

2012 Fairfax County STORMWATER STATUS REPORT



A Fairfax County, Va., publication, May 2013

*Photos on cover (clockwise from top right): Detention basin retrofit —Cinnamon Oaks; Dry Weather Screening - MS4 outfall -; Stormdrain cover; Fish – small mouth bass (*Micropterus dolomieu*) from fish monitoring; Rain garden and swale retrofit — Cub Run RECenter,; New gauge station – Long Branch; Stormdrain curb inlet retrofit —Sherwood Library, tree box filter; Fish monitoring – ecologist performing fish monitoring*
(photo credit Fairfax County)

Report prepared and compiled by:
Stormwater Planning Division
Department of Public Works and Environmental Services
Fairfax County, Virginia 22035
703-324-5500, TTY 711
www.fairfaxcounty.gov/dpwes/stormwater
May 2013



To request this information in an alternate format call 703-324-5500, TTY 711.

Fairfax County is committed to nondiscrimination on the basis of disability in all county programs, services and activities. Reasonable accommodations will be provided upon request. For information, call 703-324-5500, TTY 711.



This page was intentionally left blank.

Table of Contents

List of Figures 7

List of Tables 7

Acknowledgments 9

Introduction 10

1. Watershed Management Planning 11

2. Stormwater Capital Projects 12

 New Construction of Stormwater Management Ponds 12

 Flood Mitigation 12

 Retrofit of Existing Stormwater Management Facilities 13

 Low Impact Development 14

 Summary of 2012 Low Impact Development Projects 15

 LID Monitoring Efforts 16

 Stream Restoration and Stabilization 17

 Reston Association Stream Restoration 18

3. Operations 19

 Inspection and Maintenance of Stormwater Management Facilities 19

 Storm Drainage Infrastructure Management 20

 Roadways 22

 Pesticide, Herbicide and Fertilizer Application Program 23

 Industrial and High Risk Runoff Facilities 24

 Hazardous Materials Spill Prevention and Response 24

 Illicit Discharge and Improper Disposal 25

 Construction Site Erosion and Sediment Control 26

 Land Conservation Awards Program 27

 Trail Improvements to Address Erosion Issues 27

 Agricultural Land 28

4. Monitoring and Assessment 29

 Water Quality Monitoring 29

 Watershed Monitoring 29

 Dry Weather Screening 30

 Wet Weather Screening 31

 Biological Monitoring 31

 Approach 31

 Results 34

 Stream Quality Index 35

 Bacteria Monitoring 38

 USGS Monitoring Network 40

 Continuous Data Collection 41

Discrete Data Collection.....	41
Volunteer monitoring.....	41
Virginia Department of Environmental Quality List of Impaired Waters in Fairfax County.....	42
5. Public Outreach and Education.....	44
Illicit Discharges and Improper Disposal.....	44
Local Water Quality Improvement Initiatives	44
Watershed Cleanups	45
Stream Buffer Restoration	47
Community Low Impact Development	48
Pesticides, Herbicides and Fertilizers	50
Proper Disposal of Used Oil, Household Hazardous Waste and Household Yard Waste.....	51
Pet Waste	52
Educational Opportunities for Students.....	52
Sewer Science.....	52
Stormy the Raindrop Educational Campaign	53
Field Guide	53
Reston Association’s Watershed Education Programs for Students	53
Envirothon.....	54
Other Educational Activities	54
Northern Virginia Soil and Water Conservation District	55
Fairfax County Park Authority	55
Technical Support and Training.....	56
6. Flood Response.....	58
7. Literature Cited.....	59

List of Figures

Figure 2-1 Flood mitigation project. Photo by Fairfax County..... 13

Figure 2-2 Freds Oak pond before (left) and after (right) retrofit. Photos by Fairfax County..... 14

Figure 2-3 Great Falls Nike Field renovation. Photo by Fairfax County..... 16

Figure 2-4 Cinnamon Oaks stormwater facility before (left) and after (right). Photos by Fairfax County. 17

Figure 2-5 Government Center stream restoration before (left) and after (right). Photos by Fairfax County..... 18

Figure 3-1 Terra Grande Section 1 dam rehabilitation. Photo by Fairfax County. 20

Figure 3-2 Frost Way storm outlet before (left) and after (right) repair. Photos by Fairfax County..... 22

Figure 4-1 Sampling a flowing outfall during dry weather screening. Photo by Fairfax County. 31

Figure 4-2 Location of 2012 biological monitoring sites..... 33

Figure 4-3 Countywide distribution of benthic macroinvertebrate and fish IBI ratings..... 34

Figure 4-4 Trends in the countywide stream quality index. 36

Figure 4-5 Percentage of sites exceeding Virginia’s instantaneous water quality standard for *E. coli*. 39

Figure 4-6 Water chemistry results associated with the bacteria monitoring program 40

Figure 5-1 Youth volunteers begin clean-up near the Fort Hunt Tributary of Little Hunting Creek as part of the fall 2012 Clean Virginia Waterways event. Photo by Raytheon..... 45

Figure 5-2 Volunteerfest® invasives removal event in Pohick Stream Valley Park. Photo by FCPA..... 48

Figure 5-3 A homeowner-installed rain garden featured on the 2012 Watershed Friendly Garden Tour. Photo by NVSWCD. 49

Figure 5-4 Fairfax County Supervisor Penelope Gross (Mason District) and Stormy the Raindrop celebrate the NACo 2012 Achievement Award 53

Figure 5-5 Educational booth on display at Fall for Fairfax. Photo by Fairfax County..... 55

Figure 5-6 The annual Wetlands Awareness Day at Huntley Meadows Park. Photo by FCPA. 56

Figure 6-1 May 2012 joint training of Fire and Rescue Department and Stormwater Management employees for flood response at the Huntington and Belleview communities 58

List of Tables

Table 2-1 Flood mitigation projects completed in 2012..... 12

Table 2-2 Retrofit projects completed in 2012..... 13

Table 2-3 LID projects constructed in 2012 15

Table 2-4 2012 stream restoration and stream stabilization projects. 18

Table 3-1 2012 dam rehabilitation and safety projects..... 20

Table 3-2 2012 infrastructure repairs and channel clearing projects..... 21

Table 3-3 2012 trail improvement projects 27

Table 4-1 Results of statistical analysis to determine if there is a significant difference between observed constituent concentrations at Stations VNA and OQN for 2005 to 2012..... 29

Table 4-2 Computed seasonal and annual unit area constituent loadings at monitored locations for 2012. 30

Table 4-3 2012 benthic macroinvertebrate sampling results by stream order..... 34

Table 4-4 2012 biological sampling results for individual monitoring sites..... 35

Table 4-5 Countywide SQI for sampling years 2004-2012 showing percentage of sites in each rating category. 36

Table 4-6 Overall watershed conditions for sampling years 2004-2012 combined. 38

Table 5-1 2012 Earth Sangha buffer restoration activities. 47

Acknowledgments

The staff of the Stormwater Planning Division appreciates the following organizations for their contributions to this report and ongoing commitment to protecting water resources in Fairfax County.

