**"Protecting our land and our water."**

# 2007 Fairfax County
# Stormwater Status Report

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# Introduction

This report highlights the accomplishments of Fairfax County's stormwater management program in 2007 and describes the county's ongoing stormwater management programs, the challenges it faces and the partnerships forged to meet those challenges. The stormwater management program supports the water quality (and quantity) theme of the Board of Supervisors' Environmental Agenda, which is organized into six major themes: growth and land use; air quality and transportation; water quality; solid waste; parks, trails and open space; and environmental stewardship. The agenda centers on two principles: conservation of limited natural resources must be interwoven into all government decisions; and the county must be committed to providing the necessary resources to protect the environment.

Stormwater discharges are generated by rainfall and/or snowmelt running off the land and impervious areas such as paved streets, parking lots and building rooftops. Stormwater picks up and carries away sediments, nutrients, toxic substances, pathogens and other pollutants, depositing them into lakes, streams, rivers, wetlands and coastal waters. These pollutants have potentially harmful effects on drinking water supplies, recreation and aquatic life. In addition, pavement and other hard surfaces prevent water from infiltrating into the ground, causing high volumes of stormwater to accumulate and surge into storm drains at high speeds. When quickly flowing runoff empties into receiving waters, it can severely erode stream banks and damage sensitive stream valley ecosystems. The county is proactive in the mission of environmentally friendly stormwater management and control through the following ongoing activities:

- Developing watershed management plans
- Implementing improvements to stormwater management infrastructure
- Conducting inspection and maintenance programs for stormwater control systems and structures to ensure their effectiveness
- Conducting stream monitoring and evaluation programs
- Sharing resources and information for the purposes of educating residents and developing strategies to promote good water quality practices
- Developing strategic initiatives to further reduce stormwater runoff volume and the negative environmental effects of the continual increase in impervious area.

Although the Fairfax County Department of Public Works and Environmental Services (DPWES) Stormwater Planning Division (SWPD) compiled the data for this report, implementation of the county's stormwater program is accomplished through the collective efforts of its partners, including private organizations, state agencies, other county agencies and many divisions in the DPWES. These include:

*Private organizations*
Audubon Naturalist Society
Earth Sangha
Fairfax ReLeaf
Northern Virginia Regional Commission
Northern Virginia Soil and Water Conservation District
Reston Association

*State agencies*
Virginia Cooperative Extension, Environmental Horticultural Division of Fairfax County
Virginia Department of Conservation and Recreation
Virginia Department of Environmental Quality
Virginia Department of Forestry

*County agencies*
Fire and Rescue Department, Hazardous Materials Investigative Services Section
Health Department
Park Authority
Planning and Zoning Department
Public Schools

*Department of Public Works and Environmental Services divisions*
Code Services Division
Construction Management Division
Environmental and Facilities Inspections Division
Environmental and Site Review Division
Land Acquisition Division
Maintenance and Stormwater Management Division
Planning and Design Division
Solid Waste Collection and Recycling Division
Solid Waste Disposal and Resource Recovery Division
Wastewater Collection Division
Wastewater Planning and Monitoring Division
Wastewater Treatment Division

The subsequent pages provide an in-depth look into stormwater management in Fairfax County under the following categories:

1. *Watershed Management Planning*. The county has completed and is implementing six watershed management plans which cover more than 50 percent of the land area in the county. In 2007, work was initiated for the remaining land area and all of the watershed plans are expected to be completed before 2010. These plans will provide an assessment of stormwater conditions, recommend protection strategies and improvement projects and encourage public involvement.

2. *Stormwater Capital Projects*. The county continued to implement stormwater management-related capital projects in 2007. Approximately 45 of the completed projects involved flood mitigation, stormwater management facility construction, stormwater management facility retrofits for water quality benefits or stream stabilization and restoration. Another 16 projects involved maintenance work on the stormwater system infrastructure. The county and its partners constructed demonstration projects to encourage the use of low impact development concepts and techniques. The county continued to inspect and perform maintenance as needed on more than 1,200 public stormwater management facilities and annually inspect one-fifth of the 2,270 privately-maintained facilities in the county.

3. *Operations*. The county must operate its facilities in a manner consistent with the requirements of its Virginia Stormwater Management Program (VSMP) permit, which regulates discharges of stormwater from the county's municipal separate storm sewer system (MS4). The permit contains requirements for the operation of county roadways; use of pesticides, herbicides and fertilizers on the county's public rights-of-way, parks, and other public properties; and operation of facilities characterized by regulation as high risk sources of stormwater pollutants, including county landfills. In order to reduce the possibility of pollutants reaching the county's stormwater infrastructure and streams, the county also implements programs to detect and eliminate sources of illegal discharges such as cross-connections with sanitary sewer systems and responds to incidents of hazardous material releases, spills and illegal dumping.

4. *Monitoring and Assessment*. The county conducts watershed water quality monitoring, dry weather screening, wet weather industrial high risk monitoring, bacteria monitoring, water quality measurements, physical habitat evaluations and biological assessment of fish and aquatic macroinvertebrates. The county also uses data collected by more than 400 volunteer monitors and 500 students to track stream conditions.

A summary of the Virginia Department of Environmental Quality's 2006 Draft Water Quality Assessment and Impaired Waters Report is included in this chapter. VDEQ identifies streams, lakes and estuarine waters as impaired when monitoring data show that they do not meet the commonwealth's water quality standards and are not suitable for their intended uses such as swimming, fishing or aquatic life. The 2006 final report listed 35 water bodies with a total of 96 impairments within or bordering Fairfax County. Many of these water bodies are listed for multiple impairments based on elevated levels of pollutants, high levels of contaminants in fish or reduced numbers of aquatic organisms (macroinvertebrates and/or fish).

5. *Public Outreach and Education*. The county conducted presentations and staffed booths at community meetings and events to raise awareness of non-point source pollutants and the actions residents can take to help protect streams. The county partnered with numerous local agencies to promote environmental stewardship events such as the stream cleanups, storm drain marking events, rain barrel building workshops and invasive species removals in 2007 that mobilized nearly 1,900 volunteers. The county also partnered with various organizations to host a high school science program, a middle school teacher training program, stream buffer restoration projects and a regional pollution prevention radio campaign.

6. *Strategic Initiatives*. The county and its partners are actively involved in protecting watersheds and improving the quality of stormwater that enters the streams through initiatives to control runoff and reduce the negative effects of the continual increase in impervious area. In 2007, the DPWES and its partners collaborated on numerous efforts to improve the county's stormwater management program, meet state and federal guidelines to control stormwater runoff close to the source, protect the environmental quality of streams and reservoirs and prevent flooding.

# 1. Watershed Management Planning

In 2003, Fairfax County initiated a process to develop comprehensive watershed management plans for each of the county's 30 watersheds. The plans are being developed in support of Virginia's commitment under the Chesapeake Bay 2000 Agreement and are part of the Fairfax County Board of Supervisors' Environmental Agenda. Today, more than half of the county has plans that have been adopted by the Fairfax County Board of Supervisors; the remaining land area should have completed plans by 2010.

The development of comprehensive watershed management plans began with the Little Hunting Creek Watershed. The plans review and synthesize previous studies and compile available data. This information is used to evaluate current watershed conditions and to project stormwater runoff from ultimate development conditions, allowing a thorough characterization of each watershed. The characterization is used to identify candidate sites for development of structural and non-structural projects designed to address problem areas or to preserve high quality areas in each watershed. Preliminary cost estimates are then developed for proposed projects, and a cost/benefit analysis is used to help prioritize projects and develop an implementation plan.

Between 2003 and 2007, six watershed management plans were adopted that cover 11 of the county's 30 watersheds. Work was initiated in 2007for the remaining land area, and all of the watershed plans are anticipated to be completed before 2010. The current status of watershed planning is presented in more detail in Table 1.1.

**Table 1.1: Status of Fairfax County watershed planning process**

| ***Watershed Planning Group*** | ***Watershed Name*** | ***Total Area (sq. mi.)*** | ***Fairfax Co. Area (sq. mi.)*** | ***Plan Status*** |
|---|---|---|---|---|
| Little Hunting Creek* | Little Hunting Creek | 11.0 | 11.2 | Adopted 02/2005 |
| Popes Head Creek* | Popes Head Creek | 18.9 | 18.2 | Adopted 01/2006 |
| Cub Run and Bull Run* | Bull Run | 9.7 | 8.4 | Adopted 02/2007 |
| | Cub Run | 55.3 | 39.1 | |
| Difficult Run* | Difficult Run | 57.7 | 55.3 | Adopted 02/2007 |
| Cameron Run* | Cameron Run | 42.0 | 32.6 | Adopted 08/2007 |
| Middle Potomac Watersheds* | Bull Neck Run | 2.3 | 2.3 | Adopted 05/2008 |
| | Dead Run | 3.1 | 3.1 | |
| | Pimmit Run | 12.6 | 10.3 | |
| | Scotts Run | 6.0 | 6.0 | |
| | Turkey Run | 2.0 | 2.0 | |
| Little Rocky Run and Johnny Moore Creek** | Johnny Moore Creek | 5.3 | 5.3 | Initiated 2007 |
| | Little Rocky Run | 7.4 | 7.4 | |
| Accotink Creek** | Accotink Creek | 51.1 | 37.8 | Initiated 2007 |
| Pohick Creek** | Pohick Creek | 36.5 | 34.3 | Initiated 2007 |
| Sugarland Run and Horsepen Creek** | Horsepen Creek | 23.5 | 8.8 | Initiated 2007 |
| | Sugarland Run | 22.5 | 10.5 | |

**Table 1.1: Status of Fairfax County watershed planning process**

| *Watershed Planning Group* | *Watershed Name* | *Total Area (sq. mi.)* | *Fairfax Co. Area (sq. mi.)* | *Plan Status* |
|---|---|---|---|---|
| Dogue Creek, Belle Haven and Four Mile Run | Dogue Creek | 19.4 | 13.3 | Initiated 2007 |
| | Belle Haven | 2.8 | 2.8 | |
| | Four Mile Run | 30.1 | 2.0 | |
| Lower Occoquan Watersheds** | High Point | 6.3 | 6.3 | Initiated 2007 |
| | Kane Creek | 4.8 | 4.8 | |
| | Mill Branch | 8.8 | 8.8 | |
| | Occoquan | 3.4 | 3.4 | |
| | Old Mill Branch | 4.4 | 4.4 | |
| | Ryans Dam | 3.6 | 3.6 | |
| | Sandy Run | 8.2 | 8.2 | |
| | Wolf Run | 5.9 | 5.9 | |
| Nichol Run and Pond Branch** | Nichol Run | 7.7 | 7.7 | Initiated 2007 |
| | Pond Branch | 8.4 | 8.4 | |

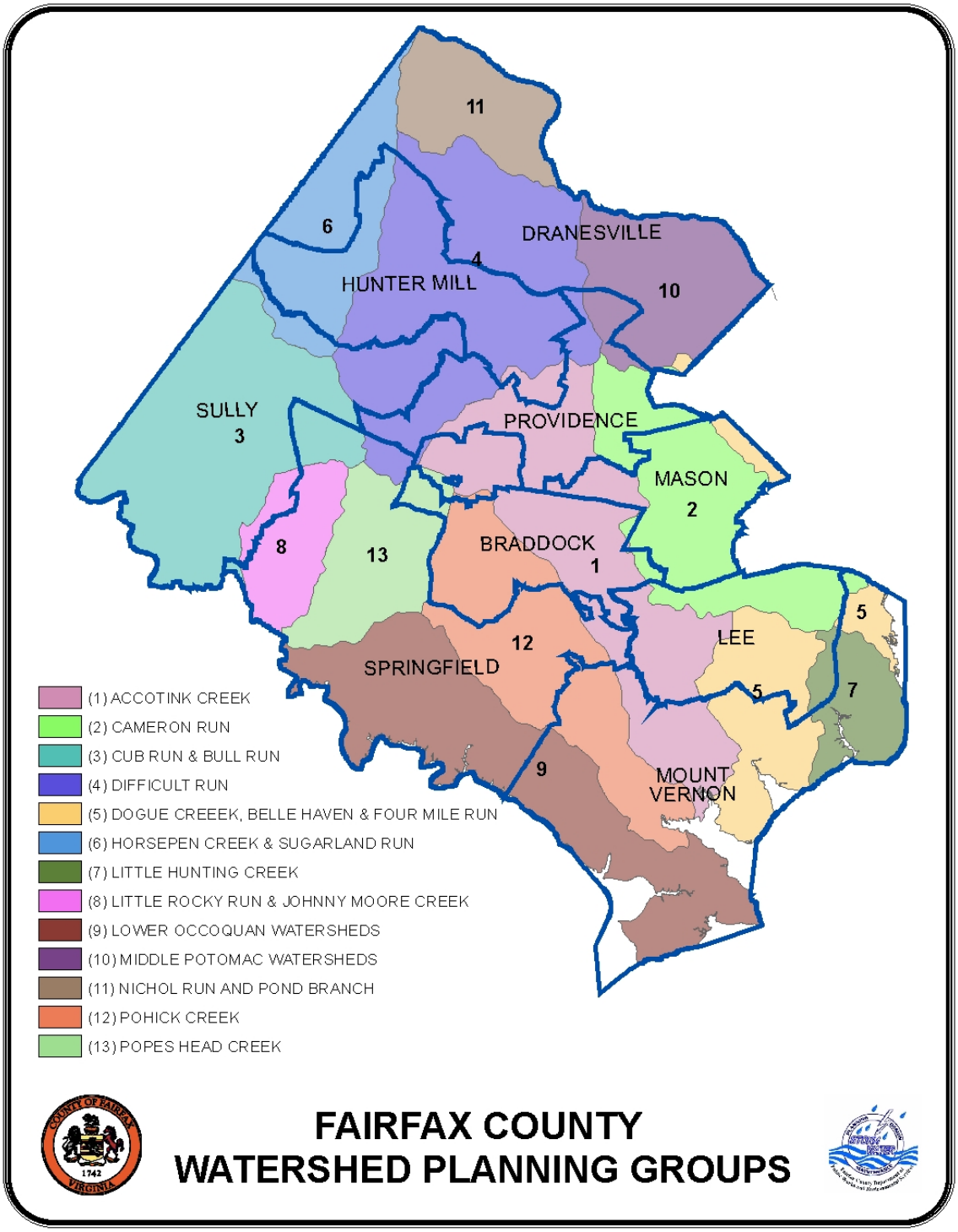
* Copies of final approved plans may be found on the specific watershed Web site at www.fairfaxcounty.gov/dpwes/watersheds
** The status of these plans may be found at the above Web site

## The Future of Watershed Management Plans

There are seven plans in the development process which encompass the remaining 19 watersheds in the county. Community involvement is a vital component in developing and implementing a successful plan. Fairfax County will host two public meetings for each plan. These meetings will provide education on watershed issues and seek resident input on issues confronting each watershed:

- *Introductory and Issues Scoping Forum:* At the first meeting, the county will present the planning process to the community and develop an initial list of watershed issues and concerns. This forum is designed to prepare the community for informed input on development of the plan.
- *Draft Plan Review Workshop:* The second meeting will provide the community with an opportunity to review the first draft of the watershed plan and provide input.

Additionally, for each plan, the county will invite a group of 20 to 30 local residents to be part of the Watershed Advisory Group (WAG). This group will assist in the creation of the plans by advising the county about community outreach opportunities and key issues affecting their watershed, providing suggestions on the topics and formats for public education materials and reviewing and commenting on initial and final drafts of the watershed management plan. The group will be created after the county hosts the Introductory and Issues Scoping Forum for that plan, which should be by the end of 2008.


