V. Monitoring and Assessment

This section discusses the county's ongoing monitoring and watershed assessment program in water quality and stream quality (physical assessment and bioassessment) as well as the roles of the Northern Virginia Soil and Water Conservation District and the Audubon Naturalist Society.

Runoff carries pollutants, including trash, to county streams.

Runoff is a significant cause of erosion in county streams.

Dry Weather Screening Program

The determination of the areas in the county, and ultimately the selection of the specific storm sewer outfalls that would comprise the 2005 Dry Weather Screening Program, started with a review of the following: United States Geological Survey Accotink Total Maximum Daily Load study results, data collected by staff as part of the Bacteria Monitoring Program, and the locations of the National Pollution Discharge Elimination Systems permitted sites in the county. Fourteen subwatersheds in the county were selected and a Geographic Information Systems layer was created allowing the identification of the specific outfalls to be monitored. Fifty-seven outfalls were identified and Geographic Information Systems maps created to assist the field teams in locating the outfall. The field investigation resulted in finding 23 outfalls with flow. Water quality analysis for pH, copper, detergents, conductivity, chlorine and phenol were taken in the field, resulting in six positive tests for contaminants. In the retests of five of the sites the pollutants were no longer detected, however in one site the pollutants remained. The Department of Environmental Quality and the Department of Conservation and Recreation were notified of the location of the site and its National Pollution Discharge Elimination Systems permit number. As part of the 2006 program, all six of these sites will be screened again with particular attention placed on the one site that continued to have pollutants.

Wet Weather Screening Program and Industrial and High Risk Runoff Program

During 2005, two of the nine sites identified in 2004 from the Department of Environmental Quality list of Virginia Pollution Discharge Elimination System permitted stormwater industrial facilities were selected for wet weather monitoring. All nine sites were field investigated in 2005 to determine potential monitoring locations and to evaluate accessibility. One of the sites monitored was a used motor vehicle parts yard and the other a petroleum bulk station and terminal, both permitted by the Department of Environmental Quality for industrial stormwater.

These sites were monitored twice during rain events and the water quality samples were processed by the county's Noman Cole Waste Water Treatment Facility. ***Appendix J*** is a summary of the water quality analysis. On August10, 2005, both sites had levels of copper, lead, and zinc which were above the Virginia Water Quality Standards for Aquatic Life, Fresh Water Chronic.

The 2006 wet weather screening program will evaluate potential re-tests of the 2005 sites and will update the program plan and the list of potential sites to be monitored. The 2004 list of potential sites will be expanded by coordination with the county's Fire and Rescue Department's Hazardous Materials and Investigative Service and the county's Division of Solid Waste Disposal. In addition, a Geographic Information Systems-based screening procedure for identifying potential "hot-spots," based primarily on intensity of land-use (imperviousness and land-use type), is part of the long term goals and will be used to rank and prioritize potential sites for field screening. Possible areas include landfills; other treatment, storage, or disposal facilities; hazardous waste treatment, storage, disposal, and recovery facilities; and facilities subject to the Emergency Planning and Community Right-To-Know Act (Title III, Section 313. The goal of the county's program is to identify and possibly investigate and monitor industrial and other high-risk areas to determine if they are contributing substantial pollutant loading to the Municipal Separate Storm Sewer System.

Watershed Monitoring Program

The permit requires the development of a watershed monitoring program to verify the effectiveness and adequacy of control measures in the county's Storm Water Management Plan and to identify areas of water quality improvement or degradation. The permit requires monitoring to be conducted at representative stations in at least two watersheds at in-stream locations and/or stormwater outfalls with a minimum drainage area of 100 acres.

The county's goals for the watershed monitoring program are to: (i) obtain data for the development, calibration, and verification of water quality simulation models, and (ii) determine whether the concentrations of constituents in stormwater runoff from different residential land-uses (low density and medium/high density) are statistically significant.

