

There are approximately 850 miles of stream channels (with perennial streamflow) draining 30 designated major watersheds (drainage basins) in the county, with 23 watersheds falling entirely within the county's borders (Figure 1). The 30 watersheds drain either to the north and east to the Potomac River, or to the south into the Bull Run/Occoquan rivers (which eventually outlets into the Potomac). The 30 major watersheds within the county range in size from the two square mile Turkey Run drainage to the 58 square mile Difficult Run basin. The mouths of the streams draining the far southeastern portion of the county are influenced by the tidal rhythm of the Lower Potomac. The major lakes throughout the county are all man-made impoundments and were designed primarily for stormwater control, recreational, or aesthetic purposes. The Occoquan River is impounded just upstream of where it passes under Route 123. The reservoir was created when the river was dammed in 1950, and then enlarged in 1957 by the county to provide a source of drinking water for residents within the region. In July 1982, the Fairfax County Board of Supervisors voted to restrict development on 41,000 of the 64,500 acres within Fairfax County draining to the reservoir. The resultant "down-zoning" limited the number of residences to one home per five acres in an effort to improve the quality of stream water draining into the drinking water reservoir.

Fairfax County lies within two major physiographic provinces, the Coastal Plain and Piedmont (Figure 1). Physiographic provinces are areas that have common geology, surface processes, and landscape history having characteristic landforms and environments. Each province comprises areas with similar terrestrial and aquatic floral and faunal ecosystems, including certain communities which may be unique to those provinces. These provinces are the basic landscape units by which biological communities can be evaluated and compared. The Piedmont province covers 60% of the county (243 mi<sup>2</sup>) and is typified by gently rolling landscapes, deeply weathered bedrock/soils and a relatively low occurrence of solid outcrop. The Triassic basin occupying the far western portion of Fairfax County is a subset of the larger Piedmont province, and covers 17% of the county (69 mi<sup>2</sup>). The Triassic basin is actually the remains of a huge prehistoric lake bottom that covered portions of western Northern Virginia

# The Watersheds and Physiographic Provinces of Fairfax County



Figure 1: The 30 watersheds and two physiographic provinces and sub-province in Fairfax County, Virginia.

and Maryland. It is typically much flatter and has unique lake sediment-type soils as compared to the encompassing Piedmont province. The Coastal Plain province spans the eastern portion of the county and bounds the Piedmont along the fall line. The fall line is a low east-facing cliff paralleling the Atlantic coastline from New Jersey to the Carolinas. It marks the boundary between the hard Paleozoic metamorphic rocks of the Piedmont (to the West) from the softer, flatter Mesozoic and Tertiary sedimentary rocks of the Coastal Plain. To the west of this line, the streams are typified by greater-sloping channel bottoms and the resultant higher velocity riffle-run habitats. East of this line, in the Coastal Plain, the stream channels (and landscapes), have much gentler slopes, and as a result much more flat water areas dominated more by lower velocity pool and glide habitats. Historically, this fall line presented an obstacle to further upstream navigation to early European settlers in boats and thus is the location of many major mid-Atlantic cities such as Philadelphia, Baltimore, Washington DC, and Richmond. Interstate 95 generally traverses this geologic feature through Northern Virginia.