Private organizations

Clean Fairfax Council

Earth Sangha

Fairfax ReLeaf

Reston Association

State agencies

Lake Barcroft Water Improvement District

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

Department of Planning and Zoning

Fairfax County Park Authority

Fairfax County Public Schools

Fire and Rescue Department, Hazardous Materials Investigative Services Section

Health Department

Other government agencies

Northern Virginia Regional Commission

Northern Virginia Soil and Water Conservation District

Department of Public Works and Environmental Services divisions

Building Design and Construction Division

Code Services Division

Construction Management Division

Environmental and Facilities Inspections Division

Environmental and Site Review Division

Land Acquisition Division

Maintenance and Stormwater Management Division

Solid Waste Management Program

Wastewater Collection Division

Wastewater Planning and Monitoring Division

Wastewater Treatment Division

Introduction

Stormwater runoff is the rainfall and/or snowmelt that flows across the land and impervious areas such as paved streets, parking lots and building rooftops. Stormwater runoff can pick up and carry sediments, nutrients, toxic substances, pathogens and other pollutants to lakes, streams, rivers, wetlands and coastal waters. These pollutants have the potential to harm drinking water supplies, recreation and aquatic life. In addition, impervious surfaces prevent water from infiltrating into the ground, causing high volumes of stormwater to instead surge into storm drains at high speeds. When a surge of stormwater empties into receiving waters, it can severely erode stream banks and damage sensitive stream valley ecosystems.

Fairfax County has been proactive in addressing stormwater management and the control of pollutants. Fairfax County's Stormwater Management program supports the water quality goals of the Board of Supervisors' Environmental Agenda, which centers on the two principles that 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. This report highlights the accomplishments of the stormwater management program during calendar year 2012:

1. *Watershed Management Planning.* Over the past several years, the Board of Supervisors adopted watershed management plans covering all 30 of the county's watersheds. The plans provide an assessment of stormwater conditions, recommend protection strategies and improvement projects and encourage public involvement.
2. *Stormwater Capital Projects.* The county and its partners continued to implement stormwater management-related capital projects, including flood mitigation projects, stormwater management facility retrofits, low impact development (LID) projects, stream restoration and stream stabilization projects.
3. *Operations.* The county maintains and operates its stormwater management facilities and stormwater drainage infrastructure consistent with the requirements of its Municipal Separate Storm Sewer System (MS4) permit, which regulates discharges of stormwater from the county's MS4. In an effort to minimize the pollutants reaching the MS4 and streams, the county also implements best management practices for operation of county roadways; use of pesticides, herbicides and fertilizers on county properties; controlling industrial and high risk runoff; detection and elimination of sources of illegal discharges; and spill response.
4. *Monitoring and Assessment.* The county conducts watershed water quality monitoring, dry weather screening, wet weather industrial high risk screening, physical habitat evaluations and biological assessment of fish and aquatic macroinvertebrates.
5. *Public Outreach and Education.* The county continues to partner with local organizations to implement programs informing residents of water quality issues and encouraging environmental stewardship.
6. *Strategic Initiatives.* The county and its partners works proactively to improve the county's stormwater management through the flood response program, MS4 program planning and watershed management planning.

While 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 in county agencies, state agencies and private organizations.

1. Watershed Management Planning

Starting with the Little Hunting Creek Watershed Management Plan in 2003, the county embarked on a watershed planning initiative that assessed the needs of the county's 30 watersheds. The process resulted in 13 plans covering all 30 watersheds, which contain proposed improvements to be considered over the next 25 years. The overarching goals of the watershed plans are:

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

The following is a list of the plans, the associated watersheds and the dates the plans were adopted by the Board of Supervisors:

1. Little Hunting Creek Watershed Management Plan (February 2005)
2. Popes Head Creek Watershed Management Plan (January 2006)
3. Cub Run and Bull Run Watershed Management Plan (February 2007)
4. Difficult Run Watershed Management Plan (February 2007)
5. Cameron Run Watershed Management Plan (August 2007)
6. Middle Potomac Watersheds Management Plan (May 2008)
 - Included watersheds: Bull Neck Run, Dead Run, Pimmit Run, Scotts Run, and Turkey Run
7. Pohick Creek Watershed Management Plan (December 2010)
8. Sugarland Run and Horsepen Creek Watershed Management Plan (December 2010)
9. Belle Haven, Dogue Creek and Four Mile Run Watershed Management Plan (January 2011)
10. Lower Occoquan Watershed Management Plan (January 2011)
 - Included watersheds: High Point, Kane Creek, Mill Branch, Occoquan, Old Mill Branch, Ryans Dam, Sandy Run, and Wolf Run
11. Nichol Run and Pond Branch Watershed Plan (January 2011)
12. Accotink Creek Watershed Management Plan (February 2011)
13. Little Rocky Run and Johnny Moore Creek Watershed Plan (February 2011)

The plans were developed with the assistance of the community through public meetings and more focused stakeholder group meetings. This public involvement process helped to ensure that the plans will meet the needs in the watershed and have the support of county residents. Public involvement is still being encouraged during plan implementation. In November 2012 the county held a second meeting for watershed advisory groups and other public interests to give a status update on implementing the watershed plans and the broader stormwater management program. The presentation is available online at <http://www.fairfaxcounty.gov/dpwes/watersheds>.

The number of projects selected for implementation each year will be determined as part of the annual budget process. Efforts to include implementation of non-structural projects and policy recommendations from the watershed plans are ongoing.

Each watershed management plan includes a list of proposed non-structural projects, such as stream buffer restorations, rain barrel programs and community outreach and education. The first six plans that were adopted also include over 300 policy and action recommendations that, when implemented, will improve environmental stewardship in the county's communities and watersheds. These non-structural projects and policy recommendations, in concert with the structural projects, represent a holistic approach to watershed management. County staff is working together with several partners and agencies to develop a plan prioritizing and implementing these non-structural projects and policy recommendations.

At this time, each of the non-structural recommendations have been reviewed, categorized by feasibility and consolidated by themes. Project feasibility, MS4 permit compliance, effectiveness and resource needs are being considered during the prioritization process. Roughly two-thirds of the recommendations are MS4 permit related. Priority will be given to permit related recommendations, but this will not preclude other recommendations from being implemented. At this time, more than half of the recommendations are categorized as “ongoing” which means we have already implemented this recommendation or continue the recommendation through outreach and education. Additionally, many feasible policy based recommendations will be implemented through the ongoing development of a new Stormwater Ordinance and updates to the Public Facilities Manual (PFM). The Stormwater Ordinance will reflect the latest Virginia Stormwater Management Permit requirements that must be adopted by the county before July 1, 2014.