To support these goals, a long-term monitoring program was established at two in-stream stations. The first station (VNA) drains a 152-acre medium/high density residential area in the Accotink Creek watershed, while the second station (OQN) drains a 415-acre low density residential area in the Sandy

Run watershed. Station VNA has an estimated imperviousness of 25.1 percent while station OQN has an estimated imperviousness of 10.1 percent (Table 1 of ***Appendix K***).

Automated sampling equipment is used to collect stormwater for water quality monitoring. Collection is triggered by preset rainfall amount and stream stage level. The rain gauges, designed to National Weather Service specification, operate by a tipping bucket mechanism capable of measuring rainfall at 0.01-inch intervals. Sampling equipment consists of the following equipment: Isco 6700 automatic sampler, Isco 730 bubble flow module, Isco Pal 1101 pH and temperature monitors, and American Sigma rain gauge. To report data from the Isco 6700 automatic sampler and Pal 1101 pH monitor, data loggers use Isco FlowLink4 and Isco Samplink software programs, respectively. The FlowLink4 reports include hourly summary reports and graphs (plotted using five-minute data intervals) for rain and flow. The Isco Pal pH monitor measures pH during the entire monitoring period; readings are recorded every fifteen minutes and whenever a sample is collected. For quality control, flow depth calibrations and flow depth measurement checks, along with rain gauge precipitation checks are conducted during each station set up.

Wet weather sampling equipment:
Isco automatic sampler with bubble flow module and pH and temperature monitors; and American Sigma tipping bucket rain gauge.

A total of five storms were monitored over this reporting period. Rainfall, flow, and water quality analysis data sheets from the monitored storms are provided in ***Appendix K***. The results of a statistical analysis to determine if there were significant differences between observed constituent concentrations at the two stations is shown in Table 2 of ***Appendix K***. Seasonal and annual unit-area constituent loadings from the monitored sites for 2005 were computed using the Simple Method, and are summarized in Table 3 of ***Appendix K***.

As can be seen from Table 2 in ***Appendix K***, a significant difference ($p < 0.1$) is indicated for NH_3-N and TKN concentrations from the two sites, with differences for other constituents not statistically significant. The NH_3-N and TKN concentrations are higher at the medium/high density residential site compared to the low density residential site. A point estimate for the difference in NH_3-N concentrations is 0.205 mg/l, while a point estimate for the difference in TKN concentrations is 0.770 mg/l. Monitoring will continue in 2006 and the full data set used to determine if the observed high variance in constituent concentrations from the medium/high density residential site can be reduced sufficiently to allow detection of statistically significant differences for other constituents. The data set will also support the development of continuous water quality models that provide more refined prediction of water quality loadings.

Bacteria Monitoring Program

As required by the Environmental protection Agency, Fairfax County completed its transition in 2005 to using *E. coli* as our indicator of possible fecal contamination versus using fecal coliform. *Escherichia coli* (*E. coli*) is a type of bacteria that is found in the intestines of warm blooded animals. Alone, this bacterium is generally not harmful to humans, but it may indicate the possible presence of pathogenic

(disease-causing) bacteria and viruses. The level of *E. coli* in streams is used by localities to determine if primary recreational contact is safe in local and state waterways.

To determine the concentration of *E. coli* in streams, the Stormwater Planning Division conducted bacteria sampling at 39 locations throughout the county. Grab samples of stream water are collected twice every season, starting in the spring, for a total of six rounds in 2005. Water chemistry parameters were also collected at the time of sampling, including levels of nitrate and total phosphorous, pH, water temperature, dissolved oxygen, and specific conductance.

E. coli, nitrate, and total phosphorous samples are processed at the Fairfax County Health Department Laboratory, using the Colilert® Quanti Tray/2000 by Idexx and Skalar San++ Analyzer, respectively. The remaining chemical parameters were recorded in the field using a hand-held YSI meter. More information will be available in the Stormwater Planning Division's Annual Report on Fairfax County's Streams, which will be completed in spring, 2006.