11
6
DRANESVILLE
4
HUNTER MILL
10
SULLY
3
PROVIDENCE
MASON
2
8
13
BRADDOCK
1
5
12
LEE
SPRINGFIELD
5
7
9
MOUNT VERNON
(1) ACCOTINK CREEK
(2) CAMERON RUN
(3) CUB RUN & BULL RUN
(4) DIFFICULT RUN
(5) DOGUE CREEEK, BELLE HAVEN & FOUR MILE RUN
(6) HORSEPEN CREEK & SUGARLAND RUN
(7) LITTLE HUNTING CREEK
(8) LITTLE ROCKY RUN & JOHNNY MOORE CREEK
(9) LOWER OCCOQUAN WATERSHEDS
(10) MIDDLE POTOMAC WATERSHEDS
(11) NICHOL RUN AND POND BRANCH
(12) POHICK CREEK
(13) POPES HEAD CREEK
FAIRFAX COUNTY
WATERSHED PLANNING GROUPS

# 2. Stormwater Capital Projects

Fairfax County continues to manage an extensive inventory of stormwater structures to receive and transport stormwater runoff, and facilities designed to affect the quantity or quality of stormwater discharged to streams. This work entails construction of site-specific improvements to prevent flooding of residential properties, construction of new regional stormwater management facilities, retrofit of existing facilities to provide improved storage capacity or water quality benefits, incorporation of low impact development and better site design practices into new construction, inspection of public and private stormwater management facilities, maintenance of public stormwater management facilities and inspection and renovation of the municipal separate storm sewer infrastructure.

As in previous years, construction and retrofit of public stormwater management facilities in Fairfax County were accomplished by multiple county agencies and through partnerships with other local and regional organizations. Among the entities that helped to build or make improvements to stormwater management facilities in 2007 were the Department of Public Works and Environmental Services, the Fairfax County Park Authority, the Northern Virginia Soil and Water Conservation District and the Northern Virginia Regional Commission. Additionally, the DPWES continued to inspect and maintain public stormwater management facilities and the municipal separate storm sewer system infrastructure.

## Flood Mitigation

Preventing and reducing the impacts of flooding remains a high priority for Fairfax County. The county's approach to flood mitigation may include constructing new stormwater management structures and conveyance systems, improving the existing infrastructure and re-grading. Six DPWES projects were designed and constructed in 2007 under the flood mitigation program (Table 2.1). Figure 2.1 shows the improvements which were made to the Spartan Road site.

**Table 2.1. 2007 Flood mitigation projects**

| ***Project Name*** | ***Project Description*** |
|---|---|
| Aldebaran Drive | Potential for flooding was addressed by constructing a new stormwater headwall, entrance and retaining wall and lowering the trail embankment to ensure overland relief. |
| Kilmarnock | Flood mitigation was provided by grading a swale, adjusting a drainage structure and raising the elevation of a brick retaining wall. |
| Spartan Road | A parabolic sodded swale was created to reduce flooding potential in addition to removing 5 cubic yards of sediment. |
| Telegraph Road Acquisition | Addressed drainage issues. |
| Tennyson Drive | Flood proofing was provided by constructing a berm, retaining wall and sump pump and through extensive site restoration. |
| Wilma Lane | Flood proofing was accomplished by regrading the area, retrofitting a storm drain inlet and adding a retaining wall. |

**Figure 2.1. Spartan Road flood mitigation project. Left - visible soil erosion before flood mitigation. Right - the completed swale. (Photo by Fairfax County)**

In addition to the flood mitigation projects, the county has been actively addressing community-level flooding concerns. The Northern Virginia Soil and Water Conservation District (NVSWCD) and the county are assisting homeowners in the Falls Hill and Poplar Heights subdivisions to find solutions to severe flooding, erosion and drainage problems. A retrofit plan was developed to manage stormwater runoff and protect those properties in immediate danger of flooding, including measures to deal with existing stream bank erosion. A grant-funded project is being implemented for design and installation of several infiltration and stormwater control measures. These demonstration sites, along with an education program and technical assistance, are part of a community incentive program to help homeowners manage flooding problems.

In January 2007, a report was issued on factors which contributed to residential flooding after the intense rainfall events of June 2006, particularly in the Huntington community. In spring 2007, a community workshop was conducted to present alternative solutions to the flooding issue. As a result, new flood plain elevations have been adopted in the Huntington area.

## New Construction of Stormwater Management Ponds

Two regional stormwater management ponds were substantially completed in 2007 under Fairfax County's Regional Pond Program (Table 2.2).

**Table 2.2. 2007 Regional pond construction**

| ***Project Name*** | ***Description*** | ***Partners*** |
|---|---|---|
| Regional Pond D-37 | D-37 is an embankment-only extended detention dry pond providing quantity and quality stormwater management for 111 acres, including 76 acres upstream of the Bridges of Oakton Development. | DPWES |
| Regional Pond R-17 | The pond has an upstream drainage area of nearly 600 acres and provides protection to Little Rocky Run by enhancing water quality and reducing peak discharges. The project integrated stormwater requirements for the Kate Hanley Shelter (walking trails, boardwalks, engineered wetlands and habitat protection). | DPWES |

**Figure 2.2. Regional Pond R-17. Left – a view of the pond in spring 2007. Right – a view of the pond in 2008 with new plantings along its perimeter. (Photo by Fairfax County)**

Combined, the ponds provide Best Management Practices (BMP) control for 396 acres and control stormwater runoff from more than 700 acres. BMP control for additional acreage is provided through the use of smaller stormwater management facilities. Figure 2.2 shows two photographs of Regional Pond R-17 taken at different stages of completion. Two other ponds (D-17 and D-46) were under construction at the close of calendar year 2007.

## Maintenance and Retrofit of Existing Stormwater Management Facilities

In 2007, the county retrofitted seven stormwater management facilities and maintained several others. These retrofits included installation of BMP plates, creation of fore-bays and shallow wetlands and construction of bioretention swales and basins (rain gardens). Retrofits also included structural repairs or improvements to principal and emergency spillways, outfall pipes and dams. Retrofits are designed to improve the capacity of the original pond to reduce the amount of nutrients discharged and the impacts of storm flows downstream. Water quality retrofits enhance nutrient uptake, increase water infiltration, uptake and transpiration and create

**Figure 2.3. Stormwater Management Facility Maintenance. Accumulation of sediment and natural debris (left) in this pond at Mclean Valley Estates became a problem. Removal of the material (right) improved water quality performance of the pond and could reduce the potential for house flooding. (Photo by Fairfax County)**

habitat for wildlife. Excavation of sediment helps maintain the water quantity control and water quality functions of the ponds. Some excavation projects like the project at McLean Valley Estates (Figure 2.3) can reduce residential flooding hazards. Table 2.3 summarizes all 2007 retrofit projects.

**Table 2.3. 2007 Stormwater management facility maintenance and retrofit projects**

| ***Project Name*** | ***Description*** | ***Partners*** |
|---|---|---|
| Autumnwood Park Pond Retrofit | Removal of sediment from the pond floor, installation of a new trash rack and BMP plate and creation of a micropool for habitat and water quality benefits. | DPWES |
| Brimstone SWM 071 (6830 Brimstone Lane) | Sediment removal and installation of a beaver baffle. | DPWES |
| Cabell's Mill (13709 Cabell's Mill Drive) | Removal of approximately 400 cubic yards (CY) of sediment from the pond and excavation of a small micropool to provide wetland habitat. Installation of a BMP plate and trash racks to provide water quality protection against downstream erosion. | DPWES |
| Fairview Woods Pond Retrofit, Phases 1 and 2 (Burke Center Parkway/Fairview Woods Drive) | Phase I entailed removal of 1,200 cubic yards of sediment from the pond floor and installation of a new headwall, BMP plate and trash rack. Phase II entailed removal of approximately 600 cubic yards of silt to create a sediment forebay that will pre-filter sediment and organic debris before it reaches the pond floor. | DPWES |
| Glenbrook Woods Drive Pond Plantings (12630 Glenbrook Woods Drive) | Excavated 50 cubic yards of sediment and vegetated pond banks with 68 new wetland plants. | DPWES |
| Hunter Mill Estates Pond D-52 (10207 Brittenford Drive) | Removal of 600 cubic yards of silt and debris from the pond and creation of a forebay. | DPWES |
| Keene Mill Village SWM Retrofit Phases I and II (8957 Omega Court) | Phase I entailed removal of 1,400 cubic yards of silt and debris to improve the function of the facility. Phase II entailed sediment removal and installation of a gabion weir for improved sediment management. | DPWES |
| Lake Accotink Dredging, Lake Accotink Park | Dredging began in 2006 to increase volume and reduce peak flows. Current dredging goal is 204,000 CY of material. To date 155,000 CY have been removed. (Dredging should be completed in 2008.) | DPWES, FCPA |

**Table 2.3. 2007 Stormwater management facility maintenance and retrofit projects**

| ***Project Name*** | ***Description*** | ***Partners*** |
|---|---|---|
| Lake Braddock Sec. 3T Pond Rehabilitation Phase 1 and II (Olley Lane and Guinea Road) | Phase I entailed removal of approximately 700 tons of material from the pond floor, creation of micropools for habitat and further water quality benefits and repairs to the emergency spillway. Phase II entailed construction of a gabion weir to trap debris and sediment to prevent clogging of the control structure. | DPWES |
| McLean Valley Estates (6513 Orland St.) | Removal of heavy debris to prevent house flooding and improve water quality performance. | DPWES |
| Regional Pond D-67 (8521 Lewinsville Road) | Removal of silt to add capacity, and installation of a new trash rack | DPWES |
| Sequoia Farms Sec. 2 Pd. 2 (5588 Sequoia Farms Drive) | Removal of old gravel BMP and localized sediment deposits causing blockage and ponding of water; installation of a concrete apron, wing walls, BMP plate and trash rack; re-grading of the pond floor for positive flow; widening and re-grading of the channel adjacent to the private residence and removal of the pipe to facilitate better flow; and installation of riprap at the inflows to mitigate erosion. | DPWES |
| Sutton Oaks Lane Channel Repair (2895 Sutton Oaks Lane) | In response to a resident's complaint, cleaned adjacent pond of silt, replaced and repaired sections of the concrete channel and reseeded the area. (See Table 2.7.) | DPWES |
| The Sycamores at Van Dorn (5900 Terrapin Place) | Dry detention pond was retrofitted with improved water quality features and silt trapping efficiency while remaining functional. Removed 560 cubic yards of excess silt and debris, returning the facility to a dry pond. | DPWES |
| Trash Racks and BMP Plates (Ponds 0537DP, 0642DP, 1362DP, and 1425DP) | Replacement of existing trash racks and BMP plates with new galvanized racks and plates. | DPWES |
| Sherwood Library Retrofit 2501 Sherwood Hall Lane | Construction of two bioretention basin facilities incorporating LID measures for water quality. | DPWES |

Additionally, a privately owned site (a church) was retrofitted for water quality through the use of rain gardens and water quality swales (Figure 2.4). Details about this and other low impact development (LID) projects are provided in Table 2.4.

**Figure 2.4. LID Retrofit Project, Mount Vernon Unitarian Church. Top left - preparing the bioretention area by removing existing grass and soil. Top right - installing the gravel bed. Bottom left - amended soils and new plantings were added. Bottom right - the completed bioretention area, which was designed to hold six inches of runoff for a maximum of 72 hours. (Photo by Fairfax County)**

## Low Impact Development

Fairfax County promotes the use of environmentally sensitive site design and LID practices that minimize impervious cover and replicate natural hydrologic conditions as a means of protecting streams and other natural resources. LID projects are being used to help the county meet multiple stormwater management goals and provide the following benefits:

- A variety of LID concepts and techniques can be applied to development of new residential and commercial areas or to retrofitting established areas
- LID projects can be selected to meet space constraints
- The visibility and accessibility of certain projects provide opportunities to educate on the benefits of LID and can increase public awareness of stormwater management issues
- These innovative projects provide opportunities for scientific research
- With adequate training, residents can implement and maintain some LID practices on their properties
- Certain LID practices provide aesthetically pleasing alternatives for stormwater management.

Projects like the one at the Fairfax County Government Center's Herrity Building illustrate the opportunities that exist for implementation of LID concepts in the county.

**Herrity Building Parking Garage Green Roof Demonstration Project**

Installation of a demonstration green roof system on the top deck of the Herrity Building parking garage began at the end of 2007 and will be completed in early 2008. A green roof absorbs stormwater by acting like a natural environment, in that the water does not immediately run off to storm drains and waterways. A large portion of the stormwater is retained on the roof and is returned to the atmosphere by evaporation and transpiration. The project involved collaboration between SWPD and the Facilities Management Department (FMD). The project is meant to provide an easily accessible green roof to be explored up-close by industry professionals, county staff, residents and students. The roof demonstrates extensive, semi-intensive and intensive planting depths. The low-profile extensive areas feature many varieties of sedum, while the semi-intensive and intensive areas showcase perennials, shrubs and trees native to the Mid-Atlantic area. Five interpretive signs are being installed to educate the public about this and other green roofs.

In addition to being an educational tool, the green roof provides an important research opportunity. Performance differences between the vegetated area and an identical, un-vegetated area will be measured and recorded. A rain gage mounted on the roof will measure rainfall during storm events. Stormwater flowing from the drains of the green roof and the un-vegetated area will be tested for temperature, volume and water chemistry and then compared. The monitoring of the amount of rain, soil moisture level and volume of water leaving the green roof will provide a plethora of rain and runoff data. These data will be used to analyze rainfall-runoff characteristics of the green roof and its performance as a BMP.

**Summary of 2007 Low Impact Development Projects**

In 2007, DPWES, NVSWCD, FCPA, nonprofit organizations, and individual volunteers contributed to the design and implementation of at least 14 LID projects in the county (Table 2.4). Two LID demonstration projects constructed at the Mount Vernon and Cub Run recreation centers in 2007 were designed by DPWES, FCPA and NVSWCD in support of the Board of Supervisors' Environmental Improvement Program.