2. Stormwater Capital Projects

The Department of Public Works and Environmental Services (DPWES) Stormwater Management business area operates and maintains Fairfax County’s storm drainage system, often referred to as the municipal separate storm sewer system (MS4), to receive and transport stormwater runoff. Public stormwater management facilities designed to affect the quantity and quality of stormwater are constructed and retrofitted by multiple county organizations and through partnerships with local and regional organizations. Among the entities that helped to build or make improvements to stormwater management facilities were DPWES and the Fairfax County Park Authority (FCPA).

This section summarizes the capital projects, by type, completed during calendar year 2012.

New Construction of Stormwater Management Ponds

There were no new regional stormwater management facilities substantially completed in 2012.

Flood Mitigation

Preventing and reducing the impacts of flooding remain high priorities for Fairfax County. Part of the county’s approach to flood mitigation consists of constructing site-specific solutions to residential drainage problems. In 2012 DPWES completed ten such projects (Table 2-1).

Table 2-1 Flood mitigation projects completed in 2012.

<i>Project Name</i>	<i>Description</i>
Brookview Drive	Provided flood protection for three residential properties that existed immediately adjacent to a county storm drainage system.
Dearborn Drive	Provided flood mitigation to ensure adequate drainage of previous home site.
Oak Chase Circle	Provided flood mitigation of residential property that existed adjacent to county storm drainage system.
Lauren Drive	Provided flood mitigation of residential properties that existed adjacent to a county storm drainage system.
Luton Place	Provided flood mitigation of residential property that existed adjacent to county storm drainage system.
Sumner Road	Provided flood protection for two residential properties that existed immediately adjacent to a county storm drainage system.

Project Name	Description
Ticonderoga	Provided flood mitigation for a 1.6 acre drainage shed including replacing storm drain pipes and installing a new overflow pipe. Blockage and restoration work was included.
Vine Street Phase II	Provided flood mitigation including the installation of culverts and curb and gutter to reduce road flooding.
Westwood Hills Drive	Provided flood mitigation for a heavily wooded drainage shed through the installation of a trash rack with redundant flow openings to maintain the full capacity of the culvert crossing.



Figure 2-1 Flood mitigation project. Photo by Fairfax County.

Retrofit of Existing Stormwater Management Facilities

Stormwater management facility retrofits are intended to improve water quality and/or quantity control beyond their original designs. Water quality retrofits enhance nutrient uptake and increase the infiltration, uptake and transpiration of stormwater while water quantity retrofits help to reduce downstream flooding and erosion. Table 2-2 describes selected retrofit projects completed by the DPWES in 2012.

Table 2-2 Retrofit projects completed in 2012.

Project Name	Description
Bedrock Road	Removed approximately 200 cubic yards of sediment and applied a wetland seed mix to enhance water quality benefits in a stormwater management facility.
Countywide	Installed improved trash racks and BMP plates at eight stormwater management facilities to improve water quality control.

Project Name	Description
Davis Drive	Removed approximately 60 cubic yards of sediment and applied a wetland seed mix to enhance water quality benefits in a stormwater management facility.
Freds Oak	Retrofitted the detention basin by removing concrete trickle ditches, regrading the basin, installing four micro-pools, a gravel gallery underlying the extended flow path, imbricated stone at the inlet, a compost blanket and reforesting the side slopes.
Government Center	Retrofitted two detention ponds, restored a stream and dredged an existing pond to improve water quality benefits. This was a comprehensive private/public effort.
Oak Spring Way	Installed an improved trash rack, removed approximately 20 cubic yards of sediment and applied a wetland seed mix to enhance water quality benefits in a stormwater management facility.
Patriot Village Section 2, Pond B	Retrofitted the detention basin by removing sediment to restore pond volume and create plunge pools, restoring eroded stream banks, replacing the riser structure and constructing a permanent access road to improve water quality.
Villa D’Este Village Section 3	Rehabilitated an existing detention basin by extending the principal spillway pipe, reconstructing the dam embankment, stabilizing 260 linear feet of stream and constructing a permanent access road.



Figure 2-2 Freds Oak pond before (left) and after (right) retrofit. Photos by Fairfax County.

Low Impact Development

Fairfax County promotes the use of environmentally sensitive site design and low impact development (LID) practices that minimize impervious cover and replicate natural hydrologic conditions as a means of protecting streams and other natural resources. Onsite infiltration, groundwater recharge, and filtration of pollutants are some of the benefits that can be achieved by these practices. LID projects are used to help the county meet multiple stormwater management goals and provide the following benefits:

- A variety of LID concepts and techniques can be used to meet stormwater requirements of new developments and to retrofit existing developed areas that do not have adequate stormwater controls.
- LID projects are often a viable solution to address stormwater needs if space is limited.

- The visibility and accessibility of certain projects provide opportunities to educate the public on the benefits of LID and can increase 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.

LID practices are being incorporated as permitted by the Public Facilities Manual and the related Letters to Industry to improve the quality of stormwater leaving a site.

Summary of 2012 Low Impact Development Projects

DPWES, FCPA, various non-profit organizations and individual volunteers contributed to the design and implementation of seven projects within the county that incorporated one or more LID practices (Table 2-3).

Table 2-3 LID projects constructed in 2012

Project Name	Description	Partners
Freds Oak	Reforested the side slopes of a detention pond.	DPWES
Great Falls Nike Field Renovation	Renovated existing adult-sized natural turf fields into synthetic* turf fields and installed stone galleries and a vegetated bio-swale to infiltrate stormwater runoff. Planted native grasses, trees and shrubs to increase uptake.	FCPA
Lake Fairfax Skatepark	Constructed a rain garden for stormwater quality and quantity.	FCPA
Noman Cole	Constructed a rain garden.	
Oak Marr Fields #1 and #2 Renovation	Renovated existing adult-sized natural turf fields into synthetic* turf fields with a supporting open-graded aggregate base providing storage capacity to reduce peak flows during large storm events and eliminate need for fertilizer and pesticides.	FCPA
Packard Center	Designed and constructed a rain garden to treat roof, turf and sidewalk runoff.	FCPA, NVSWCD
Waples Mill Elementary School	Installed 5820 square feet of permeable pavers within parking bays to capture sheet flow runoff.	DPWES
*The phosphorus removal efficiency rate for synthetic turf systems is a conservative 15 percent.		



Figure 2-3 Great Falls Nike Field renovation. Photo by Fairfax County.