Bioassessment and Integrated Water Quality Monitoring Program

The long-term biological and bacteriological monitoring program provides a comprehensive analysis of stream conditions throughout the county, while simultaneously meeting the requirements set forth in local, state, and federal regulations, including the:

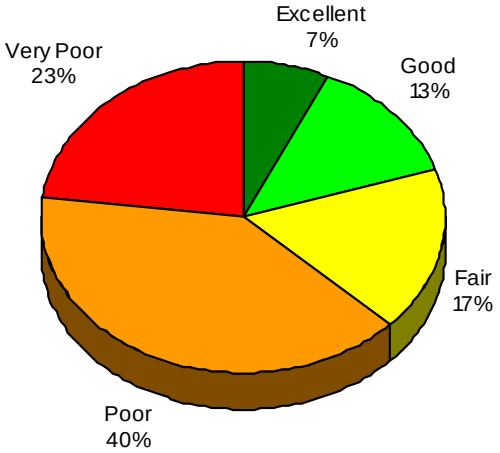
- Chesapeake Bay Act
- Municipal Separate Storm Sewer System Permit
- Virginia Pollutant Discharge Elimination System Clean Water Act

The program will 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 prioritizing implementation measures to restore the county's watersheds.

In 2005, a probabilistic-based site selection sampling methodology was used to identify randomly-selected stream bioassessment locations throughout Fairfax County. These sites were stratified and proportionally distributed throughout the county based on Stahler stream order. This methodology eliminates any site selection bias and is commonly used as a cost-effective way of obtaining statistically defensible determination of stream conditions at a countywide scale. A total of 43 sites were sampled in 2005 with:

- 30 sites randomly selected in Fairfax County
- 11 reference locations in Prince William National Forest Park
- Two coastal plain reference locations in Fairfax County

Results from the 2004 monitoring campaign suggest 80 percent of the county's waterways are in "Fair" to "Very Poor" condition. This indicates significant impairments in the county's streams due to a notable decrease in biological diversity.



More information regarding the results of the 2004 monitoring campaign is available in the *2005 Annual Report on Fairfax County's Streams* available on the Web at:

www.fairfaxcounty.gov/dpwes/stormwater/streams/assessment.htm

This report also includes volunteer monitoring data and information regarding the 2001 Stream Protection Strategy Baseline Study Report. The results from this bioassessment were used to identify, rank, and prioritize county streams. The baseline data is being used as part of a long-term database as well as a guide for future management activities, especially as they relate to the development and implementation of Watershed Management Plans. The baseline report was publicized in 2001 and is available on the county's Web site at:

www.fairfaxcounty.gov/dpwes/environmental/sps_main.htm

Floatable Monitoring Program

The county is an active participant and supporter of several trash cleanup and education programs. Throughout calendar year 2005, an army of volunteers collected over 100 tons of trash from Fairfax County's land and waterways. The dominant types of trash that were collected include plastic grocery bags, aluminum cans, glass bottles, Styrofoam pieces and cups, and athletic balls.

To better highlight cleanup efforts and identify trash hot spots, in calendar year 2006 the county will continue to work with and support the following organizations that coordinate large and small-scale volunteer cleanups:

- The Alice Ferguson Foundation
- The Virginia Department of Conservation and Recreation
- The International Coastal Cleanup
- The Friends of the Occoquan

More information about the cleanup events that occurred in 2005 is available in the Stormwater Management Outreach and Education Section of this report.

Accotink Creek Total Maximum Daily Load

The United States Geological Survey has published a paper specifically on the Total Maximum Daily Load project in the Accotink Creek watershed of Fairfax County. This report outlines the multi tracer techniques and methods used in the study to detect sources of human waste in stormwater and the development of the fecal coliform Total Maximum Daily Load for Accotink Creek. It can be viewed and downloaded from the Web at:

http://water.usgs.gov/pubs/wri/wri034160/wrir03-4160.htm

United States Geological Survey conducted eight synoptic sampling events of over 100 sites each in an effort to address the fecal coliform Total Maximum Daily Load. County staff plans to use the results and lessons learned from this study to help investigate and address areas with elevated fecal coliform bacteria based on hot spots identified as part of the countywide bacteria monitoring program.