**Table 2.4. LID projects constructed in 2007**

| ***Project*** | ***Description*** | ***Partners*** |
|---|---|---|
| Carl Sandburg Park Field Renovation | Renovated an existing natural turf field to synthetic turf and an open-aggregate base to provide storage capacity with reduced peak flows. Water quality benefits include phosphorus removal at a 15 per cent efficiency rate and the elimination of pesticide and fertilizer application. | FCPA |
| Cub Run Recreation Center LID Demonstration | Construction began in 2006 on a vegetated swale, soil amendments and a rain garden with underground storage to decrease the volume, peak discharge and phosphorus concentration of stormwater runoff from the 1.91-acre site. Construction was completed in 2007 with planting of trees and shrubs and placement of an interpretive sign. | FCPA, DPWES, NVSWCD |

**Table 2.4. LID projects constructed in 2007**

| ***Project*** | ***Description*** | ***Partners*** |
|---|---|---|
| Herrity Building Parking Garage Vegetated Roof Demonstration Garden | Installation of the vegetated roof began in 2007. The roof will be monitored for performance beginning in 2008. | DPWES |
| Hidden Oaks Nature Center LID Parking Lot | Rebuilt the existing parking lot using several LID concepts such as pervious pavers, rain gardens and a bio-retention area that will improve stormwater quality for the site. | FCPA |
| Lake Fairfax Park Field Renovations | Renovated two existing natural turf fields to synthetic turf and an open-aggregate base to provide storage capacity with reduced peak flows. Water quality benefits include phosphorus removal at a 15 per cent efficiency rate and the elimination of pesticide and fertilizer application. | FCPA |
| Lake Martin/Governor's Run Rehabilitation | Installation of a fore-bay, shoreline stabilization and wetland plantings and reforestation as well as rehabilitation of approximately 300 feet of Governor's Run. | |
| Marie Butler Levin Park Demonstration Rain Garden and Arboretum | Design and installation of an 825-square foot rain garden began in 2006. Construction was completed in May 2007, and the garden was planted in October 2007. The rain garden treats runoff from more than an acre of lawn, parking lot and road. This visible and accessible area will serve as a public education and LID demonstration site. | FCPA, NVSWCD, Earth Sangha, McLean Citizens Association |
| Mount Vernon Recreation Center LID Demonstration | Construction began in 2006 on a vegetated swale, soil amendments and a rain garden with underground storage to decrease the volume, peak discharge and phosphorus concentration of stormwater runoff from this 1.61-acre site. Construction was completed in 2007 with planting of trees and shrubs and placement of an interpretive sign. | FCPA, DPWES, NVSWCD |
| Mount Vernon Unitarian Church 1909 Windmill Lane | Installation of two bioretention basin facilities to incorporate new LID practices, which will help to increase the water quality and quantity control in Little Hunting Creek watershed. The construction of the rain garden and water quality swale was substantially complete in 2007, and plantings were planned for 2008. | DPWES |
| Patriot Park | Substantially completed construction of an over-sized adult synthetic turf soccer field. An open-aggregate base provides storage capacity with reduced peak flows. Water quality benefits include phosphorus removal at a 15 per cent efficiency rate and the elimination of pesticide and fertilizer application. The project included construction of a new stormwater management facility that included a large bio-retention area. | FCPA |

**Table 2.4. LID projects constructed in 2007**

| *Project* | *Description* | *Partners* |
|---|---|---|
| Pimmit Run Stream Valley Park | Constructed a natural surface trail along Pimmit Run between Old Dominion Drive and Brookhaven Road with multiple stream crossings utilizing large rocks. | FCPA |
| Poplar Tree Park Field Renovations | Renovated two existing natural turf fields to synthetic turf and an open-aggregate base to provide storage capacity with reduced peak flows. Water quality benefits include phosphorus removal at a 15 per cent efficiency rate and the elimination of pesticide and fertilizer application. | FCPA |
| South Run Park Field Renovations | Renovated two existing natural turf fields to synthetic turf and an open-aggregate base to provide storage capacity with reduced peak flows. Water quality benefits include phosphorus removal at a 15 per cent efficiency rate and the elimination of pesticide and fertilizer application. | |
| Wakefield Park/Audrey Moore Recreational Center Rain Garden | Completed renovation of an existing stormwater management (SWM) pond to install a rain garden in December 2007. It will control runoff from 2.43 acres, including a 0.22 acre parking area. The site will be planted and an interpretive sign installed in 2008. | FCPA, NVSWCD |
| Waverly Park | In 2006, removed sections of asphalt train and several culvert pipes on tributaries to Wolftrap Creek, relocated the bridge to an area with greater bank stability, stopped mowing on approximately 4 acres of floodplain and coordinated a volunteer project to plant trees to improve the stream buffer. In 2007, two large culverts were removed from the creek and replaced with fiberglass foot bridges. | FCPA |

In 2007, the planning and design division began several projects that incorporate a variety of innovative LID practices (Table 2.5). These projects are expected to be completed in 2008.

**Table 2.5. LID project plans under development in 2007**

| | |
|---|---|
| Cub Run RECenter LID system and Herrity Building vegetated roof | Design of systems to monitor LID performance |
| Dolley Madison Library renovation | Includes reforestation, pervious pavement, raised planter boxes, deep root tree boxes and vegetated swales. |
| Laurel Hill project at former site of Lorton Prison | Includes right-of-way LID features for the new Lorton Road and a full suite of LID practices (including soil amendment, bioretention facilities, vegetated swales, wetlands) for the remaining land footprint. |
| Martha Washington Library renovation | Includes naturalized landscaping and a bioretention basin. |

**Table 2.5. LID project plans under development in 2007**

| | |
|---|---|
| McLean Community Center stormwater retrofit | Includes a pond retrofit, soil amendment and naturalized landscaping. |
| Sherwood Library stormwater retrofit | Includes pervious pavement, two bioretention basins, three tree box filters and vegetated swale. |
| Various existing stormwater ponds | Multiple retrofits planned to improve water quality. |
| Walt Whitman Elementary School stormwater retrofit | Includes vegetated swales and bioretention basins |

In addition to the projects summarized in Tables 2.4 and 2.5, FCPA, NVRC and NVSWCD were involved in other LID-related activities in 2007:

- FCPA maintained two existing rain gardens at Lake Accotink Park to enhance water quality and educate residents
- FCPA worked to reduce the amount of mowed turf areas at numerous park sites around the county, concentrating on riparian corridors and lake fronts to promote water quality
- FCPA sought opportunities to recommend LID stormwater management techniques as part of its park planning, development and renovation process. Examples of this in 2007 include the site development for Patriot Park, the Hidden Oaks Nature Center parking lot expansion and the Lake Fairfax Phase II park improvements. All of these projects will incorporate or have incorporated LID features to provide stormwater management
- The Northern Virginia Regional Commission (NVRC) has revised the 1992 edition of the Northern Virginia Best Management Practices Handbook to incorporate LID guidelines. The handbook is a widely used resource for Fairfax County planners and public works staff. Twelve designs and water quantity sizing guidelines have been developed. A steering committee, which included the director of the Department of Public Works and Environmental Services for Fairfax County, provided guidance and oversight to the technical advisory committee of local government and private industry staff. The updated handbook awaits jurisdictional review and finalization of the state regulations to be completed. A second phase of the project to develop sizing criteria is under development
- NVSWCD provided recommendations to the Department of Planning and Zoning on 155 rezoning and special exception applications. Recommendations addressed better site design techniques, low impact development practices and stormwater management measures that would lessen impacts on streams. Comments were provided to DPWES-Land Development Services on the erosion and sediment control and stormwater management aspects of 49 site plans. NVSWCD works directly with developers to advise them on ways to develop sites that protect environmentally sensitive areas and with less adverse impact on streams and other natural resources
- In 2007, using a grant from the Virginia Department of Conservation and Recreation, NVSWCD conducted a study of 20 publicly and privately maintained rain gardens in the county. The evaluation focused on the physical characteristics of these three-to-five-year-old rain gardens in relation to how well they were functioning. The analysis included infiltration tests and lab analyses of soil texture, organic matter content and bulk density. The filter media were examined to determine the type and level of pollutants

retained and their relationship to the area drained. The installation was compared to the approved design. In general, publicly maintained rain gardens fared better than private ones, as did those built according to their approved designs. The findings led to recommendations for design specifications, as well as for training and education initiatives that would ensure rain gardens are properly installed and well-maintained.

## Stream Restoration and Stabilization

In 2007, the county completed seven stream restoration projects with the assistance of a number of non-profit organizations and volunteers. These projects are summarized in Table 2.6.

**Table 2.6. Stream restoration and stabilization projects completed in 2007**

| ***Project Name*** | ***Problem*** | ***Solution*** | ***Partners*** |
|---|---|---|---|
| Balmacara Phase II Stream Stabilization (6957 and 6969 Duncraig Court) | Residential property affected by stream erosion | Stabilization of eroded streambank with gabion basket walls, riprap, soil stabilization and other related items to provide protection for two properties along Dead Run Creek. | DPWES |
| Coach Road Channel Retrofit (9928 Coach Rd.) | Storm drain stream erosion | Regraded and stabilized the washed-out area and added 50 tons of riprap. | DPWES |
| Governor's Run Phase 1 and 2 | Storm drainage | Construction of an access road and fore-bay, stream restoration, landscaping and tree plantings at Lake Martin. | DPWES |
| Hunters Branch Stream Restoration | Blockage | Stream clean-up along Hunters Branch and removal of blockage. | DPWES |
| Little Pimmit Run Stream Valley Park | Streambed erosion | Restored more than 300 feet of stream. The project provided bank stabilization, protection of a sanitary sewer line, protection of private property, improved habitat and a stable public trail crossing. | FCPA, NVSWCD, homeowners |
| Pleasant Ridge | Eroded stream and damaged stormwater outfall, potentially affecting a house | Restored and stabilized stream bank and repaired stormwater outfall. | DPWES |
| 8211 Woodland Avenue | Erosion damage to home foundation and deck | Installation of approximately 80 feet of riprap to mitigate erosion damage to house foundation and deck and replacement of driveway. | DPWES |

In June 2007, NVSWCD completed the Little Pimmit Run Stream Restoration project, a public-private partnership that used natural stream channel design and innovative techniques to restore 675 feet of a severely degraded stream segment and to protect three threatened sanitary sewer lines parallel to and crossing the stream. Nearby homeowners assumed two-thirds of the cost for

design and construction of the project, which is located primarily within parkland. Other partners included FCPA, DPWES-Wastewater Collection Division, the Dranesville District Supervisor, a private engineering firm and a private construction company. The design included two stacked stone walls to bankfull height, five j-hooks to control and direct flow, bankfull benches, riffles and pools throughout the segment, an integrated trail crossing, floodplain and upland grading and planting with native grasses, shrubs and trees (Figure 2.5).

**Figure 2.5. Little Pimmit Run Stream Restoration Project. Left - before restoration, the site was characterized by eroding and downcut banks, threatened trees and degraded riparian zone. Right - features of the restored stream segment include the stacked stone wall (top, right of photo); reclaimed land (right); two j-hooks (foreground, left); pools and riffles; and riparian zone revegetation. (Photo by Fairfax County)**

In addition to the completed projects summarized above, planning commenced on two major restoration projects: stream restoration on about 500 feet of Turkeycock Run at Green Spring Gardens and restoration of the central wetland at Huntley Meadows Park.

## Infrastructure Inspection and Maintenance

The Maintenance and Stormwater Management Division (MSMD) of DPWES inspects and maintains all county owned and operated stormwater management (SWM) facilities, Best Management Practice facilities and infrastructure, including stormwater dry ponds located within residential subdivisions. DPWES inspects and implements maintenance for privately maintained stormwater management facilities. In 2007, the county inspected all county maintained SWM and BMP facilities at least once for maintenance purposes and inspected 20 per cent of the privately maintained facilities as shown in Table 2.7.

**Table 2.7. 2007 Stormwater management maintenance and inspection summary**

| ***Activity or Facility*** | ***Number of Facilities*** | ***Number Inspected*** | ***Dam embankments mowed*** | ***Inspection Reports Written*** | ***Maintenance work orders written/ completed*** |
|---|---|---|---|---|---|
| County maintained facilities | 1206 | 1206 | 1,120[1] | 1,206 | 277 / 277 |
| Privately maintained facilities | 2,790 | 558 | N/A | 558 | N/A |

**Table 2.7. 2007 Stormwater management maintenance and inspection summary**

| ***Activity or Facility*** | ***Number of Facilities*** | ***Number Inspected*** | ***Dam embankments mowed*** | ***Inspection Reports Written*** | ***Maintenance work orders written/ completed*** |
|---|---|---|---|---|---|
| Storm drainage network inspections | N/A | 285 miles | N/A | N/A | 754 / 754 |
| Stormwater system inspections by closed circuit TV | N/A | 25 miles | N/A | N/A | Included in above |
| State regulated dams | 16 | 16 / 2* | 16 | 16 | 16 |

1 Embankments mowed include 35 regional ponds which were maintained four times each in 2007.
* 16 Annual maintenance inspection / 2 Bi-annual Engineering Inspection

In addition to routine maintenance inspections, county staff with expertise in dam design and construction continued to perform biennial inspections of 16 state-regulated dams in the county to identify any safety or operational items in need of corrective action and to ensure that the dams satisfy state requirements for safety. A work program was established and implemented to correct deficiencies and address maintenance items discovered during inspections. Critical items such as the stability of the dam embankment and the function of the water control structures are addressed on a priority basis. Routine items such as mowing are accomplished on a scheduled basis, currently five times per year.

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), NVSWCD and Fairfax County are partnering to rehabilitate four flood control dams that were constructed in the Pohick Creek watershed during the 1970s and 1980s. Improvements in geologic modeling technology, newer federal and Virginia safety standards and more recent residential development necessitate the rehabilitation projects. In 2007, several public meetings were held to discuss the first rehabilitation project at Lake Royal and ensure that resident concerns were addressed during the project design. The adopted Lake Royal dam rehabilitation option includes realigning the auxiliary spillway to direct water away from townhomes that were built after the dam was completed, armoring the auxiliary spillway with articulated soil and grass-covered concrete blocks to prevent erosion and increasing the height of dikes to constrain flow to the auxiliary spillway using earthen, grass-covered embankments. The cost of the improvements are to be shared by NRCS and Fairfax County, with NRCS providing up to 65 percent of the estimated cost of $3.1 million. Lake Royal dam rehabilitation was scheduled to start in 2008.

The county's inventory of stormwater management facilities, stormwater infrastructure and associated easements is being tracked through the use of the county's geographic information system databases. The DPWES Maintenance and Stormwater Management Division implements an infrastructure management plan to maintain and update the accuracy and inventory of the municipal separate storm sewer system (MS4). The infrastructure management plan covers 399 square miles served by the county's MS4 as identified on 436 tax map grids. During a five year cycle (completed in 2005), Fairfax County field-verified the storm drainage conveyance system

on each tax map grid, identified stormwater pipes, outfalls, and associated appurtenances and created a GIS-based data layer. A GIS-based spatial database of stormwater-related easements was begun in 2005. Work was completed on 75 tax maps prior to 2007. MSMD completed an additional 91 tax grids in 2007, and the final 270 tax grids are expected to be complete by the end of 2008.

Fairfax County has implemented an Infrastructure Rehab Program that has inspected 70 miles of pipe, 4600 structures and five miles of channels by closed-circuit television (CCTV). MSMD designed repairs for three miles of pipe and 370 structures. The construction of 60 rehab projects totaling approximately $4 million is about 40 per cent complete.

**Table 2.8. MS4 Infrastructure Repairs and Channel Clearing Projects**

| ***Project Location*** | ***Project Description*** |
|---|---|
| 7232 and 7234 Allan Avenue | Rebuilt collapsing storm drain inlets and regraded and re-vegetated the area. |
| 6071 Brook Drive | Cleared concrete channel and added grouped riprap to portions of the upper channel. |
| Chesterbrook Drive and North Albemarle Street | Infrastructure repair. |
| Evers Drive | Infrastructure repair. |
| 2828 Fallfax Drive | Removed and replaced approximately 15 feet of channel. |
| 7201 Gulf Hill Court | Replaced 45 feet of collapsed corrugated metal pipe with 45 feet of 27-inch diameter reinforced concrete pipe. |
| Hayfield Road Baptist Church | Infrastructure repair. |
| Highland Lane | Infrastructure repair (channel clearing). |
| 7297 Hillary Street | Lowered the inlet and provided an additional throat to increase the capacity of the storm system and minimize flooding. |
| Huntington/Fenwick /Arlington Terrace | Removed sediment from five outfall channels in the Huntington community, cleaned storm structures and 2,481 linear feet of storm pipe leading to the channels. A repeat cleaning of the outfall channels was done after flushing the storm line system. |
| Madrillon Road | Cleared a concrete channel of surrounding vegetation and debris. |
| Middle Ridge Road | Cleared a concrete channel of silt and graded hill which permitted access to the channel. |
| Morris Street | Removed debris and peripheral overgrown vegetation from a channel. |
| Old Dominion Drive | Removed concrete channel and laid geofabric and riprap. |
| 2895 Sutton Oaks Lane | In response to a resident's complaint, repaired and replaced sections of the concrete channel, cleaned the adjacent pond of sediment and reseeded the area. (See Table 2.3 concerning pond retrofit at the site). |
| 7429 Vernon Square Drive | Installed new inlet, curb, gutter and repaved road surface. |

Reinvestment in the stormwater system includes clearing channels and removing vegetation affecting the integrity or performance of the infrastructure. In 2007, projects were completed in

locations throughout the county, including several in Mason, Mt. Vernon, Providence and Springfield districts (Table 2.8). Figure 2.6 shows the site of a channel clearing project located at Middle Ridge Road.