LID Monitoring Efforts

New LID monitoring efforts started in the fall of 2012 at the recently retrofitted Cinnamon Oaks stormwater facility. Step pool conveyance LID techniques were used at the two inlets to the pond to carry the stormwater that runs off the streets and yards to the pond. The step pool conveyance system is designed to not only slow the incoming stormwater and to minimize the physical impact to the retrofitted facility but to cool the water by allowing it to travel underground and to remove some of the nutrients and sediment. The step pool conveyance system consists of a series of pools of different elevations with energy dissipating rock weirs in-between the pools and a stone/sand gallery beneath the pools. In addition the stormwater facility itself is designed to slow the movement of the water to the outlet as the path is no longer a straight shot in a concrete trickle ditch but a series of micro-pools and low dam embankments that meander from the bottom of the step pool conveyance system to the outlet of the facility. The entire area is planted in native grasses and plants and the dam and road embankment have a large no-mow zone.



Figure 2-4 Cinnamon Oaks stormwater facility before (left) and after (right). Photos by Fairfax County. Three permanent monitoring stations have been established: one at each of the inlets to the facility and one at the outlet. Each consists of a fiberglass shelter that houses a battery operated automatic monitoring system. A solar cell is utilized to assist in keeping the batteries charged. The data logger in the automated sampler is accessible through a cell phone connection. Depth and flow sensors as well as water pick-up tubes are installed in the pipe at each of the inlets and at the outlet from the facility to determine the flow rate of the stormwater in the pipe. A rain gage is installed in the middle of the stormwater facility on one of the low dam embankments.

The data gathered will allow the determination of the volume of water that entered the stormwater facility and the volume of water that left the facility. Water quality analysis will be performed on the stormwater samples retrieved by the automated samplers at the two inlets and the outlet. It is anticipated that a large percentage of the water will be retained by the combination of the LID step pool conveyance system and the series of micro-pools in the facility and that there will be a very large reduction in the nutrient and TSS (Total Suspended Solids) load from the inlet to the outlet.

Monitoring has concluded at the three innovative stormwater management systems installed at Fairfax County government facilities after a second round of monitoring in 2011 and 2012: Providence District Supervisor's Office/Fire Station 30 in Merrifield, Cub Run RECenter and the Herrity Government Center building. Final results are not yet available, but the preliminary results suggest that performance was similar to the 2008 through 2009 results summarized below:

- Providence rain garden – 80.5 percent retention of rainfall and a 32 to 90 percent reduction in nutrients and TSS.
- Cub Run RECenter rain garden – rain events less than 0.44 inches of rain did not leave the facility, there was a 51 to 95 percent reduction in nutrients and TSS and an average temperature reduction of 2.76 degrees Fahrenheit.
- Herrity Garage green roof – retained at least the first one-half inch of rain and there was a 17 to 86 percent nutrient and TSS removal when compared to a non-green roof, control site that was also monitored.

Stream Restoration and Stabilization

In 2012 the county completed three stream restoration projects with the assistance of a number of non-profit organizations and volunteers. These projects are summarized in Table 2-4.

Table 2-4 2012 stream restoration and stream stabilization projects.

<i>Project Name</i>	<i>Description</i>	<i>Partners</i>
Government Center	Restored 1000 linear feet of stream including removal of material from the pond and returning it to the stream banks. This will provide for a more erosion resistant channel as well as providing a better habitat for the creatures that utilize the stream.	DPWES
Sheffield Hunt	Restored 940 linear feet of a tributary to Pohick Creek to mitigate stream bank erosion, improve water quality and address safety concerns related to the channel and dam embankment and retrofit an existing stormwater management facility.	
West Barnyard Run - Huntley Meadows Park	Installed stormwater blockages made from fallen trees in order to slow down stormwater flows and reduce stream bank erosion and deposition of silt into wetlands. Planted over 200 native trees and shrubs along the borders of the park's central wetlands to repair damage done by a recent boardwalk construction project.	NVSWCD, USFWS, FCPA



Figure 2-5 Government Center stream restoration before (left) and after (right). Photos by Fairfax County.

Reston Association Stream Restoration

Since 2008 more than eight miles of stream restoration have been completed in Snakeden Branch, The Glade, and Colvin Run watersheds as part of the Northern Virginia Stream Restoration Bank. Additional projects in Reston's Colvin Run watershed located north of the Dulles Toll Road and east of Reston Parkway are designed to improve streams that drain into Buttermilk Creek, Lake Anne and Lake Newport.

3. Operations

Fairfax County's stormwater management program is designed to prevent harmful pollutants from being dumped or washed by runoff into its municipal separate storm sewer system (MS4) and discharged into local water bodies. Controlling and managing sources of stormwater pollutants are vital components of the program, and specific actions the county took in 2012 are described in this section

Inspection and Maintenance of Stormwater Management Facilities

The county's stormwater management facility inventory is valued at over \$0.5 billion and has an expected life cycle of 40 years. The Maintenance and Stormwater Management Division (MSMD) of DPWES inspects and maintains all county-owned and operated stormwater management (SWM) facilities and Best Management Practice (BMP) facilities and infrastructure, including stormwater dry ponds located in residential subdivisions. MSMD inspects and oversees private maintenance agreements for privately owned stormwater management facilities. In 2012 MSMD inspected 374 of the 1,541 county-maintained stormwater management and BMP facilities at least once. MSMD inspected 664 of the 3,720 privately-maintained facilities in 2012.

In 2012 MSMD continued its maintenance program for county stormwater management facilities. Maintenance can include repairs to stormwater management facility structures and removal of sediment. During 2012 the county cleaned and/or mowed 1,289 dam embankments, including 50 regional ponds which were maintained four times each during the calendar year. Cleaning involves removing trash, sediment and debris from the trash rack, control structure and all inflow channels leading to the control structure. At each stormwater management facility, deposited sediment is removed from the trickle ditch upstream from the control structure and deposited offsite. The cleaning helps keep the facility functioning properly by conveying water and performing the BMP function as designed. The county completed 477 maintenance work orders to correct deficiencies in publicly maintained SWM/BMP facilities.

In 2010 MSMD met with the Fairfax County Sheriff's department about using the Community Labor Force (CLF) crews to help maintain Fairfax County's public low impact development (LID) stormwater facilities. A partnership was created between the two agencies, and the CLF work crews were tasked with maintaining roughly 39 publically maintained LID facilities. MSMD staff trained the CLF crew on maintenance techniques and the crew has been maintaining these facilities for over two and a half years. Due to the great job that the CLF crews did with the LIDs, the sheriff's office was asked about involving the crew in a new task, trash removal in all of the publically maintained stormwater ponds. The crew is now removing trash from those ponds in addition to maintaining the LID facilities.