Kingstowne Environmental Monitoring Program

The goal of the Kingstowne Environmental Monitoring Program is to provide information to protect Huntley Meadows Park from the detrimental effects of upstream development occurring in Dogue Creek watershed. Of particular concern are excessive sediment loads, which can place too much silt in the natural stream channels and potentially smother wetland vegetation. Excessive sediment loads could also increase the suspended sediment concentrations to levels that are harmful to aquatic life. Construction upstream of the monitoring point is minimal and erosion and sedimentation controls, including stormwater best management practices, are minimizing sediment loads to Dogue Creek.

The original monitoring program consisted of a single station upstream of Telegraph Road (know as the Kingstowne station). During the summer of 2002 a new monitoring station (known as South Van Dorn, or SVD) was established on Dogue Creek downstream of the existing Kingstowne station in order to comply with a U.S. Army Corps of Engineers permit issued for the construction of South Van Dorn Street, Phase III. This new station is intended to evaluate the implementation of the Dogue Creek Watershed Stormwater Control Plan. This plan resulted in the construction of a number of stormwater management facilities, which were designed to achieve a 50 percent total phosphorus removal rate from stormwater discharges in the watershed. A 10-year monitoring and maintenance plan is in the process of being implemented in order to confirm compliance with this permit condition. The new station is located adjacent to Telegraph Road and monitors drainage from a watershed area of 1,148 acres (the 845 acres monitored by the Kingstowne station, plus an additional 303 acres). Phosphorous loads are not meeting the U.S. Army Corps of Engineers' requirements; the county and the Corps are currently evaluating the problem and determining the course of action.

A total of 20 baseflow (grab samples) and 23 storm water quality samples (using automated samplers) were collected at the Kingstowne station and South Van Dorn during the July 2004 – June 2005 monitoring period. Baseflow sampling provides a good indication of background levels of pollutants and may provide information regarding chronic water quality problems. Since the grab samples were taken on a monthly-to-biweekly basis, the data provide a "snapshot" of water quality conditions rather than a continuous record. The data from the water quality samples (using automated samplers) will serve as a basis for long-term water quality trend analysis. The Kingstowne Annual Report is presented in ***Appendix L***.

Northern Virginia Soil and Water Conservation District Volunteer Stream Monitoring Program

The Northern Virginia Soil and Water Conservation continued its successful biologically-focused volunteer stream monitoring program. Across Fairfax County, trained volunteers assess the ecological health of streams. This Volunteer Stream Monitoring Program provides training, equipment, support, data processing, and quality control (See program overview, ***Appendix M***). Monitoring includes biological and chemical aspects and a habitat assessment. Volunteers are trained to assess ecological conditions in streams based on the diversity and composition of benthic macroinvertebrates (stream insects). They conduct biological monitoring following the modified Virginia Save Our Streams Protocol. Volunteers also conduct chemical analyses of turbidity and nitrate/nitrite and make physical observations. Training includes indoor and field workshops and mentoring by experienced monitors. Volunteers commit to monitoring their chosen stream four times a year or assist other monitors at their sites. Sites are located throughout the county and in the City of Fairfax. Certified data is forwarded to Fairfax County, the Department of Environmental Quality, the Virginia Save Our Streams,

and other interested organizations or individuals. In addition to learning about stream monitoring, many volunteers also become involved in watershed groups, clean-up programs, and educational programs. The Northern Virginia Soil and Water Conservation District works with many organizations to coordinate and lead additional watershed-based learning opportunities for citizens and students to help them become better environmental stewards. The Northern Virginia Soil and Water Conservation District also provides guidance for science projects and internships.

The Northern Virginia Soil and Water Conservation District's Volunteer Stream Monitoring Program supplements the county program and provides other services to the environmental community in Fairfax County. In addition to providing monitoring data, the Northern Virginia Soil and Water Conservation District provides training sessions for monitors, conducts special programs at schools, makes presentations at environmental conferences and for civic associations, sponsors tours, hosts a list serve, and publishes a newsletter. Many programs are enhanced by partnerships with other groups in the county government and private environmental organizations. The Northern Virginia Soil and Water Conservation District staff assists a variety of citizen watershed groups by providing administrative and technical support. These groups include: Difficult Run Community Conservancy, Friends of Little Rocky Run, Friends of Accotink, Friends of Burke Spring Branch, Fairfax Trails and Streams, Friends of Cub Run, and Friends of Sugarland Run.