**Figure 2.6. Channel Clearing Project at Middle Ridge Road. The channel before (left) and after (right) silt removal. (Photo by Fairfax County)**

# 3. Operations

Fairfax County's stormwater management plan is designed to prevent harmful pollutants from being dumped or washed by runoff into the municipal separate storm sewer system, and then discharged into local water bodies. Controlling and managing sources of stormwater pollutants are vital components of the plan. The plan addresses how the county manages materials used to treat county roadways and parking lots; applies pesticides, herbicides and fertilizers; takes preventive measures to prevent sanitary sewer system leaks; controls discharges from high priority and industrial facilities like county landfills; and responds to spills of hazardous materials. These actions reduce the possibility of materials reaching the county's stormwater infrastructure and streams.

## Roadways

The county maintains approximately five miles of road segments and 159 acres of parking lots for public facilities such as government centers, libraries, fire stations, police stations, health centers, bus transit facilities, park-and-ride lots and commuter rail stations. To limit the discharge of sand and de-icing materials into the county's streams, sand and chemical treatment are provided only when dictated by safety concerns. The DPWES performed sweeping operations at 103 sites that were treated during the winter of 2007.

## Pesticide, Herbicide and Fertilizer Application Program

County agencies involved in the administration of public rights-of-way, parks and other municipal properties continue to collaborate to implement nutrient and integrated pest management practices. As part of this effort, in 2007 the county began tabulating the acreage of managed land, identifying the various management techniques and striving to improve the way county lands are managed. The preliminary tabulation showed that more than 23,000 acres are managed by county agencies. The data indicated that more than 2,300 acres are mowed, 717 acres are treated with herbicides and/or pesticides and 434 acres are fertilized. The remaining acres were undisturbed or the turf was managed by over seeding and aeration. Further tabulation will continue as the land area managed by the county changes.

The Northern Virginia Soil and Water Conservation District reviews nutrient and integrated pest management plans for private golf courses and plant nurseries, and provides comments and recommendations to the Department of Planning and Zoning. The NVSWCD reviews and comments on the implementation and monitoring reports received from golf courses.

The NVSWCD makes conservation information related to pesticide, herbicide and fertilizer application publicly available through its Web site at www.fairfaxcounty.gov/nvswcd/

The Fairfax County Office of the Virginia Cooperative Extension (VCE) had more than 550 attendees at pesticide recertification workshops. Participants were educated on pesticide safety, application, storage and disposal. VCE held a four-day pesticide certification workshop in which 81 attendees from the landscape industry based in Fairfax and Northern Virginia studied the Virginia Core Manual and Categories in Ornamentals and Turf. VCE offered the Virginia Certification exam for workshop participants to become certified applicators. Through this

workshop, VCE was able to educate several participants who had been applying pesticides without applicator certificates.

## Agricultural Land

Fairfax County's Chesapeake Bay Preservation Ordinance and Agricultural and Forestal District Ordinance require land in agricultural use to have a soil and water quality conservation plan. Horse-keeping operations are the predominant agricultural land use in the county. These are located in the northern, western and southern areas of the county, and range from five to more than 100 acres. Plans include practices to reduce erosion and sediment pollution from pastures and stables, manage excess nutrients from animal waste and fertilizers and address the misuse of pesticides and herbicides. The plans prescribe vegetated riparian buffers for streams (Resource Protection Areas). In 2007, 17 soil and water quality conservation plans were developed for 355 acres, which included 7,700 linear feet of Resource Protection Areas.

Under the Chesapeake Bay Preservation Ordinance, the NVSWCD develops soil and water quality conservation plans for agricultural lands. The plans recommend best management practices to prevent sediment, fertilizers, pesticides, herbicides and animal wastes from harming water quality.

## Sanitary Sewer Inspection and Maintenance

Inspection and maintenance of the county's sanitary sewers help eliminate sewage leaks to the county's stormwater system and waterways. Rehabilitation and repairs include dig-up repairs, manhole rehabilitation and trench-less pipe repair using technologies such as robotic, cured-in-place and fold-and-reformed pipe rehabilitation processes.

The Sanitary Sewer Infiltration Abatement Program conducts wastewater flow measurements and analysis to identify areas of the wastewater collection system with excessive inflow/ infiltration problems. Closed circuit television (CCTV) is used to inspect trunk sewer mains to identify defective sewer lines for repair and rehabilitation. The Sanitary Sewer Extension and Improvement Program addresses pollution abatement and public health considerations by providing sanitary sewer service to areas identified by the Department of Health as having non-repairable, malfunctioning septic systems. In 2007, one extension and improvement project installed 1,300 linear feet of eight inch sanitary sewer and provided sanitary sewer connections to 11 homes. A summary of these two programs is shown in Table 3.1.

**Table 3.1. 2007 Sanitary sewer maintenance and inspection summary**

| ***Activity*** | ***Old sanitary sewer lines*** | ***New sanitary sewer lines*** | ***Total after nine years*** | ***Dig ups*** | ***Manholes*** | ***Trench-less pipe repair*** |
|---|---|---|---|---|---|---|
| Inspections by CCTV | 188 miles | 15 miles | N/A | N/A | N/A | N/A |
| Rehabilitation and Repairs | 32,014 feet | N/A | 239 miles | 30 | 742 | 96 |

**Table 3.1. 2007 Sanitary sewer maintenance and inspection summary**

| | | | | | | |
|---|---|---|---|---|---|---|
| Constructed to replace failing septic system | N/A | 1,300 feet (11 homes) | N/A | N/A | N/A | N/A |

## County Landfills

Landfills are categorized generally as high-risk facilities because of their potential to release pollutants into the environment. Fairfax County's Division of Solid Waste Disposal and Resource Recovery (DSWDRR) is responsible for the operation of the I-95 landfill in Lorton and the I-66 transfer station/closed landfill in Fairfax. Both facilities are covered under a Virginia Pollutant Discharge Elimination System (VPDES) general permit.

The I-95 closure project was designed to complete capping of approximately 130 acres of the municipal solid waste section of the landfill and was approved by the Virginia Department of Environmental Quality. The final phase was completed during the summer of 2007. The final cover system has 18 inches of low-permeability soil and a 15 inch protective cover or vegetative support layer. Therefore, stormwater is managed more efficiently and infiltration is reduced significantly, with less leachate. This minimizes the need for post-closure maintenance.

Phase IIB is part of the I-95 area three lined landfill project. The phase IIB project has a disposal capacity of 375,000 tons and continues to accept ash from the energy/resource recovery facility at the I-95 complex and from a similar facility in Alexandria. Filling may be completed in 2008. Phase IIIA was under construction in 2007. This new cell will be covered with a rain cap to separate leachate and stormwater.

At the I-66 transfer station, a new stormwater detention pond was constructed to accommodate stormwater runoff from the northeast slope of the closed landfill and the adjacent residents' disposal facility lot. The detention pond is not connected to the stormwater drainage system and is not fully functional.

Staff performs visual inspections of the stormwater outfalls located at the county landfills in each quarter of the calendar year. Annual benchmark sampling is done between July 1 and June 30 of the monitoring year. Results of water quality tests conducted to satisfy VPDES permit conditions have been satisfactory.

Staff training in pollution prevention is provided and is required as part of county waste disposal permits. Stormwater pollution prevention plans are maintained at each facility and are updated when conditions change. Spill kits are available at each location.

DSWDRR operates the household hazardous waste program, which costs approximately $560,000 annually.

## Hazardous Materials Spill Prevention and Response

The Fire and Rescue Department responds to all reported incidents of hazardous material releases, spills and discharges. Fire and Rescue's Hazardous Materials and Investigative

Services (HMIS) staff receive training in pollution prevention measures and proper response procedures when pollutants or spills may reach storm drains. HMIS staff is trained in the proper handling of hazardous wastes as part of the household hazardous waste collection program. The department maintains a contract with a major commercial hazardous materials response company to provide additional containment and clean-up support for large scale incidents. In 2007, the HMIS received 315 complaints, 231 of which were spills or leaks of petroleum based substances. There were 54 hydraulic oil (mostly from trash trucks), 41 home heating fuel oil , 48 gasoline, 35 diesel fuel, 26 motor oil and 17 mineral oil spills. Other releases involved antifreeze, paint, sewage and mercury. Storm drains and waterways were involved in 53 of these releases.

The HMIS works with the DPWES and the Department of Planning and Zoning to ensure that responsible persons take responsibility for spill control and cleanup by enforcing codes and ordinances. HMIS issues criminal citations during investigations of hazardous materials incidents and utilizes enforcement action to protect and restore the environment, and to ensure that costs incurred by the county are recovered.

The HMIS conducts long-term monitoring of contaminated sites that may contact surface waters or stormwater management facilities. As a part of the oversight program, the HMIS processes requests to discharge treated groundwater into the storm drainage system from remedial activities at those sites. The HMIS then monitors the discharge for the duration of the agreement. In 2007, the Hazardous Materials Technical Support Branch managed 63 sites with ongoing remediation activities and opened ten additional oversight files. Twenty-three oversight files were closed in 2007; the remainder will be carried into 2008.

## Countywide Dump Site Removal Program

Illegal dumpsites can block or divert stormwater flows, pollute stormwater runoff and create aesthetic problems. Fairfax County removes dump sites on public property. Cleanups involve removing debris from stream channels, drainage basins and surrounding areas. In 2007, the county removed material from two illegal dump sites (Figure 3.1).

**Figure 3.1. Left - Robin Way Court dump site. Right - William Lane dump site. (Photo by Fairfax County)**

# 4. Monitoring and Assessment

Fairfax County oversees a vigorous monitoring program that includes activities designed to characterize waterbodies, identify problems and assess the effectiveness of stormwater controls. This section discusses ongoing monitoring and watershed assessment programs in water quality and stream health administered by the Fairfax County Department of Public Works and Environmental Services and other regional partners.

## Water Quality Monitoring

### Watershed Monitoring

Two long-term monitoring stations were established in 2005; one in a medium to high density residential area in the Accotink Creek watershed; and the other in a low density residential area in the Sandy Run watershed. Automated sampling equipment (Figure 4.1) was used to collect stormwater. Collection was triggered by pre-set rainfall amount and stream stage level. Sampling devices recorded rainfall amount, flow levels, pH and temperature at timed intervals. Four storms were monitored in 2007, and the data were combined with 2005 and 2006 storm data. Pollutant concentrations at the two stations were compared statistically. Nutrient loadings (nitrogen compounds and phosphorus) were significantly higher at the medium to high density residential land use site than at the low density site. Results were submitted to the Virginia Department of Conservation and Recreation in the 2007 VPDES permit annual report.

**Figure 4.1. Watershed monitoring equipment: left to right, automatic sampler with bubble flow modules; pH and temperature monitors; tipping bucket rain gauge. (Photo by Fairfax County)**

### Dry and Wet Weather Monitoring

Identifying and removing illegal or improper connections to storm drainage systems and receiving waters is a measure for reducing stormwater pollution. In 2007, the county selected 103 storm drainage outfalls for dry weather screening and recorded physical parameters at each outfall in accordance with the "Dry Weather Screening Program – Site Selection and Screening Plan." Water was found to be flowing at 19 of the outfalls, and was tested for a range of pollutants including ammonia, conductivity, surfactants, fluoride, pH, potassium, phenol, copper and chlorine. Low levels of copper and fluoride were detected at six of the outfalls tested. Upon retesting these sites, four continued to exceed the screening criteria, and further testing was conducted to track down the source. A map of the storm drainage system and a GPS unit were used to track the network of sites. Observations of flowing water and land use were recorded, and water was tested where flow was found. This procedure was followed through the network of stormwater pipes until there was no water flowing. A specific source of pollutants could not be found at any of the four sites.

Wet weather screening and industrial high risk monitoring were conducted at six sites, twice in 2007. Using the county's GIS data layers and procedures outlined in the "Wet Weather

Screening and Industrial/High Risk Monitoring Program – 2006 Site Selection and Screening Plan," these sites were identified as industrial and commercial facilities with high potential for discharging pollutants. Monitoring consisted of automatic sampling at outfalls or in manholes, which enabled calculations for event mean concentrations and for first-flush sampling for oil and grease and chemical oxygen demand. The water chemistry data did not reveal a significant source of pollution in the stormwater from any of the sites when compared to the Center for Watershed Protection's Illicit Discharge Detection and Elimination.

### Kingstowne and South Van Dorn Street Monitoring

The Kingstowne Environmental Monitoring Program provides information to protect Huntley Meadows Park from the detrimental effects of upstream development, particularly excessive sediments and phosphorus, in the Dogue Creek watershed. Two stations (Kingstowne and South Van Dorn) were monitored to comply with a U.S. Army Corps of Engineers permit. Data are also used to evaluate the effectiveness of the Dogue Creek Watershed Stormwater Control Plan in removing phosphorus from stormwater discharges. From July 2006 through June 2007, 20 storm event samples were collected at the two stations using automated samplers. Erosion and sedimentation controls, including stormwater best management practices, are minimizing sediment loads to Dogue Creek. However, the permit phosphorous load reduction target of 50 per cent was not attained for South Van Dorn during the monitoring period. The mean annual total phosphorus concentration measured at South Van Dorn during storm events was 0.164 mg/L, which is equal to a 45.3 per cent removal rate. This was the fifth consecutive monitoring year that the reduction requirement was not met. The county and the Corps are conducting further evaluations to determine why the 50 per cent requirement has not been attained.

## Biological Monitoring

### Approach

The Fairfax County biological stream monitoring program includes an annual sampling of fish and macroinvertebrate communities in wadeable, non-tidal freshwater streams (Figure 4.2).

**Figure 4.2. Left - ecologists collect macroinvertebrates from a county stream in spring 2007. Right - Fish are collected in late summer. (Photo by Fairfax County)**

Benthic macroinvertebrates are organisms lacking a backbone, which inhabit the stream bottom and are large enough to be seen with the naked eye (Figure 4.3). These organisms include aquatic snails, water mites, worms, leeches, crustaceans and many types of insects (both larval and adult forms). These creatures are an integral and critical part of a healthy stream ecosystem and serve many important functions, including forming the core diet of most fishes.

**Figure 4.3. A county ecologist identifies macroinvertebrates in the lab. (Photo by Fairfax County)**

Countywide biological monitoring is conducted annually using a probabilistic design approach. Using this approach, statistically valid inferences may be made about the condition of the county's streams. Each year, all potential sampling sites are stratified by stream order (first through fifth order) and 40 sites are selected randomly for monitoring. At these sites, samples are collected for both benthic macroinvertebrates and fish (once annually) and for *E. coli* bacteria concentration (four times annually). Water quality and stream habitat characteristics are evaluated. As more data are collected and compiled, meaningful trends can be inferred with greater confidence. The previous year's annual stream reports are available online at www.fairfaxcounty.gov/dpwes/stormwater/streams/streamreports.htm or in the biological monitoring program's standard operating procedures manual. Figure 4.4 (below) shows the locations of the 2007 monitoring sites and their respective stream orders.