## 1.2 Monitoring Efforts

### 1.2.1 Stream Protection Strategy

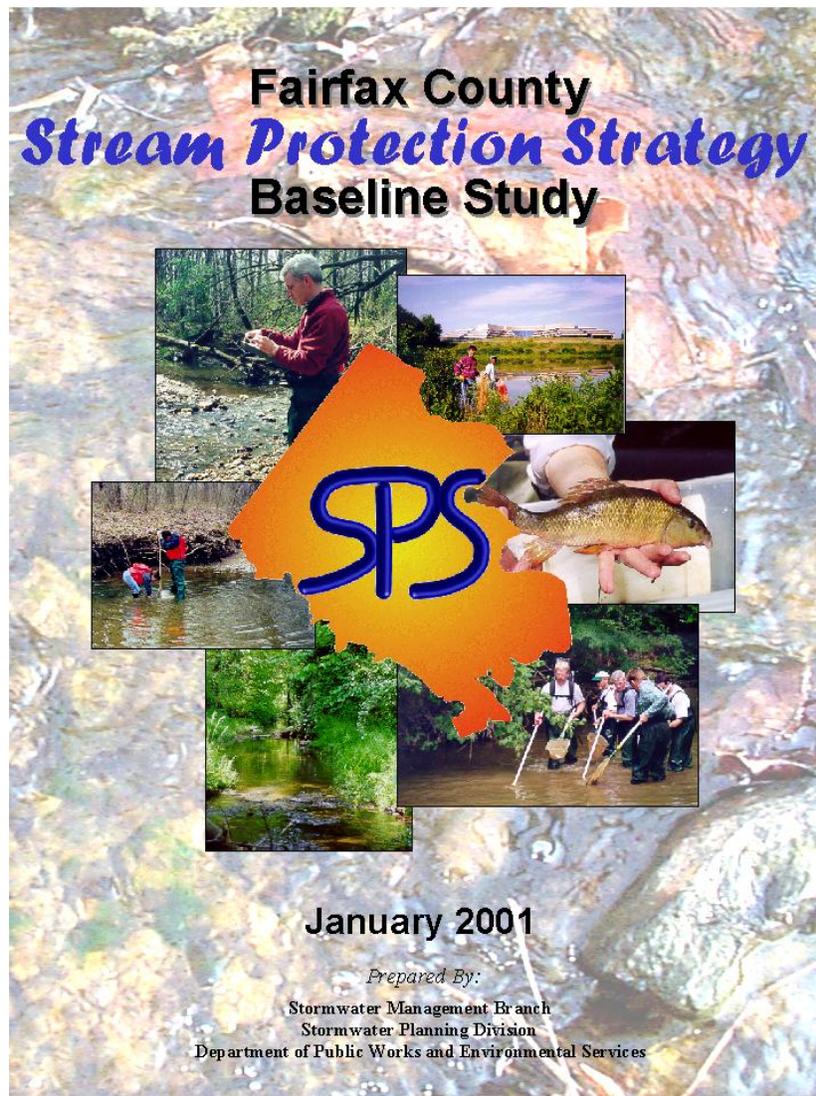
The Stream Protection Strategy Baseline Study on the biological condition of Fairfax County's streams was published in January 2001. This study evaluated the physical, chemical, and biological conditions of 114 sites located along the major streams and tributaries in each of the county's 30 watersheds based on data collected in 1999. Modified versions of the Environmental Protection Agency's (EPA) Rapid Bioassessment Protocol (RBP) were applied along with a Quality Assurance/Quality Control (QA/QC) methodology. Eleven reference sites, located in the Prince William Forest National Park, were used for comparison.

The results of the baseline study were used to identify, rank, and prioritize county streams and create broad management categories and strategies for future restoration and/or preservation efforts on a sub-watershed basis. The baseline study set the framework for developing comprehensive management programs for the county's watersheds.

Major recommendations from the baseline study and their status are summarized below:

<b>Recommendations</b>	<b>Status</b>
Continue a five-year rotational sampling scheme for the county's streams.	A probability-based sampling scheme has been developed. This report summarizes the methodology and results of monitoring during 2004.
Complete a countywide stream physical assessment survey on ALL streams	A Countywide Stream Physical Assessment was completed in 2003
Develop and implement a countywide watershed management program.	Currently, watershed plans have been initiated or completed for over 50 percent (200 square miles) of the county. All watershed management plans are scheduled to be completed by 2009. These plans will be updated periodically.
Pursue a dedicated source of funding for implementing the proposed improvements in county streams and the stormwater infrastructure system.	A Stormwater Needs Assessment Program was completed in 2005 that identified program needs and alternative funding sources. Approximately \$18 million in new funds was dedicated from tax revenues in the fiscal year 2006 budget to supplement funds for the stormwater program.
Encourage the use of Best Management Practices (BMP) and Low Impact Development (LID) techniques in all new construction and retrofit activities.	In 2001, a letter to industry (#01-11) was published to facilitate the use of innovative Best Management Practices (BMP). Currently, DPWES is working on amendments to the Public Facilities Manual (PFM) to include additional Best Management Practices (BMP) and Low Impact Development (LID).

The data and the report are being used as part of a long-term database, as well as to guide future activities as they relate to the development and implementation of Watershed Management Plans.



[http://www.fairfaxcounty.gov/dpwes/environmental/sps\\_main.htm](http://www.fairfaxcounty.gov/dpwes/environmental/sps_main.htm)

### 1.2.2 Post-Baseline Study Sampling

Under the original recommendation of the baseline study, trend data was to be collected at each of the 114 sites on a five year rotational basis, where 20 percent of the total sites would be collected annually. Staff began this process in the spring of 2001. Biological and habitat data was collected at approximately 20 percent of the original monitoring locations. Specifically, assessments were made at 23 sites, randomly selected from the original site list, and at the 11 reference locations within Prince William Forest Park. An additional seven sites were established on streams whose watersheds were designated as Priority Assessment Areas in the baseline study.

Unlike the monitoring conducted in 1999, the 2001 effort also included an additional fish sampling event in the spring. This was done in an effort to understand possible seasonal variations in fish distribution patterns and overall abundance, and their subsequent influence on metric development and scoring. Specifically, large numbers of young-of-year fish were collected and enumerated in the original assessments—which may have led to inflated population measures relative to habitat quality—and it was hoped that early season sampling, prior to emergence and development of fry, would eliminate this potential problem.

Results from the 2001 sampling event may be found in Appendix A.