In addition to routine maintenance inspections, county staff with expertise in dam design and construction continues to perform annual inspections of 19 state-regulated dams in the county which are owned by DPWES to identify any safety or operational items in need of corrective action and to ensure that the dams satisfy state safety requirements. A work program was implemented to correct problems discovered during inspections (Table 3-1). 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 scheduled five times per year. Fairfax County's Dam Safety Program is approved by the Virginia Department of Conservation and Recreation. The program coordinates emergency action plans related to flooding for county-owned facilities.

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), Northern Virginia Soil and Water Conservation District (NVSWCD) and Fairfax County have been working together to rehabilitate four flood control dams that were constructed in the Pohick Creek watershed during the 1970s and 1980s. New federal and Virginia dam safety regulations necessitated the rehabilitation

projects. Three rehabilitation projects were completed. The final design for the fourth dam (Huntsman Lake) is complete and has been approved by NRCS. The availability of federal cost-share funds will be determined by Congress during an upcoming budget session.

Table 3-1 2012 dam rehabilitation and safety projects.

<i>Project Name</i>	<i>Description</i>
Country Creek Section 1 (0085DP)	Rehabilitated the dam, slip-lined pipe, removed sediment and retrofitted stormwater management facility to restore functionality of the pond.
McLean Station (0272DP)	Rehabilitated the dam, removed sediment and retrofitted stormwater management facility to restore functionality of the pond.
Kingstowne SWM Pond #4 (0841DP)	Rehabilitated the dam, removed sediment, installed access road and retrofitted stormwater management facility to restore functionality of the pond for certification of state-regulated dam.
The Tallwoods Section 3 (0132DP)	Stabilized an eroded storm drain outfall and removed sediment from nearby stormwater management facility.
Terra Grande Section 1 (0582DP)	Rehabilitated the dam, slip-lined pipe, removed sediment and retrofitted stormwater management facility to restore functionality of the pond.



Figure 3-1 Terra Grande Section 1 dam rehabilitation. Photo by Fairfax County.

Storm Drainage Infrastructure Management

As required by its MS4 permit, Fairfax County must maintain an accurate inventory of its infrastructure. MSMD implements an infrastructure management plan to track Fairfax County’s stormwater management facilities, stormwater infrastructure and associated easements using the county’s

geographic information system (GIS) databases. The infrastructure management plan encompasses Fairfax County's 399 square miles as identified on 436 tax map grids. Over a five-year cycle completed in 2005, MSMD field-verified the storm drainage conveyance system on each tax map grid, identified storm drainage pipes, outfalls and associated appurtenances and created a GIS-based data layer. Routine maintenance began during the spring of 2010 on the GIS-based stormwater easement database. In 2012 the GIS inventory was continuously updated with new as-built plans and field verification of system location and components within the identified easements. Over 70 as-built construction plans were digitized and 416 tax map grids were reviewed for completeness, proper maintenance responsibility identification and spatial accuracy.

The county's storm conveyance inventory, valued at over \$1 billion, has pipes and storm structures in excess of 80 years old and primarily consists of facilities with an expected life cycle of 75 years. Based on a pilot study, it is estimated that five percent of the county's storm drain conveyance system is failing and another ten percent exhibits the beginning signs of failure. In 2011 DPWES began development of a comprehensive condition assessment program that will eventually support a sustainable rehabilitation program for stormwater infrastructure. In 2012 MSMD continued implementation of its infrastructure inspection and rehabilitation program. Staff inspected 2,200 pipe segments and 4,000 storm structures with video and photo documentation. Under the rehabilitation program more than 50 miles of pipe were videoed, documenting the existing structural and service conditions of the interior of the storm system. These efforts represent 292 miles, or 23 percent of the storm drainage network, being screened through walking and/or video documentation for obvious deficiencies. In addition, more than 5,100 feet of storm pipe in the county's inventory were rehabilitated or repaired through replacement or by lining entire pipe segments using cured-in place pipe lining methods (Table 3-2).

Table 3-2 2012 infrastructure repairs and channel clearing projects.

<i>Project Name</i>	<i>Description</i>
Briar Creek Drive	Repaired and replaced storm outlet structure by resetting pipes, sealing joints, reconstructing end of pipe structures and stabilizing outlets from undermining.
Countywide Pipe Assessment and Repair	Recorded (video and photographs) 54 miles of storm pipe and inspected 336 miles of storm structures and outfalls to assess the condition, which led to 5,524 feet of storm drain rehabilitation using trenchless technologies and traditional methods.
11232 Cranbrook Lane	Repaired and replaced storm outlet structure by resetting pipes, sealing joints, reconstructing end of pipe structures and stabilizing outlets.
Frost Way	Repaired and replaced storm outlet structure by reconstructing end of pipe structures and stabilizing outlets.
Lake Meadow Drive	Modified two storm structures to improve efficiency and utilize to improve flood protection of residential dwellings and property.
Lamplighter Way	Repaired and replaced storm outlet structure by resetting pipes, sealing joints, reconstructing end

Project Name	Description
	of pipe structures and stabilizing outlets.
Long Pine Drive	Replaced 176 linear feet of storm pipe, including a new endwall and armored distilling basin to stabilize the outlet.
Pumphrey Drive	Repaired and replaced storm outlet structure by resetting pipes, sealing joints, reconstructing end of pipe structures and stabilizing outlets.
Ridge Creek Way	Replaced 24 feet of storm pipe to repair a cave-in at a sidewalk and stormwater management pond.
Tod Street	Modified storm structure to improve efficiency and to improve flood protection of residential dwellings and property.
Trenholm Drive	Modified storm structure to improve efficiency and to improve flood protection of residential dwellings and property.
Waters Edge Landing	Upgraded a failed storm drain outfall that led to a slope failure to address safety concerns and protect nearby utilities.
Woodbury Woods	Installed 78 feet of storm pipe, a drop inlet and 40 feet of receiving channel to improve a failed storm pipe system for a 4.3 acre drainage shed.
Woodhurst Blvd	Modified storm structure to improve efficiency and to improve flood protection of residential dwellings and property.



Figure 3-2 Frost Way storm outlet before (left) and after (right) repair. Photos by Fairfax County.

Roadways

The Virginia Department of Transportation (VDOT) is responsible for maintenance and operation of public roads (interstate, primary, secondary, residential) in Fairfax County. The county is responsible for maintaining several miles of discontinuous road segments, many of which are unpaved. A significant

component of Fairfax County's roadways program is sweeping parking lots associated with county facilities such as government centers, libraries, public schools, fire stations, police stations, health centers, bus transit facilities, park and ride lots, commuter rail stations, public housing facilities and staffed park locations.

In an effort to limit the discharge of pollutants from parking lots into the county's streams, the county provides sand and chemical treatment only when dictated by safety concerns. The county sweeps material from each treated parking area once annually during the spring.