The biological health of the benthic macroinvertebrate and fish communities is quantified using a multi-metric Index of Biological Integrity (IBI), which numerically rates various functions of the biological assemblage such as pollution tolerance, community diversity, active ecological functions and other characteristics. An IBI has been developed for macroinvertebrate and fish communities. The macroinvertebrate IBI is applied to all 40 sites, while the fish IBI is applied to sites with drainage areas greater than 300 acres (approximately half of the sites). Headwater streams with small drainage areas typically harbor very few fish.

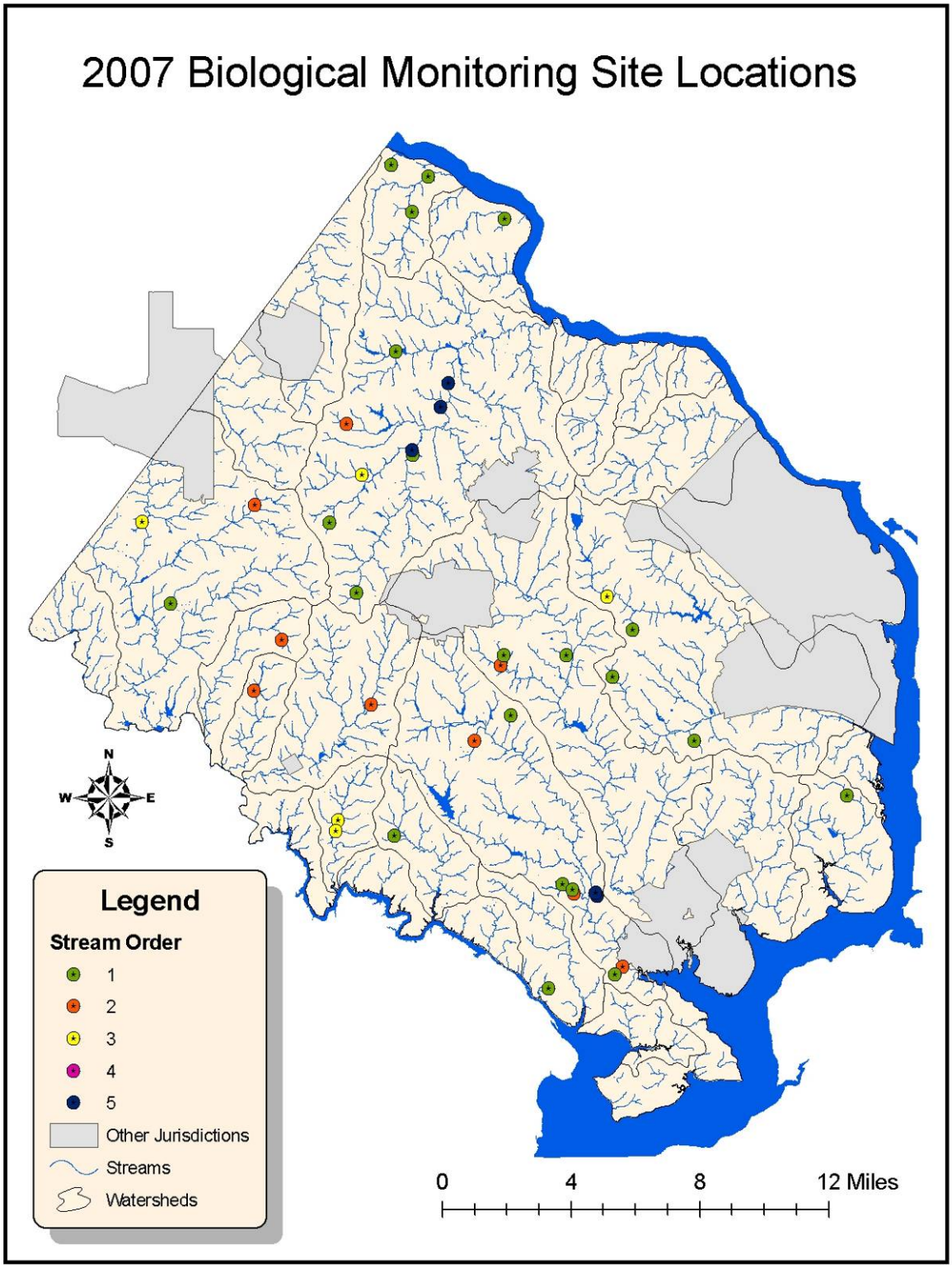



**Figure 4.4. Location of 2007 biological monitoring sites**

**Results**

Figures 4.5 and 4.6 show the results of the countywide distribution of macroinvertebrate and fish IBI scores, respectively.

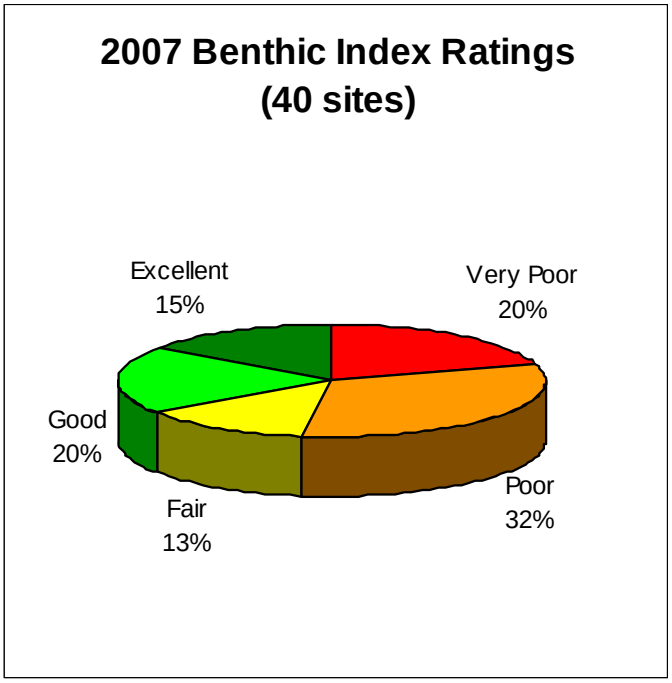



**Figure 4.5. Countywide distribution of benthic macroinvertebrate IBI ratings**

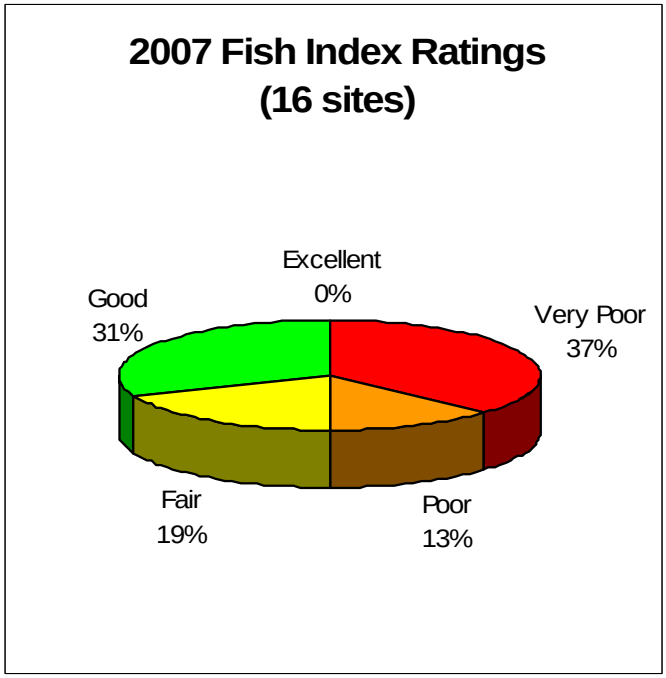



**Figure 4.6. Countywide distribution of fish IBI ratings**

The Northern Virginia region experienced a severe drought during the summer of 2007 (after macroinvertebrates were sampled). The annual rainfall total was eight inches in deficit at the beginning of the fish sampling season in August. As a result, several of the smaller fish sampling sites were dry or too low to sample (only very shallow standing pools were remaining). This resulted in 16 sites being sampled for fish. This drought condition may explain some of the differences seen when comparing the fish and macroinvertebrate IBIs.

Table 4.1 shows a breakdown (stratified by stream order) of the 2007 biological monitoring results for benthic macroinvertebrates and the scoring ranges for the rating categories. Table 4.2 shows the monitoring results at individual sites.

**Table 4.1. 2007 benthic macroinvertebrate sampling results by stream order**

| Stream Order | Number of Samples | Minimum Score | Maximum Score | Standard Deviation | Mean IBI Score | Rating |
|---|---|---|---|---|---|---|
| 1 | 21 | 9.8 | 91.7 | 29.2 | 48.3 | Fair |
| 2 | 9 | 8.3 | 89.9 | 25.0 | 32.7 | Poor |
| 3 | 5 | 12.0 | 64.7 | 21.0 | 29.3 | Poor |
| 4 & 5 | 5 | 23.2 | 61.1 | 15.5 | 39.7 | Poor |
| ALL | 40 | 8.3 | 91.7 | 26.4 | 41.3 | Fair |

| Rating Category | Score Range |
|---|---|
| Excellent | 80 - 100 |
| Good | 60 - 79.9 |
| Fair | 40 - 59.9 |
| Poor | 20 - 39.9 |
| Very Poor | 0 - 19.9 |

**Table 4.2. 2007 biological sampling results for individual monitoring sites**

| Map Code | Site ID | Watershed | Physiographic Province | Stream Order | Drainage Area | | Benthics | | Fish | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Acres | Miles$^2$ | IBI* | Rating | IBI* | Rating |
| 1 | AC0702 | Accotink Creek | Piedmont | 1 | 226.45 | 0.35 | 18 | Very Poor | N/A | |
| 2 | AC0703 | Accotink Creek | Piedmont | 1 | 234.33 | 0.37 | 16 | Very Poor | N/A | |
| 3 | AC0704 | Accotink Creek | Piedmont | 2 | 764.59 | 1.19 | 29 | Poor | 43 | Fair |
| 4 | CA0701 | Cameron Run | Piedmont | 1 | 66.85 | 0.10 | 37 | Poor | N/A | |
| 5 | CA0702 | Cameron Run | Piedmont | 1 | 403.13 | 0.63 | 30 | Poor | 0 | Very Poor |
| 6 | CA0703 | Cameron Run | Coastal Plain | 1 | 229.18 | 0.36 | 60 | Good | N/A | |
| 7 | CA0704 | Cameron Run | Piedmont | 3 | 2,920.73 | 4.56 | 20 | Poor | 50 | Fair |
| 8 | CU0701 | Cub Run | Triassic Basin | 2 | 666.40 | 1.04 | 24 | Poor | 21 | Very Poor |
| 9 | CU0702 | Cub Run | Triassic Basin | 3 | 9,005.75 | 14.07 | 35 | Poor | 7 | Very Poor |
| 10 | CU0703 | Cub Run | Triassic Basin | 1 | 533.82 | 0.83 | 20 | Poor | 21 | Poor |
| 11 | DF0701 | Difficult Run | Piedmont | 5 | 18,439.52 | 28.81 | 47 | Fair | 57 | Good |
| 12 | DF0702 | Difficult Run | Piedmont | 5 | 19,686.40 | 30.76 | 61 | Good | 64 | Good |
| 13 | DF0703 | Difficult Run | Piedmont | 2 | 353.4 | 0.55 | 8 | Very Poor | 7 | Very Poor |
| 14 | DF0704 | Difficult Run | Piedmont | 1 | 176.8 | 0.28 | 23 | Poor | N/A | |
| 15 | DF0705 | Difficult Run | Piedmont | 1 | 89.0 | 0.14 | 57 | Fair | N/A | |
| 16 | DF0706 | Difficult Run | Piedmont | 1 | 77.9 | 0.12 | 78 | Good | N/A | |
| 17 | DF0707 | Difficult Run | Piedmont | 1 | 292.1 | 0.46 | 15 | Very Poor | DRY | |
| 18 | DF0708 | Difficult Run | Piedmont | 3 | 1,721.0 | 2.69 | 70 | Good | 57 | Good |
| 19 | DF0709 | Difficult Run | Piedmont | 5 | 11,695.6 | 18.27 | 41 | Fair | 50 | Fair |
| 20 | JM0701 | Johnny Moore Creek | Piedmont | 2 | 1,072.2 | 1.68 | 45 | Fair | DRY | |
| 21 | LH0701 | Little Hunting Creek | Coastal Plain | 1 | 519.8 | 0.81 | 17 | Very Poor | 7 | Very Poor |
| 22 | LR0701 | Little Rocky Run | Piedmont | 2 | 279.8 | 0.44 | 14 | Very Poor | N/A | |
| 23 | MB0701 | Mill Branch | Piedmont | 1 | 71.0 | 0.11 | 88 | Excellent | N/A | |
| 24 | NI0701 | Nichol Run | Piedmont | 1 | 65.6 | 0.10 | 34 | Poor | N/A | |
| 25 | NI0702 | Nichol Run | Piedmont | 1 | 23.5 | 0.04 | 67 | Good | N/A | |
| 26 | NI0703 | Nichol Run | Piedmont | 1 | 20.3 | 0.03 | 69 | Good | N/A | |
| 27 | PC0701 | Pohick Creek | Piedmont | 2 | 401.1 | 0.63 | 12 | Very Poor | DRY | |
| 28 | PC0702 | Pohick Creek | Piedmont | 1 | 39.3 | 0.06 | 32 | Poor | N/A | |
| 29 | PC0703 | Pohick Creek | Piedmont | 5 | 13,421.3 | 20.97 | 23 | Poor | 57 | Good |
| 30 | PC0704 | Pohick Creek | Piedmont | 5 | 13,403.2 | 20.94 | 26 | Poor | 71 | Good |
| 31 | PC0705 | Pohick Creek | Piedmont | 2 | 204.6 | 0.32 | 90 | Excellent | N/A | |
| 32 | PC0706 | Pohick Creek | Piedmont | 2 | 496.9 | 0.78 | 29 | Poor | 0 | Very Poor |
| 33 | PC0707 | Pohick Creek | Piedmont | 1 | 22.1 | 0.03 | 79 | Good | N/A | |
| 34 | PC0708 | Pohick Creek | Piedmont | 1 | 21.6 | 0.03 | 92 | Excellent | N/A | |
| 35 | PC0709 | Pohick Creek | Piedmont | 1 | 117.7 | 0.18 | 10 | Very Poor | N/A | |
| 36 | PH0701 | Popes Head Creek | Piedmont | 2 | 139.8 | 0.22 | 42 | Fair | N/A | |
| 37 | PN0701 | Pond Branch | Piedmont | 1 | 12.9 | 0.02 | 85 | Excellent | N/A | |
| 38 | SA0701 | Sandy Run | Piedmont | 1 | 180.5 | 0.28 | 87 | Excellent | N/A | |
| 39 | WR0701 | Wolf Run | Piedmont | 3 | 1,925.5 | 3.01 | 71 | Good | DRY | |
| 40 | WR0702 | Wolf Run | Piedmont | 2 | 2,717.2 | 4.25 | 90 | Excellent | 36 | Poor |

* Benthic and Fish IBI's have a maximum score of 100

Overall, both IBI distributions showed that approximately 50 per cent of the sites evaluated exhibited either "poor" or "very poor" biological conditions. When compared to previous years, this is an improvement over the 70 to 80 per cent seen typically. This may be a result of the random site selection (it is possible for better groups of sites to be chosen in some years). Lacking future sampling results, it would be imprudent to assume that 20 per cent of the streams countywide have improved significantly in biological condition. Biological responses to environmental improvement usually take much longer than the responses to environmental degradation. The countywide stream quality index, described in the following sub-section, is a way of tracking and evaluating these conditions over time.