Fieldwork for the Perennial Stream Identification and Mapping project initiated with a pilot study in October-December 2001. Formal field identifications commenced in March 2002 and continued through October 2003. The 2003 RPA maps were adopted by the Fairfax County Board of Supervisors on November 18, 2003. This fieldwork was rechecked and validated with a 10 percent quality control re-survey in the spring and summer of 2004. Following data analysis, map production, and Planning Commission hearings, the final Chesapeake Bay Preservation Area (RPA) maps were adopted by the Board of Supervisors on July 11, 2005. Further information can be found at [www.fairfaxcounty.gov/dpwes/stormwater](http://www.fairfaxcounty.gov/dpwes/stormwater).

**1999** – Monitoring efforts initiated in the county as part of the Stream Protection Strategy Baseline Study. One hundred and fourteen sites were established and sampled in the county for benthic macroinvertebrates and fish.

**2000** – Sampling continued in support of the baseline study. A portion of the sites were resurveyed for fish, under relatively normal drought conditions.

**2001** – Baseline study was released in January. As recommended, 20 percent of the original 114 sites were resurveyed for the benthic macroinvertebrate and fish community composition. Seven additional sites were established in Priority Assessment Areas. A spring fish sampling event occurred, to understand any possible seasonal variations in distribution and abundance.

**2002 – 2003** – Fieldwork conducted as part of the Perennial Streams Identification and Mapping project.

**2004** – Biological monitoring sites were randomly selected based on stream order. Benthic macroinvertebrates were collected and identified from all sites. Fish were collected at higher order sites (greater than 2<sup>nd</sup> order).

### **1.2.3 Bacteria Monitoring**

The bacteria monitoring program was initiated in 1969 by the Department of Health's Division of Environmental Health to generate a baseline for bacterial levels in the waterways of Fairfax County. This bacteria baseline allowed the Health Department to monitor the water quality of the streams by establishing a "normal" level of bacteria for different sections of our waterways. By establishing a baseline, it enabled the Health Department to determine when a spike in the bacteria concentration occurred for a particular waterway and facilitated staff to locate pollution sources and to initiate corrective action or refer to the appropriate agency for corrective action. Fecal coliform has been used as an indicator of possible bacteria contamination because it is commonly found in human and animal feces. Although fecal coliform is generally not harmful itself, the occurrence indicates the possible presence of pathogenic (disease-causing) bacteria, viruses, and protozoans which are correlated with swimming-associated gastroenteritis. In 2003, the Fairfax County Health Department transferred the bacteria monitoring program to the county's Stormwater Planning Division in an effort to consolidate all stream monitoring functions in the county. At the time of transfer, 80 sites were divided into nine zones and were visited at a frequency of once to twice per month by the Health Department. The monitoring program has been modified by Stormwater Planning Division, the routine sampling was reduced to visiting each zone four times per year. The Stormwater Planning Division has continued this monitoring effort and took over 300 samples from 25 watersheds in 2004.

### **1.2.4 Volunteer Biomonitoring**

Data that is generated by volunteer stream monitors supplement the county program by providing greater coverage of the county's streams and information on general trends. Audubon Naturalist Society monitors six sites in Fairfax County. Northern Virginia Soil and Water Conservation District has several years' worth of data for 35 sites in the county, and sometimes monitors as many as 50 sites in a given year. In working together with these volunteer monitoring organizations, the county effectively doubles the number of sites visited in a particular year.

In addition to learning about stream monitoring, many volunteers also become involved in watershed groups, clean-up programs, and educational programs. Newsletters and calendars are sent to about 700 people and forwarded to hundreds more, a very effective way to reach large numbers of existing and potential monitors.

Several newsletters and other information can be found on the NVSWCD monitoring Web site at [www.fairfaxcounty.gov/nvswcd/monitoring.htm](http://www.fairfaxcounty.gov/nvswcd/monitoring.htm) or by contacting Joanna Cornell, NVSWCD Watershed Specialist, at [jjcornell@gmu.edu](mailto:jjcornell@gmu.edu) or 703-324-1425.

### **1.2.5 Other Monitoring Efforts**

There are many agencies and groups that regularly monitoring water quality in the county. A listing of these can be found in Appendix G.

## **1.3 Goals**

The goal of this report is to present the results of Fairfax County's annual surface water quality monitoring efforts. The results are used to help determine the county's Stream Quality Index as an indicator of the overall condition of Fairfax County's waterways. It is envisaged that

future reports will serve as a clearinghouse for information and data related to the biological, chemical and physical conditions of the county's waterways, collected through various county agencies and local organizations.

The long-term biological and bacteriological monitoring program supports the Board of Supervisor's Environmental Excellence for Fairfax County, a 20-year Vision by providing a comprehensive analysis of stream conditions throughout the county, while simultaneously meeting the requirements set forth in local, state, and federal regulations, including:

- Chesapeake Bay Act;
- Municipal Separate Storm Sewer System (MS4) Permit;
- Virginia Pollutant Discharge Elimination System (VPDES); and
- Clean Water Act.

While supporting these requirements, the program will also develop a substantial dataset, which over time will provide essential data to determine the overall rate of change or trends in the conditions of Fairfax County's streams and provide a basis for prioritization of watershed implementation measures to restore watersheds.