The county's parking lot sweeping program is currently carried out by three organizations: Department of Public Works and Environmental Services, Department of Housing and Community Development (DHCD), and the Park Authority. DPWES sweeps parking lots at county government and public schools sites as well as paved county road segments, where feasible. DHCD sweeps parking lots on residential developments such as apartment complexes, townhouse developments, group homes and senior facilities that are owned and operated by DHCD. FCPA plows and/or treats essential use parking areas at staffed park locations and commuter parking lots. In 2012 more than 775 cubic yards of material was removed from 338 county government and public schools sites, 41 residential sites, 26 essential use areas at parks and 30 county-maintained road segments through sweeper trucks and hand sweeping.

Pesticide, Herbicide and Fertilizer Application Program

County agencies involved in the administration of public rights-of-way, parks and other municipal properties currently have some form of nutrient and pest management plans and either implement the plans themselves or have contractors implement them. County personnel and private contractors follow the Virginia Department of Conservation and Recreation's nutrient management guidelines, the Virginia Department of Agriculture's guidelines, and the Virginia Pesticide Control Act, 2006. In addition, many agencies are also collecting information on the application rates and total annual usage of pesticides, herbicides and fertilizers (PHF).

Park Authority staff worked to reduce the amount of mowed turf areas at several park sites around the county to promote water and air quality improvements and provide additional wildlife habitat. Staff discontinued mowing at Confederate Fortifications Historic Site and Johnny Moore Stream Valley Park (11.8 acres), Chapel Road Park (2.61 acres), George Mason Park (0.55 acres), Newington Commons Park (1.50 acres) and Pinecrest Golf Course (3 acres). The vast majority of the remaining mowed turf areas do not receive any regular treatments of either fertilizers or pesticides.

The Park Authority currently has two Virginia state-certified nutrient management planners on staff, one for parks and a recently certified planner for golf courses. To date there are 21 certified nutrient management plans for parklands, covering a total of 1,669.9 acres.

An additional 188.4 acres of parkland were operated under nutrient management plans prepared by a Virginia state-certified nutrient management planner from the Northern Virginia Soil and Water Conservation District (NVSWCD) in 2012. Three plans are under development for golf courses, but there are no completed certified nutrient management plans for golf course acres at this time.

The federal and state pesticide laws and regulations require pesticide applicators to be certified to use restricted-use pesticides. In addition, Virginia law requires all commercial applicators to be certified to use any pesticide. Applicators must renew their pesticide licenses through continuing education every two years. In 2012, Agriculture and Natural Resource Extension agents for the Virginia Cooperative Extension (VCE) conducted programs in pesticide safety and integrated pest management (IPM) throughout Northern Virginia. The program assisted agricultural producers and licensed pesticide applicators to comply with the law and protect the environment and human health through the safe and efficient use of pesticides and alternative pest control tactics.

In 2012 VCE trained 550 commercial pesticide applicators for re-certification in Northern Virginia. The trainees provided the following feedback about the experience:

- 96% of participants responding to the survey reported “I know what I need to do to comply with state and federal laws and regulations.”
- 85% stated “I’ve learned more about proper use of application equipment (calibration, drift minimization).”
- 98% stated “I read pesticide labels and use the personal protective equipment (PPE) they require”
- 85% have gained new knowledge for identifying and controlling ticks and mosquitoes
- 85% understand how timing affects weeds control options
- 81% have gained new knowledge to make safe and informed decisions about pesticide use
- 81% have gained new knowledge for identifying and controlling nuisance mammals
- 81% have a better understanding of invasive plants and how to manage them
- 85% understand the legal changes affecting pesticide applicators through the legal update

Virginia's Pesticide Disposal Program is a cooperative effort between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Pesticide Control Board, with participation from VCE and the Division of Consolidated Laboratory Services. The program assists agricultural producers, licensed pesticide dealers and pest control firms, golf courses and homeowners with the proper disposal of unwanted pesticides. The program is available at no cost to eligible participants. The Pesticide Disposal Program requires participants to transport their unwanted agricultural and commercial pesticides to a central collection site where the hazardous waste disposal contractor will package the pesticides for eventual disposal. If a participant cannot safely package the unwanted pesticides for transport, the disposal contractor will make arrangements to containerize the pesticides for transport.

Industrial and High Risk Runoff Facilities

In 2012 the Stormwater Planning Division updated its list of high risk industrial and commercial properties that drain to the county's MS4. Facilities were added to the list that may have the potential to contribute a significant pollutant load to the MS4 based on their standard industrial classification code.

During 2012 three Virginia Pollutant Discharge Elimination System (VPDES) permits were terminated for facilities within the county's MS4 service area and one new VPDES permit was issued for the site of a proposed pharmacy. There are currently 34 facilities that are covered under a VPDES stormwater general permit and eight facilities that are covered under a VPDES individual permit that drain to Fairfax County's MS4. In addition, there is currently one facility with a no-exposure certification. Of the 42 permitted facilities, seven are county facilities. As required by the permits, each county facility is implementing a stormwater pollution prevention plan (SWPPP), which includes spill prevention and response procedures.

Fairfax County is developing a database application to better manage the list of VPDES facilities that discharge to the county's MS4. The new database will also include other industrial and/or commercial facilities within the county's MS4 deemed to be high risk and facilitate scheduling and tracking inspections. Fairfax County receives and reviews discharge monitoring reports (DMRs) from facilities that hold a general stormwater industrial VPDES permit and discharge to the county's MS4.

Hazardous Materials Spill Prevention and Response

The FRD Hazardous Materials Response Team (HMRT), when requested by Fire Department first responders, 911 dispatch protocols or the Fire Marshal's Office, responds to reported incidents of

hazardous material releases, spills and discharges in the county (regardless of whether the material has potential to enter the county-operated MS4 or another system, such as VDOT's). The department maintains and tracks firefighter training/certification under OSHA 29 CFR 1910.120 (q) and NFPA 472. The department's Fire and Hazardous Materials Investigative Services (FHMIS) personnel receive regular training in pollution prevention and are equipped to initiate spill control measures to reduce the possibility of hazardous materials reaching the storm drainage system. Resources available to personnel include personal protective equipment, technical tools and equipment for spill control, and absorbent products such as pads and booms for spill containment. HMIS also maintains a contract with a major commercial hazardous materials response company to provide additional containment and clean-up support for large-scale incidents.

In 2012, FHMIS received 562 complaints. Approximately 253 of the complaints involved the actual release of various petroleum or chemical substances. Of the 253 releases, most involved the release of either diesel fuel (30), home heating fuel oil (53), gasoline (12), motor oil (13), or hydraulic oil (28). Other releases investigated involved antifreeze, paint, sewage, wastewater discharges, water treatment chemicals and mercury. Storm drains were involved in 21 of the releases. Documentation of individual releases and the county's responses is maintained by FHMIS.