**Stream Quality Index**

A number of key indicators have been developed to support the Fairfax County Board of Supervisors' Environmental Agenda. One is used to measure watershed and stream quality. This is known as the Stream Quality Index (SQI). Benthic macroinvertebrate IBI data from the biological monitoring program (based on the probabilistic design approach which began in 2004) were used to develop this indicator.

The number of sites placed in each of five rating categories ("excellent," "good," "fair," "poor," or "very poor" based on the benthic macroinvertebrate monitoring data) was used to develop a stream quality index value of overall stream conditions countywide. This index value is computed by multiplying the percentage of total sites rated "excellent" by five, those rated "good" by four, those rated "fair" by three, those rated "poor" by two and those rated "very poor" by one and then taking each of those numbers and dividing it by the total number of sites. The values are then summed, resulting in a single numeric index ranging from one to five with a higher value indicating better stream biological conditions. Thus, an SQI value of five would correspond to all streams countywide as being rated "excellent." An index of 2.5 would indicate that conditions are intermediate between "fair" and "poor" and an index score of one corresponds to "very poor."

Table 4.3 shows the SQI for all years probabilistic monitoring has been employed. The 2007 SQI shows an increase in overall stream quality from previous years. However, it is difficult to draw solid conclusions about environmental trends based on data from four sampling years. Additionally, it is uncertain what effects changing climatic conditions (i.e., drought, warming) may have on the index and inferred trends. This index will be reported annually to evaluate long-term trends in the overall health of streams. As more data are reported annually, emerging trends can be identified with greater certainty.

**Table 4.3. Countywide Stream Quality Index for sampling years 2004 - 2007**

| Sampling Year | Percentage of Total Sites | | | | | Index Value |
|---|---|---|---|---|---|---|
| | Very Poor | Poor | Fair | Good | Excellent | |
| 2004 | 33 | 27 | 20 | 10 | 10 | 2.37 |
| 2005 | 15 | 43 | 25 | 8 | 10 | 2.55 |
| 2006 | 48 | 25 | 14 | 11 | 2 | 1.95 |
| 2007 | 20 | 33 | 14 | 19 | 15 | 2.78 |

Table 4.4 presents a summary of biological monitoring data collected countywide over the last four sampling years. Results are presented by watershed to give a general indication of stream

conditions within each watershed. Due to the random site selection methodology employed, some watersheds have not been sampled for benthic macroinvertebrates and/or fish. For general conditions of these particular watersheds, see the 2001 Stream Protection Strategy (SPS) Baseline Study at www.fairfaxcounty.gov/dpwes/environmental/sps_main.htm. The data reported in the SPS study were collected in 1999 and watershed conditions may have changed significantly since that time. Additionally, section four of the 2006 annual stream report has detailed watershed condition maps showing the results of county and resident volunteer monitoring data from 1999 through 2005 and can be found at www.fairfaxcounty.gov/dpwes/stormwater/streams/streamreports.htm.

**Table 4.4. Overall watershed conditions for sampling years 2004 - 2007 combined**

**Overall Watershed Conditions (2004-2007)**

| Watershed | Benthics | | | Fish | | |
|---|---|---|---|---|---|---|
| | Number of Sites | Average IBI | Rating | Number of Sites | Average IBI | Rating |
| Accotink Creek | 16 | 23.5 | Poor | 9 | 31.7 | Poor |
| Belle Haven | 2 | 12.2 | Very Poor | 1 | 14.3 | Very Poor |
| Bull Neck Run | N/A | | | | | |
| Bull Run | 1 | 39.6 | Poor | N/A | | |
| Cameron Run | 10 | 32.3 | Poor | 6 | 17.9 | Very Poor |
| Cub Run | 10 | 29.5 | Poor | 8 | 32.1 | Poor |
| Dead Run | 2 | 23.5 | Poor | N/A | | |
| Difficult Run | 36 | 39.5 | Poor | 20 | 50.4 | Fair |
| Dogue Creek | 3 | 21.5 | Poor | 2 | 42.9 | Fair |
| Four Mile Run | N/A | | | | | |
| High Point | N/A | | | | | |
| Horsepen Creek | N/A | | | | | |
| Johnny Moore Creek | 3 | 40.8 | Fair | 1 | 64.3 | Good |
| Kane Creek | 1 | 40.9 | Fair | N/A | | |
| Little Hunting Creek | 4 | 18.4 | Very Poor | 4 | 12.5 | Very Poor |
| Little Rocky Run | 7 | 20.8 | Poor | 3 | 54.8 | Fair |
| Mill Branch | 2 | 57.2 | Fair | N/A | | |
| Nichol Run | 5 | 67.5 | Good | N/A | | |
| Occoquan | 2 | 88.9 | Excellent | N/A | | |
| Old Mill Branch | N/A | | | | | |
| Pimmit Run | 1 | 7.8 | Very Poor | N/A | | |
| Pohick Creek | 23 | 34.7 | Poor | 11 | 50.6 | Fair |
| Pond Branch | 4 | 51.4 | Fair | 1 | 35.7 | Poor |
| Popes Head Creek | 11 | 49.2 | Fair | 7 | 64.3 | Good |
| Ryans Dam | N/A | | | | | |
| Sandy Run | 4 | 68.2 | Good | N/A | | |
| Scotts Run | 1 | 13.3 | Very Poor | 1 | 0 | Very Poor |
| Sugarland Run | 4 | 50.6 | Fair | 1 | 42.9 | Fair |
| Turkey Run | N/A | | | | | |
| Wolf Run | 2 | 80.4 | Excellent | 1 | 35.7 | Poor |
| Fairfax County | 154 | 37.7 | Poor | 76 | 41.5 | Fair |

## Bacteria Monitoring

In 2007, the Fairfax County Stormwater Planning Division undertook an initiative to review and update Fairfax County's bacteria monitoring program to ensure that it is consistent with current standards and practices and uses the most effective procedures. Work included reviewing site selection (past and present) and field and laboratory methods. This review also included compiling information on other bacteria monitoring approaches that might enhance the county's program.

As recommended by the U.S. Environmental Protection Agency, the bacterium *Escherichia coli* (*E. coli*) is now used, and will continued to be used, by Fairfax County as the water quality indicator for fecal contamination in surface water. In 2007, SWPD completed its fourth year collecting data for the bacteria monitoring program since acquiring the program from the Fairfax County Health Department. To determine levels of *E. coli* in county streams, grab samples of stream water were taken at 47 sites in 17 watersheds throughout the county. A severe drought adversely impacted the number of samples collected. Staff collected samples three times during the year of program assessment.

According to the Virginia DEQ, the following standard now applies for primary contact recreation to all surface water:

- *E. coli* shall not exceed a geometric mean of 126 per 100 mL of water or exceed an instantaneous value of 235 per 100 mL of water.

### Water Chemistry Results

**Temperature (◦C)**
Minimum……0.3
Maximum……..25.5
Average ……12.3
**Dissolved Oxygen (mg/L)**
Minimum……3.5
Maximum……..19.2
Average …….9.4
**Specific Conductance (µs/cm)**
Minimum……64
Maximum……..1167
Average ……298.2
**pH**
Minimum……...5.8
Maximum……..8.3
Average ……7.0
**Nitrate (mg/L)**
Minimum……..<0.1
Maximum……..5.2
Average ……1.3
**Total Phosphorous (mg/L)**
Minimum……..<0.1
Maximum……..1.0
Average ……0.10

As bacteria sampling in Fairfax County was conducted three times in 2007, the geometric mean standard cannot be applied to the data. Therefore, the county's analysis is based on the frequency that the level of *E. coli* exceeded the instantaneous threshold of 235. Because there are several methodologies to determine the level of *E. coli* in surface water, each with its own unit (i.e., MPN, CFU), all discussion of *E. coli* concentration will remain unit-less at a state level.

*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. The upper limit of detection for the Quanti Tray/2000 yields a most probable number (MPN) of 2420. The remaining chemical parameters are recorded in the field using a handheld multi-probe water quality meter.

In 2007, 58 percent of Fairfax County's bacteria monitoring locations were consistently below the Virginia DEQ's standard of 235 units per 100 mL of water (Figure 4.7). Fairfax County concurs with officials from the Virginia DEQ and the Virginia Department of Health, who

caution that it is impossible to guarantee that any natural body of water is free of risk from disease-causing organisms or injury.

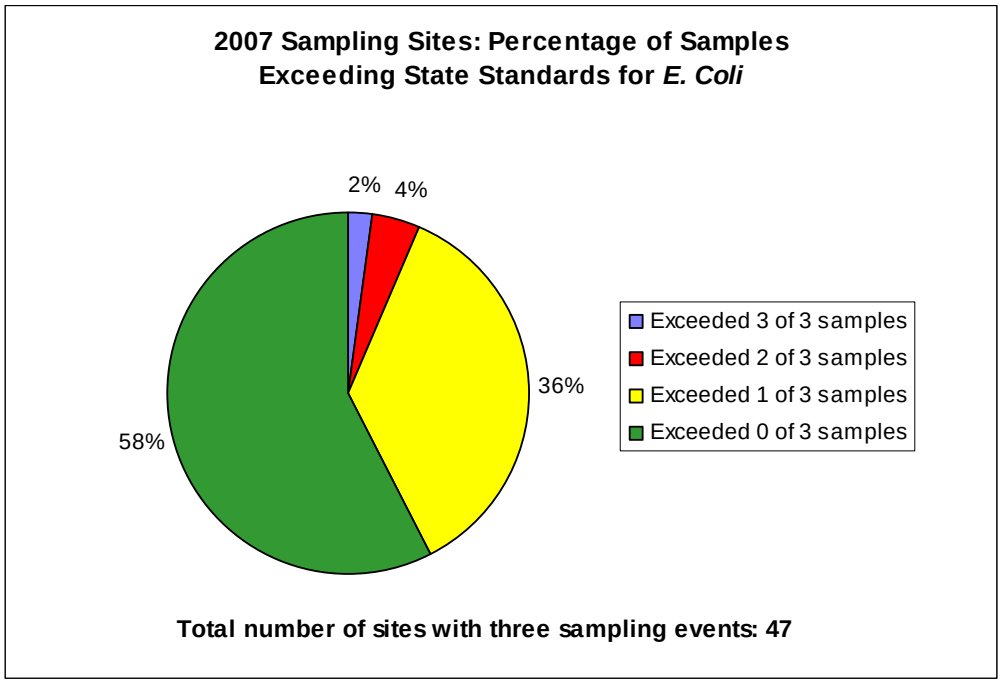



**Figure 4.7. Percentage of sites with exceedances of the state's instantaneous water quality standard for *E. coli* (235 units per 100 mL)**

Based on historical and ongoing bacteria monitoring data, the Fairfax County Health Department issues the following statement related to the use of streams for contact recreation:

- "[A]ny open, unprotected body of water is subject to pollution from indiscriminate dumping of litter and waste products, sewer line breaks and contamination from runoff of pesticides, herbicides and waste from domestic and wildlife animals. Therefore, the use of streams for contact recreational purposes such as swimming, wading, etc., which could cause ingestion of stream water or possible contamination of an open wound by stream water, should be avoided."

## Virginia Department of Environmental Quality List of Impaired Waters in Fairfax County

The Virginia Department of Environmental Quality recently released a draft summary of water quality conditions in Virginia from January 1, 2001, to December 31, 2006. The goals of Virginia's water quality assessment program are to determine whether water bodies meet water quality standards and then design and implement a plan to restore waters identified as having impaired water quality. Water quality standards designate uses for waters and define the water quality needed to support each use. There are six designated uses for surface waters in Virginia: aquatic life, fish consumption, public water supplies (where applicable), shellfish consumption, swimming and wildlife. Several subcategories of the aquatic life use have been adopted for the Chesapeake Bay and its tidal tributaries. If a water body contains more pollutants than allowed by water quality standards, it will not support one or more of its designated uses. Such waters

have "impaired" water quality and are listed on Virginia's 303(d) list as required under the Clean Water Act.

The Virginia DEQ's 2006 Water Quality Assessment Integrated Report lists 35 water bodies with a total of 96 impairments in Fairfax County. Many of these water bodies are listed for multiple impairments based on elevated levels of pollutants, high levels of contaminants in fish or reduced numbers of aquatic organisms (macroinvertebrates and/or fish). Waters listed as impaired for aquatic life uses typically exhibit substantially suppressed ecosystems. Scores for biological integrity indices of these waters rank at or below 50 per cent of the scores for natural (unimpaired) reference waters. This impaired condition is analogous to "very poor," "poor" and many of the "fair" streams as rated by the county's benthic macroinvertebrate IBI described above. Table 4.5 presents additional details on the draft list of impaired waters, including the impacted use and related water quality standard for each water body.

Once a water body has been listed as impaired, a Total Maximum Daily Load (TMDL) report identifying the sources causing the water quality problem and the reductions needed to resolve it must be developed by the DEQ and submitted to the U. S. Environmental Protection Agency for approval. Upon approval, state law requires the development of a TMDL implementation plan outlining both point and non-point source controls needed to restore water quality. These specific controls may be incorporated into any Virginia Pollutant Discharge Elimination System (VPDES) or Virginia Stormwater Management Program (VSMP) permits identified as contributing to the water quality impairment. These permits are issued by the commonwealth and are used to regulate the inputs of pollution into receiving waters. The county holds a Municipal Separate Storm Sewer System (MS4) permit, which regulates the discharge of stormwater to receiving water bodies through the county's storm drainage (stormwater conveyance) system. Once specific controls are incorporated into a permit, these controls become mandatory.

The draft report, past annual reports (including past Health Department stream reports), appendices and protocols are available on the stream quality assessment program page located at www.fairfaxcounty.gov/dpwes/stormwater/streams/assessment.htm. Additional information on the DEQ water quality program and the draft report are available at www.deq.state.va.us/water/.

**Table 4.5. DEQ 2006 List of Impaired Waters in Fairfax County**

| Water Type | Water Name | 2006 Total |
|---|---|---|
| ESTUARINE | Accotink Bay | 2 |
| | Belmont Bay | 2 |
| | Belmont Bay (Occoquan River) | 3 |
| | Dogue Creek | 3 |
| | Fourmile Run | 4 |
| | Gunston Cove | 2 |
| | Hunting Creek | 3 |
| | Little Hunting Creek | 3 |
| | Occoquan Bay | 5 |
| | Occoquan Bay/Belmont Bay | 4 |
| | Occoquan River | 3 |
| | Occoquan River/Massey Creek * | 1 |
| | Pohick Bay | 6 |
| | Potomac River * | 1 |
| TOTAL ESTUARINE WATERS | | 14 |
| TOTAL ESTUARINE IMPAIRMENTS | | 42 |
| RESERVOIR | Occoquan Reservoir | 3 |
| RIVERINE | Accotink Creek | 4 |
| | Backlick Run | 1 |
| | Broad Run ** | 4 |
| | Bull Run | 8 |
| | Cameron Run/Hunting Creek | 1 |
| | Cub Run | 1 |
| | Difficult Run | 6 |
| | Elklick Run | 2 |
| | Fourmile Run | 1 |
| | Holmes Run | 2 |
| | Indian Run | 1 |
| | Mills Branch | 1 |
| | Mine Run | 1 |
| | Pimmit Run | 7 |
| | Pohick Creek | 4 |
| | Popes Head Creek | 2 |
| | Snakeden Branch | 1 |
| | Sugarland Run | 2 |
| | Tripps Run | 1 |
| | Wolf Run | 1 |
| TOTAL RIVERINE WATERS | | 20 |
| TOTAL RIVERINE IMPAIRMENTS | | 51 |
| TOTAL WATERS | | 35 |
| TOTAL IMPAIRMENTS | | 96 |

* These two segments were broken out from existing impairments.