In 2005, the Northern Virginia Soil and Water Conservation District led 55 stream monitoring training sessions or watershed programs, with over 1500 participants (note: The same person can attend multiple programs and therefore is counted multiple times). Watershed programs include: indoor stream ecology programs at schools, presentations to civic groups, table displays at environmental programs, tours of water and sewage treatment plants, watershed walks, and stream clean-ups. In 2005, the Northern Virginia Soil and Water Conservation District began a new series of watershed bike rides. They were popular and will be continued in future years.

The numbers of active monitors is remaining steady, with new monitors replacing those who move away from the area. In 2005, there were 50 active sites. There were 100 monitors who collected winter data, 140 monitors who collected spring data, 165 monitors who collected summer data, and 180 monitors who collected fall data. Approximately 500 students were introduced to stream monitoring through indoor workshops at schools, outdoor special programs, and science fair projects. During 2005, volunteers logged over 4000 Earth Team hours. The Earth Team is a national program of the Natural Resources Conservation Service and tracks volunteer time.

Starting in 2005, Northern Virginia Soil and Water Conservation District and added two new monitoring programs bacterial monitoring, and temperature monitoring

In partnership with the Fairfax County Park Authority, the Department of Public Works and Environmental Services, and a volunteer scientist from United States Geological Survey, the Northern Virginia Soil and Water Conservation District began to coordinate a temperature monitoring program to assess the impact of a large stream restoration project. Data is downloaded monthly, and the temperature is measured every half hour at the sites. Volunteers were trained to download temperature data at seven stations from "ibuttons" using a Palm Pilot. Training materials for the program are available at:

www.fairfaxcounty.gov/parks/resources/tempmonitor.pdf

In partnership with the Department of Environmental Quality and Arlington County, the Northern Virginia Soil and Water Conservation District co-coordinates with Arlington County a bacterial monitoring program to assess the changes in Four-Mile Run as a result of Total Maximum Daily Load implementations. Data is collected monthly from ten sites by more than 25 volunteers. An overview of

the program was published in the Northern Virginia Soil and Water Conservation District newsletter and is available at:

www.fairfaxcounty.gov/nvswcd/newsletter/ecoli.htm

Audubon Naturalist Society

The Audubon Naturalist Society water quality monitoring program recruits, trains, equips, and organizes volunteers to assess the health of streams throughout the Washington, D.C., region. The program uses a modified version of the Environmental Protection Agency's Rapid Bioassessment Protocols to perform habitat assessments and benthic macroinvertebrate surveys. All monitoring equipment is provided to the volunteers. There are currently four permanent Audubon Naturalist Society sites within Fairfax County, with a fifth scheduled to open spring 2006, and these are covered by approximately 20 volunteers. The data collected by Audubon Naturalist Society are currently shared with the Department of Environmental Quality for 305 (b) listings, Prince William County, the Department of Public Works and Environmental Services, National Park Service, and Dept of Game & Inland Fisheries.

Volunteers assess habitat conditions and macroinvertebrate community composition (usually to family level) at specific points throughout the year (May, July, and September, with an optional winter sample). Macroinvertebrates are collected using a "hand-scrubbing" sampling technique, and collected individuals are visually identified to the family taxonomic level where possible. Multiple samples are collected from riffle and pool areas.

Monitors gauge overall habitat condition by visually assessing parameters such as substrate composition, embeddedness, turbidity, bank cover, and canopy cover. Four other components of the Environmental Protection Agency's Rapid Bioassessment Protocol habitat assessment—channel flow status, bank stability, sediment deposition and riparian zone width—are also scored. Readings of pH and water temperature are taken concurrently.