In both emergency and non-emergency spills that reach the storm drainage system, FHMIS enforces appropriate codes and ordinances to ensure that responsible parties take appropriate spill control and cleanup actions to protect and restore the environment.

FHMIS monitors, on a long-term basis, contaminated sites that have a potential for the contaminant coming in contact with surface waters or stormwater management facilities. As a part of the Oversight Program, FHMIS, as an agent of the Director of DPWES, accepts, reviews, and processes requests to discharge treated groundwater from remedial activities at contaminated sites into county storm drains. FHMIS then monitors the discharge for the duration of the agreement. In 2012 the Hazardous Materials Technical Support Branch of FHMIS monitored 36 oversight cases. Most of these oversight files involve contaminated underground storage tank sites.

Fire and Rescue continued to maintain membership in the Fairfax Joint Local Emergency Planning Committee (FJLEPC), which includes representatives of Fairfax County, the City of Fairfax, and the towns of Vienna and Herndon. Fire and Rescue periodically updates its Hazardous Material Emergency Response Plan.

Illicit Discharge and Improper Disposal

Inspection and maintenance of the county's sanitary sewers help eliminate sewage leaks to the MS4 and waterways. Rehabilitation and repairs include dig-up repairs, manhole rehabilitation and trenchless pipe repair using technologies such as robotic, cured-in-place and fold-and-reformed pipe rehabilitation processes. Programs that help prevent, detect and eliminate illicit entry of sanitary wastes into the MS4 are implemented and documented in the Wastewater Management and Capital Facilities business areas of DPWES.

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, and uses closed circuit television (CCTV) to inspect trunk sewer mains in an effort to specifically identify defective sewer lines for repair and rehabilitation. In 2012, 208 miles of old sewer lines and approximately 12 miles of new sewer lines were inspected, resulting in the identification of sanitary sewer lines and manholes needing repair and rehabilitation. In 2012 approximately 31 miles of sanitary sewer lines were rehabilitated, bringing the total length of sewer lines repaired over the past ten years to approximately 214 miles.

The Sanitary Sewer Extension and Improvement Program addresses pollution abatement and public health considerations and provides sanitary sewer services to areas identified by the Department of Health as having non-repairable or malfunctioning septic systems. In 2012 four Extension and Improvement projects were completed consisting of approximately 5,360 feet of eight-inch gravity sanitary sewer, approximately 3,863 feet of 1.5-inch to 2.5-inch diameter low-pressure sanitary sewer including six individual grinder pumps, and sanitary sewer connections for 68 existing homes and three vacant properties.

The Health Department sends flow diversion valve reminder notices to homeowners on the anniversary of the installation of their septic system to remind them to turn their flow diversion valve once a year. The Health Department mailed 14,957 notices in 2012. The notice also reminds homeowners to pump out their septic tank every three to five years. In 2012 the Health Department mailed 1,467 non-compliance letters to owners of homes that had not pumped out their septic tank during the five-year period required in Chapter 68.1 of the Fairfax County Code and the Chesapeake Bay Preservation Area Designation and Management Regulations. If a homeowner fails to comply, a follow-up letter is mailed to them informing them that action will be taken under the regulations to insure their septic tank is pumped out as required.

Construction Site Erosion and Sediment Control

Through its plan review process, DPWES staff enforces the Public Facilities Manual and Subdivision Ordinance criteria related to stormwater for new development and redevelopment. DPWES Land Development Services staff review erosion and sediment control (E&S) plans for compliance with county and state requirements.

In 2012 a total of 710 E&S plans for projects that would disturb a land area of 2,500 square feet or more were submitted and approved for construction. Written reports listing these individual sites were provided on a monthly basis to Virginia Department of Conservation and Recreation (DCR).

Fairfax County's E&S control program is fully approved by DCR and is implemented by Land Development Services (LDS). In 2012, 26,617 E&S inspections were performed through the county's Alternative Inspection Program on all sites under construction. Those E&S inspections represent 54.7 percent of the 48,622 total site inspections that were performed by Site Development and Inspection Division (SDID) personnel. The site inspections total also includes 2,160 projects that were inspected for purposes other than strictly E&S control (e.g., pre-construction, streets, sanitary sewer, storm sewer, and project release).

In 2012 SDID wrote 605 "2030" E&S control reports, which identify the E&S control deficiencies developers must correct within five days. Failure to comply within the specified time frame can result in issuance of a violation to the developer. SDID issued 69 violations in 2012 and 54 of those were later cleared. The remaining 15 violations are extended until the required corrections are made or court action is initiated. SDID held 202 escrows for either landscaping or stabilization issues.

The Land Disturbance and Post Occupancy Branch of LDS investigates complaints alleging violations of Fairfax County's Erosion and Sediment Control Ordinance (Chapter 104). The branch also investigates complaints alleging violations of the county's Chesapeake Bay Preservation Ordinance (Chapter 118). In 2012 the branch received 247 total complaints. In most instances, there was either no violation or there was timely compliance if a violation was cited. The branch issued 24 Resource Protection Area (RPA) violations and 38 land disturbance violations. The branch undertook 20 criminal proceedings to ensure compliance, with two proceedings resulting in fines issued by the court.

Residents may report complaints about erosion and sedimentation to the county by phone or through email. Residents can visit the following web page to find contacts for specific land development issues: <http://www.fairfaxcounty.gov/dpwes/publications/urbanfor.htm>.

The Department of Planning and Zoning (DPZ) provides a full range of environmental review, but does not track stormwater efforts independently from other environmental efforts. In coordination with other DPZ staff and staff from other county agencies, DPZ accepted and reviewed 102 rezonings and related applications (e.g., amendments), 42 special exceptions and amendments, and 94 special permits and amendments in fiscal year 2012 for environmental considerations. In 2012 NVSWCD provided recommendations to DPZ on 123 rezoning and special exception applications. Recommendations addressed better site design techniques, LID practices and stormwater management measures that would lessen post-development impacts on streams and natural resources.

Land Conservation Awards Program

The county sponsors an annual Land Conservation Awards program to recognize the developers, contractors, site superintendents, and site inspectors who demonstrated an exemplary effort during the past year in the installation and maintenance of erosion and sediment control measures on construction projects and preservation of natural resources (such as trees, wetlands and Resource Protection Areas). In 2012, eight sites were nominated for awards in the following categories: Large Commercial, Small Commercial, Small Single Family Residential and Infill Lot. One Large Commercial, one Small Commercial and one Infill Lot were selected for awards. In addition, one site was recognized as the Best Protected Environmentally Sensitive Site of the year. The 2012 Land Conservation Awards program was held on January 18, 2013, an Outstanding Superintendent, an Outstanding Engineering Firm, and an Outstanding Contractor were also recognized. These awards are valued by recipients in the construction industry and provide incentives to do excellent work. County employees were also recognized with awards for Outstanding E&S County Inspectors and Outstanding E&S County Reviewers.