** This river is located in Loudoun County but Horsepen Creek drains to it.

## Volunteer monitoring

### Northern Virginia Soil and Water Conservation District

Northern Virginia Soil and Water Conservation District continues its successful volunteer stream monitoring program (Figure 4.8). This program supplements the county's stream bioassessment program. The data collected support the findings of the county's program and help to provide trend data. The data can also alert staff to emerging problems. Trained volunteers assess the ecological health of streams using the Virginia Save Our Streams protocol. Monitoring includes biological and chemical aspects and a physical habitat assessment. NVSWCD provides training, equipment, support, data processing, and quality control; there are currently 100 certified monitors. Data collected by volunteers are shared with Fairfax County, the Virginia DEQ, Virginia Save Our Streams, and other interested organizations or individuals. In 2007, there were 20 active volunteer monitoring sites in Fairfax County. More information can be found at www.fairfaxcounty.gov/ nvswcd/monitoring.htm.

**Figure 4.8. NVSWCD volunteers use a seine to sample a stream. (Photo by Fairfax County)**

NVSWCD, in partnership with the DPWES, the Fairfax County Park Authority and the U.S. Geological Survey (USGS), continued its temperature monitoring program in riparian restoration areas. Tiny devices called "iButtons" placed in streams record water temperatures every half-hour. Once a month, trained volunteers download the logged temperature data using handheld computers. An article about the program is available on the NVSWCD Web site, www.fairfaxcounty.gov/nvswcd/newsletter/ usgs.htm.

### Audubon Naturalist Society Water Quality Monitoring Program

The Audubon Naturalist Society's Water Quality Monitoring Program recruits, trains, equips and organizes volunteers to evaluate stream health throughout the region. Volunteers assess macroinvertebrate community composition and habitat conditions at specific points throughout the year (May, July and September, with an optional winter sample). Readings of pH and water temperature are taken concurrently. There are five Audubon Naturalist Society sites within Fairfax County. The data collected are shared with the Fairfax County DPWES, the Virginia DEQ, the Virginia Department of Game and Inland Fisheries and the National Park Service.

## USGS Monitoring Network

In June 2007, a joint funding agreement between the DPWES Stormwater Planning Division and USGS was signed by the Board of Supervisors. This agreement established a network of four automated continuous stream gauging stations (Figure 4.9) and ten less-intensely monitored sites countywide. The automated stations (constructed in 2007 but not yet fully operational) will collect flow data and water quality data every 15 minutes, which are posted to a USGS Web page within two hours of collection. These stations capture storm event samples to be analyzed for sediment and nutrient levels. This study is designed to be an ongoing, long-term monitoring effort to describe conditions and trends in water quality (e.g. nutrients and sediment) and water quantity. Ultimately, the information gathered will be used to evaluate the benefits of projects implemented under the watershed planning program.

**Figure 4.9. Autosampler shelter at South Fork Little Difficult Run. (Photo by Fairfax County)**

# 5. Public Outreach and Education

The Department of Public Works and Environmental Services (DPWES) continues to work with partners from several organizations to enhance public outreach and education campaigns. Partnerships with these groups result in an organized effort to educate county residents on key elements to improve and protect the environment. In 2007, these organizations partnered with DPWES for outreach efforts:

- Alice Ferguson Foundation: organizes the Potomac River Watershed Cleanup
  - www.potomaccleanup.org www.fergusonfoundation.org
- Audubon Naturalist Society: stream monitoring program
  - www.audobonnaturalist.org
- Earth Sangha: assists and provides volunteers for tree plantings
  - www.earthsanga.org
- Friends of the Occoquan: organizes two Occoquan River cleanup events each year
  - www.friendsoftheoccoquan.org
- Fairfax Watershed Network: promotes the Potomac River Watershed Cleanup
- Fairfax ReLeaf: assists with tree plantings
  - www.fairfaxreleaf.org
- Ocean Conservancy: organizes the International Coastal Cleanup
  - www.oceanconservancy.org
- Northern Virginia Soil and Water Conservation District: provides support for outreach activities
  - www.fairfaxcounty.org/nvswcd
- Northern Virginia Regional Commission: coordinates regional pollution prevention outreach through radio public service announcements (PSAs)
  - www.novaregion.org
- Reston Association: provides support for outreach activities
  - www.reston.org
- Virginia Department of Conservation and Recreation, Adopt-A-Stream Program: provides information and assistance to individuals and groups to clean an adopted section of a stream twice a year
  - www.dcr.state.va.us
- Virginia Department of Forestry: assists with tree plantings
  - www.dof.virginia.gov

The above list includes those organizations that partnered directly with DPWES. Individual Web sites provide additional information.

## Educational Booths and Presentations

### Fairfax County Stormwater Management

Fairfax County makes presentations to various groups throughout the county regarding stormwater management and watershed basics. The presentations include an overview of watersheds, stormwater management and actions that residents can take to protect the water quality of local streams, the Occoquan Reservoir, the Potomac River and the Chesapeake Bay.

In addition, the county works with residents on each stormwater project, of which education is a component. In 2007, the county presented this information to homeowner's associations, school groups (teachers and students), civic associations, Fairfax Master Naturalist trainees, master gardeners, Northern Virginia Community College students and others.

**Figure 5.1. "Stormy the Raindrop" greets a visitor to the 2007 stormwater booth at Celebrate Fairfax. (Photo by Fairfax County)**

Fairfax County hosts educational booths at several public events annually to raise awareness among residents about stormwater issues and to encourage watershed-friendly behaviors. In 2007, Fairfax County participated as an exhibitor or environmental educator at more than 42 events, including: Celebrate Fairfax (Figure 5.1); Boy Scout Camporee at Lake Fairfax Park; Fall for Fairfax; Former Supervisor Dana Kaufman's neighborhood resource fair on October 27; Middle Potomac Watersheds public meeting on November 29; three presentations of Watersheds 101; seven presentations of the Livable Neighborhoods Program; and two presentations of the rain barrel program.

**Northern Virginia Soil and Water Conservation District**

- Demonstrated the Enviroscope watershed model 13 times to 443 youth and adults
- Gave 26 presentations to groups ranging from 20 to more than 125 on topics of interest to engineers (the new soil survey and stream restoration), landscaping companies (rain gardens) and the general public (non-point source pollution and rain barrels)
- Distributed information on environmental programs for residents and other topics of interest (e.g., environmental landscaping, stream restoration, solutions for drainage problems) at six events
- Sponsored a rain barrel program and workshops, in which 190 participants with the help of 33 volunteers built 211 rain barrels that were installed at schools and homes in the county
- Provided technical advice to 521 homeowners and homeowner associations, including 136 on-site visits to advise on erosion, drainage, pond management and other environmental problems
- Provided site-specific soils information to 232 consultants, realtors and homeowners
- Conducted three workshops for landscape professionals, government staff and homeowners on the science, components, design and installation of rain gardens. Two of the workshops included hands-on participation in building a rain garden
- Sponsored teams from Madison High School and Hidden Pond Ecology Club in the local, regional and state Envirothon, a natural resources competition for high school students
- Responded to 2,343 information inquiries by telephone, email and during office visits
- Sponsored four Saturday morning green breakfasts featuring presentations on the invasive management and ecological stewardship training programs, the tree action plan, the Chesapeake Bay program forestry initiative, recycling and solid waste, Adopt-A-Stream and stream clean-up programs.

**Fairfax County Solid Waste**

- Sponsored five household and three business hazardous waste collection events throughout the county
- Hosted five electronics recycling events in partnership with The ServiceSource Network
- Hosted information booths at Celebrate Fairfax, Fall for Fairfax, Earth Day/Arbor Day (Figure 5.2) and other events sponsored by members of the Fairfax County Board of Supervisors.

**Figure 5.2. 2007 Earth Day event. (Photo by Fairfax County)**

**Land Development Services**

In June 2007, LDS exhibited a display on erosion and sediment controls at Celebrate Fairfax.

**Reston Association**

The Walker Nature Education Center, operated by Reston Association, offered these watershed education programs in 2007:

- The center conducted weekend programs that promoted watershed appreciation and conservation, including stream and lake explorations, interpretive kayak programs, rain barrel workshops and fishing programs
- Reston Association includes watershed education, stream and lake exploration and fishing and boating activities at its summer camp programs for youth ages three to 16
- Every Reston lake has a permanent wayside exhibit with information appropriate for all ages about the lake's watershed as well as the flora and fauna that the lake supports. There is a permanent wayside exhibit at the nature center at Snakeden Branch that includes watershed and stream restoration information.

**Virginia Department of Forestry**

- Continued to plant riparian buffers throughout the county and support DPWES with their riparian project initiative. In 2007, the Virginia Department of Forestry (VDOF) worked with volunteers from organizations and school groups to plant approximately 1,500 seedlings in Fairfax County
- Worked with Fairfax County to conduct watershed and water quality presentations on a regular basis to students, homeowners, professionals and organizations. Volunteers are educated and enlisted to plant riparian buffers. Rain garden presentations and workshops are given to garden clubs, homeowner associations and professionals. Brochures and exhibits have been developed for public outreach at festivals, Arbor Day and other environmental celebrations. There were 20 such presentations given by VDOF in 2007
- Assisted Fairfax County with the agricultural and forestal district program, which provides tax incentives in agricultural and forest management for landowners with 20 acres or more of land. The protection of forest cover and water quality are promoted in the agricultural and forestal management plans. Stream management zones are

particularly noted on these plans and efforts are made to include buffers associated with agricultural uses. Eight plans were completed in 2007. VDOF completed two tree management plans for county homeowners associations that included recommendations to plant trees to reduce stormwater runoff. Two stewardship management plans advising on forest management for stormwater control, among other objectives, were developed for large landowners in the county.

## Communication Initiatives

News releases were published announcing public meetings, watershed cleanups and related information that are distributed to the public through the media, mailings and Web postings.

### Printed Materials/Mailings

A newspaper article entitled "Stormwater Requires Attention," by Pulitzer Prize winning reporter/editor Nickolas Horrock, featuring environmental messages and interviews with stormwater management staff, was published on December 12, 2007 in the Connection newspaper's McLean and Vienna (Fairfax County) editions.

In 2007, the NVSWCD published and distributed four editions of the Conservation Currents newsletter. Topics included rain garden research, pest plants, the Pohick Dam rehabilitation, native plants, Neighborhood Ecological Training Program, soil nutrients, disappearing dogwoods, low impact development for stormwater, managing invasive plants and managing manure.

#### *Stormwater Management*

In 2007, DPWES was developing three brochures for the general public on the following topics:

- proper disposal of swimming pool water
- the floatables monitoring program
- stormwater detention basins

#### *Health Department*

Mailed 14,329 flow diversion valve reminder notices. These are sent to homeowners on the anniversary of the installation of their septic system to remind them to turn their flow diversion valve once a year. It reminds them to pump out their septic tank every three to five years.

#### *Reston Association*

The Walker Nature Education Center, operated by Reston Association, continued to distribute printed watershed education materials at the center and at community events, including "Helping Our Watersheds: Living in the Potomac and Chesapeake Bay Watershed," "Understanding, Preserving and Enjoying Reston's Lakes and Streams," and "Rain Barrels."

#### *Fairfax County Park Authority*

The Park Authority developed and released a brochure, "Water," which describes the effect of stormwater on our streams as well as tips for the homeowner.

***Solid Waste***

- Created and distributed a new electronics recycling brochure
- Created and distributed a new brochure regarding proper disposal techniques for compact fluorescent lamps
- Created and distributed new brochures to businesses regarding the county's revised solid waste ordinance, chapter 109.1, which requires all nonresidential and multifamily properties in Fairfax County to recycle paper and cardboard.

**Television**

***Fairfax County Stormwater Management***

- Public service announcements aired on Fairfax County's channel 16 in English and Spanish. "Only Rain Down the Drain," addresses the issue of illegal dumping into storm drains and streams
- A six minute television program about the history of stormwater management and how residents can make a difference in the environment was initiated in December 2007 and aired on Fairfax County's channel 16, reaching an audience of 300,000 residents.

**Radio - Regional Pollution Prevention Outreach Campaign**

As a member of the Northern Virginia Clean Water Partners, Fairfax County participates in the annual regional stormwater education campaign. Calendar year 2007 marked the third year of the campaign, with "The Call" public service announcement airing 926 times on nine radio stations including one Spanish language station. In addition, the partners developed complementing print, video- and Web-based products (www.onlyrain.org) to aid in raising the awareness of Northern Virginia residents about behaviors leading to non-point source pollution and the actions residents can take to protect local and regional water quality.

**Digital Media**

***Stormwater Management Web Site***

- Stormwater Management Web sites (main page: www.fairfaxcounty.gov/dpwes/stormwater) received more than 7,000 hits in 2007
- In December of 2007, the watershed management planning Web sites were moved from off site to be hosted by the county. This move will allow the county to provide consistent information to county residents on watershed plans that have been completed and information on upcoming plans
- Get involved in your watershed Web site: www.fairfaxcounty.gov/dpwes/watersheds/involved.

***Northern Virginia Soil and Water Conservation District Web Site***

A broad array of information on environmental topics and newsletter articles are located at www.fairfaxcounty.gov/nvswcd.

***Solid Waste Web Site***

- Maintained the Know Toxics Web page (www.knowtoxics.com) in partnership with the Northern Virginia Regional Commission (NVRC) and the Northern Virginia Regional Waste Board
- Provided updates and revisions to the Recycling and Trash portion of the county Web site to ensure the most up-to-date information for county residents.

***Web Podcasts***

Podcast messages that air through www.fairfaxcounty.gov were initiated in 2007. The podcasts receive 50 hits a day, seven days a week for a weekly audience of 350. Ninety-seven percent of podcast listeners are Fairfax County residents. Topics include: general lawn care, water efficiency, watering cycles, fertilization, soil amendment, mowing strategies, pesticides, herbicides, erosion and sediment control, dumping into storm drains, discharging swimming pool water, disposal of household hazardous waste and picking up pet waste.

## Storm Drain Marking Program

- In partnership with DPWES, NVSWCD continued the Storm Drain Marking Program to provide markers or stencils to be placed on storm drain inlets
- DPWES and NVSWCD sponsored the storm drain education, pollution prevention program. In 2007, 48 community education programs were carried out by county residents who educated their neighbors about the connection between storm drains and waterways. They glued pre-printed decals reading "No Dumping - Drains to Potomac River [or local watershed]" to the top of storm drain inlets. DPWES purchased the decals as part of its watershed implementation program. As a result, 21,297 homes in Fairfax County received non-point source pollution prevention education and 5,210 storm drains were labeled. Nine hundred and nine volunteers, including scout groups, homeowner association members, middle and high school students and individuals, gave more than 2,000 hours of their time as part of this pollution prevention effort.

## Rain Barrel Program

In 2007, nine “build-your-own” rain barrel workshops were held in Fairfax County including two free rain barrel workshops for teachers and one “train the trainer” event for volunteers. Workshops were held at Hollin Meadows Elementary School, Waples Mill Elementary School, Westfield High School, the Reston Nature Center, Hidden Oaks Nature Center, Frying Pan Farm Park and the Sully Governmental Center. One hundred and ninety people participated in these programs and 211 rain barrels were distributed in Fairfax County. Thirty-three volunteers participated in the program. Volunteers helped participants build their barrels at the workshops and cleaned and washed barrels in preparation for workshops (Figure 5.3). The

**Figure 5.3. A rain barrel built and decorated by volunteers channels roof runoff into a garden terrace. (Photo by Fairfax County)**

program was coordinated by NVSWCD. Workshops were led by NVSWCD (6), the Reston Association (2) and DPWES-SWPD (1). Additional program partners included Fairfax County Public Schools, the Fairfax County Park Authority and Fairfax County Master Gardeners. Additional jurisdictions involved in the larger Northern Virginia rain barrel effort included the City of Alexandria (1 workshop in 2007) and Arlington County (3 workshops in 2007) in partnership with Arlingtonians for a Clean Environment. NVSWCD developed a conservation landscaping display, which included information about rain barrels. This display was shown at numerous fairs and events throughout the county. NVSWCD hosted a booth focused on rain barrels at the Middleridge Night Out event in August 2007. Average attendance at this event is 150 people.

## "Explore Your Watershed" Walks

In 2007, Fairfax County continued to partner with the Audubon Naturalist Society and NVSWCD to host an ongoing series of watershed walks. These walks provide an opportunity for residents to learn more about the organisms living in Fairfax County's stream valleys, the pollution that threatens them and how people can work together to improve the quality of local waterways. Watershed walks were conducted in the following watersheds in 2007:

- Bull Run
- Nichol Run
- Pohick Creek
- Thompson Creek (in Kane Creek watershed).

## Watershed Cleanups

In 2007, the Fairfax County Floatables Monitoring Program fulfilled the floatables monitoring and Adopt-A-Stream requirements of the Virginia Pollutant Discharge Elimination System permit by:

- Obtaining floatables survey data from organizations that sponsored stream cleanups in 2006
- Developing and populating a Microsoft Access data base with 2006 floatables survey data
- Developing outreach and educational materials including a floatables data entry form, content for a floatables monitoring program Web site and a floatables monitoring program brochure
- Producing a floatables monitoring report.

The county promoted the Adopt-A-Stream program by providing support and staff for various stream and river cleanup events.

The county continues to work with and support the following organizations that coordinate volunteer cleanups:

- The Alice Ferguson Foundation (Potomac River Watershed Cleanup)
- The Virginia Department of Conservation and Recreation
- The International Coastal Cleanup
- The Friends of the Occoquan

**Figure 5.4. Left - Bags of trash collected during the spring 2007 Occoquan River Cleanup. Right - volunteers remove debris from the shores of the Occoquan Reservoir during the International Coastal Cleanup in fall 2007. (Photo by Fairfax County)**

Cleanups take place throughout the year as part of the Virginia Department of Conservation and Recreation's Adopt-A-Stream program in county parks. In spring 2007, 117 sites were established throughout the county for the annual Alice Ferguson Foundation Potomac River Cleanup. More than 94,000 pounds of trash were removed. In fall 2007 during the International Coastal Cleanup, 736 volunteers removed 37,536 pounds of trash (18.8 tons) from 32 sites (Figure 5.4).

The Fairfax County Park Authority administers an Adopting Partners program to encourage stewardship of county parklands. Through the program, FCPA has established partnerships with McLean Youth Soccer Team to remove trash from Lewinsville Park; nearby homeowners and civic associations to remove trash from McLean High Park; Fairfax Trails and Streams to remove trash from Pimmit Run Stream Valley Park; the Greater Hillwood Citizens Association to remove debris from Azalea Park and recycle plastic and aluminum from surrounding homes; and nearby civic associations to remove debris from John Mastenbrook-Greenway Downs Park.

## Stream Buffer Restoration and Seedling Sale

Fairfax County continued its countywide riparian buffer restoration project in collaboration with its partners to mitigate stormwater runoff into local streams and to support the Board of Supervisors' adopted Environmental Agenda.

In 2007, Fairfax County continued to partner with NVSWCD to provide assistance with their annual seedling sale. This program emphasizes the role of vegetation in preventing erosion, conserving energy and decreasing and filtering stormwater runoff. A variety of 8,250 native tree and shrub seedlings were sold to help promote urban reforestation, habitat enhancement and water quality protection.

The Fairfax County Park Authority, Fairfax ReLeaf and the Virginia Department of Forestry hosted independent stream buffer restorations in 2007. The FCPA completed the third year of riparian buffer enhancement. There are 30 projects on parkland throughout the county. These projects focus on the conversion of mowed grass to areas of native trees and shrubs typical of

riparian areas. Project size varies from a few to hundreds of trees. In 2007, 7.73 acres were planted with more than 1,600 native trees and shrubs.

The FCPA, with strong volunteer support, continued the aggressive management of invasive, non-native plants on more than 33 acres of parkland as part of the Invasive Management Area (IMA) program. More than half of the management sites are within Resource Protection Areas, where the invasive species interfere with forest function of critical riparian buffer vegetation. Thirteen hundred native plants, trees, shrubs and ground covers were planted at 15 IMA sites.

The FCPA offered the first Invasive Conservation Corps internship. Nine interns worked to remove 16 non-native species from 15 acres of parkland at 21 parks.

## Public School Environmental Education Partnerships

### Fairfax County Public Schools Curriculum

Environmental issues and concerns are a part of many science courses. The Fairfax County Public Schools curriculum for approximately 14,000 seventh grade students includes a course titled "Investigations in Environmental Science." Students study basic ecology concepts and how to apply them to their local watershed and the Chesapeake Bay ecosystem. The biology curriculum for approximately 10,000 ninth grade students includes exploring the interactions of populations in ecology. The course in Geosystems includes a section on the hydrologic cycle and a study of the effect of economic and public policy on natural resources. This course exposes students to specific environmental projects in the county. Students in advanced courses in biology and environmental science complete school-based projects that examine geomorphologic changes, nonpoint source pollution and stream monitoring.

### Meaningful Watershed Experience Program

Fairfax County Stormwater Management continued to partner with Fairfax County Public Schools to implement the Meaningful Watershed Field Experience Program. The program incorporates field trips for students in the seventh grade “Investigations in Environmental Science” course, and creates a hands-on learning experience that calls for the students to collect data on and analyze a variety of water quality parameters. Course materials were adapted from information provided by the Chesapeake Bay Foundation. Stormwater Management assists this program by training life science teachers in the county’s water quality monitoring techniques and program; educating teachers about local, state and federal policies surrounding watershed protection; and informing them of stewardship opportunities offered by the county for teachers and students.

### Sewer Science

The Sewer Science Program teaches county high school students about municipal wastewater treatment and stormwater management using specially designed tanks, analytical equipment, presentations and a custom student workbook. The stormwater component of the program promotes an understanding of stormwater, its relationship with wastewater, how the water and the land are connected and how each student can make a difference in the health of the environment. In 2007, stormwater management staff continued to partner with the county’s wastewater and solid waste departments to bring the program to seven schools, instructing 981

students during 13 presentations. The county presented information about the program to an audience of stormwater professionals at StormCon 2007, a national stormwater conference held in Phoenix, Arizona in August 2007.

**Thomas Jefferson High School Mentoring Program**

Fairfax County Stormwater Management continued to work with Thomas Jefferson High School seniors to identify potential sources of E. coli in surface water using new and innovative techniques. During the 2006-2007 school year, the program grew from two participants to nine students investigating four areas of the county. The group presented their findings to the Board of Supervisors in June 2007. The 2007-2008 group had six students who developed three experiments. During the past three years, these projects have become more sophisticated in their breadth and scope, asking questions that benefit Fairfax County residents. This collaboration is a "win-win" situation. The students benefit from the mentoring program by examining new concepts and technology and the county benefits by having more informed residents and accumulating more water quality data.

**Figure 5.5. Recycling Roadshow at Herndon High School. (Photo by Fairfax County)**

**Recycling Program**

Fairfax County's Solid Waste Management Program continued to provide support and education in the public school system regarding litter and recycling. In 2007, the program:

- Continued to support the Schools County Recycling Action Program (SCRAP)
- Made 40 presentations to Fairfax County high school students
- Sent information about recycling to approximately 150,000 Fairfax County public school students
- Sent litter and recycling newsletters to all fifth and seventh grade students
- Awarded $500 to twelve schools to fund school environmental projects
- Hosted its 6th annual Community Recycling Roadshow for more than 700 residents at Herndon High School on November 4 (Figure 5.5).

**Reston Association's Watershed Education Programs for Students**

Reston Association offered a school field trip for students in grades three through six. Students learned what a watershed is and explored an area of the local Snakeden Branch watershed of Difficult Run. Students conducted inventories and water quality tests at Lake Audubon and in Snakeden Branch, and discussed ways that citizens can protect the watershed.

Reston Association's Walker Nature Education Center provided the Watershed Traveling Nature Trunk program to students in grades three through eight. The nature center loaned Reston schools a collection of interactive watershed education materials, including teacher activity

guides, posters, videos, books and a demonstration watershed model that allowed students to experiment with best management practices.

## Technical Support and Training

### Land Development Services

- Made presentations in English and Spanish to the Heavy Construction Contractors Association Conference and EXPO on the county's erosion and sedimentation requirements
- Conducted a class for practicing engineers in the land development industry through the Engineers and Surveyors Institute on designing, installing and inspecting erosion and sediment controls on individual lots

### Environmental Horticulture Division of Fairfax County Extension

- Hosted 550 attendees at various pesticide recertification workshops. Participants were instructed on pesticide safety, application, storage and disposal. For example, during a four day pesticide certification workshop, 81 participants from the landscape industry based in Fairfax and Northern Virginia reviewed the Virginia Core Manual and Categories in Ornamentals and Turf. Several participants were applying pesticide without an applicators certificate. At the conclusion of the workshop, the Virginia Certification exam was offered to enable attendees to become certified applicators.

### Northern Virginia Soil and Water Conservation District

Five team leaders were trained to conduct Livable Neighborhood programs in their communities, which educate, encourage and assist individuals as they make personal commitments to behaviors that benefit water quality and the environment.

# 6. Strategic Initiatives

The Department of Public Works and Environmental Services (DPWES) and its partners continue to improve watershed protection and stormwater quality through initiatives to control runoff and reduce the negative environmental effects of the increase in impervious area. The following section discusses some of these initiatives as well as efforts by DPWES and its partners to improve the county's stormwater management program and meet state and federal guidelines to control stormwater runoff close to the source.

## Public Facilities Manual

In March 2007, the Board of Supervisors adopted two amendments to the county's Public Facilities Manual that affect land disturbance policy. The first amendment incorporated six low impact development stormwater practices:

- Bioretention basins and filters
- Vegetated swales
- Vegetated roofs
- Permeable paving
- Reforestation
- Tree box filters.

The second amendment addressed new enabling authority in the Code of Virginia that allows the submission of general erosion and sedimentation specifications to the state by persons engaging in the creation and operation of wetland mitigation banks that are in multiple jurisdictions in lieu of the submission of a conservation plan to the county. Letters to Industry were issued to advise industry of these amendments.

## Better Site Design

The use of multiple LID practices on a site is very effective in improving the quality of stormwater flowing from the site into county streams. The county continues to recommend and encourage that "Better Site Design" development techniques and LID practices be used to the full extent as allowed by the Public Facilities Manual and the related Letters to Industry to improve the quality of stormwater leaving a site.

## Supplemental Plant Lists

Three plant lists have been developed to supplement the Public Facilities Manual's LID practice amendments and posted electronically as part Letters to Industry (www.fairfaxcounty.gov/dpwes/publications/lti/07_03.htm). These lists offer plant recommendations for:

- Bioretention facilities
- Extensive vegetated roofs
- Intensive vegetated roofs

## New Development - Plan Review and Site Inspection

Through its plan review process, the DPWES enforces the Public Facility Manual and the zoning ordinance and subdivision ordinance criteria related to stormwater for new development and redevelopment. DPWES Land Development Services also reviews erosion and sedimentation control plans for compliance with the county's and the Virginia Department of Conservation and Recreation's requirements. In 2007, 767 erosion and sediment control plans were submitted and approved for projects that would disturb a land area of 2,500 square feet or more. Written reports were provided to the Virginia Department of Conservation and Recreation (DCR) informing them of these individual sites on a monthly basis. It is planned that these reports will be provided electronically in 2008. Fairfax County's alternative inspection program, established in cooperation with DCR, resulted in 35,046 erosion and sedimentation inspections in 2007 on all sites under construction. Staff issued 836 'notices to comply with the approved plans' noting the deficiency found in each case and the respective corrective action required. There were 208 notices of violation given to developers who failed to take the required corrective action. Criminal proceedings were started in 22 cases. The county's erosion and sedimentation program is fully approved by DCR.

A 24-hour hotline established by the DPWES continues to be a means for citizens to report complaints about erosion and sedimentation. More information is available about reporting environmental concerns or violations of Fairfax County environmental regulations at the DPWES Web site, www.fairfaxcounty.gov/dpwes/publications/urbanfor.htm.

The Department of Planning and Zoning coordinates with staff from other county agencies to review rezoning, special exceptions and special permit applications for environmental considerations including stormwater management. They also investigate complaints of zoning ordinance violation issues that may have stormwater impacts.

## Floodplain Management

In 2006, the U.S. Army Corps of Engineers (Corps) and county staff performed a study to assess the flooding risks to communities in the Belle Haven watershed. This study produced the critical hydrologic, hydraulic and statistical models necessary to perform benefit-cost analysis for flood reduction alternatives. In 2007, the Corps indentified benefit-cost ratios for three alternatives to reduce the flooding risks in these communities. The Corps will recommend a flood-protection alternative and request funding for the final design and construction of the alternative in 2008.

A similar effort was undertaken for the Huntington residential community located on the lower reach of Cameron Run, a significant portion of which lies within the 100 year floodplain. Construction of a levee was selected as the preferred flood protection alternative, and design criteria are under development.

The county is working with the Federal Emergency Management Agency (FEMA) on revisions to FEMA's digital Flood Insurance Rate Maps (FIRMs). The FIRMs show the areas in a community that are subject to flooding and the risk associated with these hazards. Revisions to the FIRMs are being made to re-delineate Special Flood Hazard Areas (SFHA). New FIRMs are

expected to be completed in 2009. The new maps become official after they are adopted by the county.

## Online Floodplain Warning Tool

The DPWES Fairfax Inspections Database Online or FIDO system that was launched in 2006 is equipped with a floodplain warning tool. This tool flags FIDO permits for properties within floodplains. The database is successful and will be updated as new watershed master plans are completed and new data (floodplain studies, FEMA maps) are available.

## Cameron Run Study

In September 2004, the US Army Corps of Engineers, Fairfax County and the City of Alexandria undertook a partnership to develop a feasibility study to improve water quality, flood protection and habitat in the Cameron Run watershed. Beginning in 2006, NVRC provided assistance to this multi-jurisdictional project by providing logistical and technical support for project partners, publishing a public e-newsletter about project activities and hosting a Web page dedicated to the project (www.novaregion.org/cameron_run.htm). The partner organizations defined six project goals:

- Reducing stormwater impacts on the Cameron Run watershed from impervious areas to help restore and protect the streams
- Preserving, maintaining and improving watershed habitats to support native flora and fauna
- Preserving, maintaining and improving the water quality of the streams to benefit humans and aquatic life
- Improving stream-based quality of life and recreational opportunities for residents of and visitors to the Cameron Run watershed
- Providing adequate, cost-effective flood protection for adjacent communities along major tributaries in the Cameron Run watershed
- Building framework for long-term regional cooperation.

This effort is ongoing. During 2007, the Cameron Run Feasibility Study was coordinated with the Corps' effort to address the flooding situation in Huntington. The Huntington neighborhood flooded during the June 2006 storm event. The feasibility study is scheduled to be completed in 2009.

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