Trail Improvements to Address Erosion Issues

Park Authority staff continued to work with many partners to implement special projects to minimize water quality impacts from trails in the Resource Protection Areas as described below.

Table 3-3 2012 trail improvement projects

<i>Project Name</i>	<i>Description</i>
Lake Fairfax Park Natural Surface Trails	Phase 3 of the Lake Fairfax Natural Surface Trails project completed the design phase in 2012 and will go to construction in 2013.
Country County Trail at Dulles Toll Road	Phases 1 and 2 of this project paved 390 linear feet of eroded natural surface trail underneath the Dulles Toll Road with concrete and stabilized an additional 850 linear feet of trail with stone. The work includes installation of gabion baskets and rip rap to further stabilize this area in the Difficult Run Stream Valley that is frequently flooded. Construction started in September of 2011 and was completed in July of 2012.
South Run Stream Valley Trail system near Magic Leaf Court	This project replaced 1,350 linear feet of significantly damaged 4' wide asphalt trail with 6' wide trail and corrected a severe drainage problem caused by an inadequate culvert in South Run Stream Valley Park. The project was completed in November of 2012.

Project Name	Description
Cross County Trail Connection at Pohick Road	This project in the Pohick Stream Valley required a reroute of 200 linear feet of trail to decrease the grade from over 25 percent to under 15 percent and included asphalt paving and a retaining wall to eliminate erosion. The project design and construction was completed in November of 2012.
Royal Lake Park	Staff rerouted 225 linear feet of trail next to a drainage channel to eliminate erosion when the channel overtops the trail.

Agricultural Land

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. 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. Plans include best management 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 known as Resource Protection Areas (RPAs). In 2012 NVSWCD developed 14 soil and water quality conservation plans for 315.5 acres which included instructions for 4,020 linear feet of new vegetated buffer and 6,395 linear feet of re-planted buffer. A planting plan of note included an extensive partnership effort for buffer revegetation within the RPA of Little Difficult Run in Oakton.

NVSWCD provided technical assistance to two landowners cited for violation of county code and one horse owner cited for violation of the Agricultural Stewardship Act. Technical assistance included stabilization plans for restoring sites that had imported "fill material" (soil) without an approved rough-grading plan. Such stabilization plans included the use of appropriate vegetation, riprap and erosion control blankets. For the horse owner, NVSWCD staff completed an onsite investigation to ensure that the horse waste was no longer stacked next to the perennial stream and a Soil and Water Quality Conservation Plan was developed.

NVSWCD's *Earth Friendly Suburban Horse Farming* publication, which contains detailed information about site planning, pasture management, non-vegetated heavy use areas, and animal waste management, continued to be popular. The guide was distributed to the horse-keeping community directly, at events and online.

The Virginia Department of Forestry (VDOF) assists Fairfax County with the Agricultural and Forestal District Program, which provides tax incentives for landowners with 20 acres or more of land in agricultural and forest management. In 2012 VDOF completed two Agricultural and Forestal management plans. Stream management zones were particularly noted on these plans, and efforts were made to include buffers from the agricultural uses. The protection of forest cover and water quality were both promoted in the plans.

VDOF also writes Stewardship Plans for forestland owners and Neighborhood Forest Management Plans for Homeowners and Civic Associations. As a matter of course, these plans include an assessment of water quality issues such as erosion, pet waste, and fertilizer use. The Department of Forestry wrote two Neighborhood Forest Management Plans and one Forest Stewardship Plan.

4. Monitoring and Assessment

Fairfax County oversees a comprehensive monitoring program that includes activities designed to characterize water bodies, 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 (DPWES) and other regional partners.

Water Quality Monitoring

Watershed Monitoring

Two long-term monitoring stations were established in 2005; Station VNA is in a medium to high density residential area in the Accotink Creek watershed and Station OQN is in a low density residential area in the Sandy Run watershed. Station VNA drains 152 acres, and the drainage area has an estimated imperviousness of 25 percent. Station OQN drains 415 acres, and the drainage area has an estimated imperviousness of 10 percent. Automated sampling equipment is used to collect stormwater for water quality analysis. Sampling devices record rainfall amount, flow levels, pH and temperature at timed intervals.

In 2012, two rainfall events were monitored at each of the two water quality monitoring sites, Henderson Road in Occoquan (OQN) and Kingsley Avenue in Vienna (VNA) in accordance with Fairfax County's Watershed Water Quality Monitoring Program. Samples were tested for concentrations of nine constituents of concern. Table 4-1 below contains the median, high and low concentration of each of the nine constituents over the eight years from 2005 to 2012. In addition, statistical analyses using the Mann-Whitney 2-sample test were performed to determine if there were significant statistical differences between median constituent concentrations at the two stations. In 2012, as in 2011 and 2010, the analysis found significant statistical differences for concentrations of all of the nine constituents measured at the two sites. In addition, seasonal and annual unit-area constituent loadings for 2012 were calculated and are presented in Table 4-2.

Table 4-1 Results of statistical analysis to determine if there is a significant difference between observed constituent concentrations at Stations VNA and OQN for 2005 to 2012.

Constituent*	VNA Median	VNA High	VNA Low	OQN Median	OQN High	OQN Low	Differences Statically Significant? **
NH ₃ -N	0.18	0.73	0.00	0.01	0.27	0.00	YES
COD	53	292	22	23	122	0	YES
<i>E. Coli</i>	901	200000	0	583	38000	27	YES
Fecal Strep	6500	129000	100	925	51000	18	YES
NO ₃ +NO ₂ -N	0.73	1.64	0.16	0.42	0.73	0.10	YES
TDS	128	836	51	100	160	71	YES
TKN	1.65	11.30	0.48	0.58	2.41	0.00	YES
TP	0.30	1.61	0.06	0.06	0.80	0.00	YES
TSS	52.50	1207.00	4.90	15.75	485.00	1.40	YES

*All constituent units are mg/l, other than *E. coli* and Fecal Strep which are in colonies per 100 ml.

**Statistical significance was based on a Mann-Whitney 2-sample test at a 0.1 significance level.

Table 4-2 Computed seasonal and annual unit area constituent loadings at monitored locations for 2012.

Constituent	VNA Winter	OQN Winter	VNA Spring	OQN Spring	VNA Summer	OQN Summer	VNA Fall	OQN Fall	VNA Annual	OQN Annual
NH ₃ -N	0.118	0.002	0.102	0.026	0.087	0.008	0.092	0.007	0.399	0.043
COD	32.839	3.596	32.139	14.810	24.727	3.975	80.754	10.488	170.5	32.9
<i>E. Coli</i>	0.407	0.119	9.837	11.165	90.323	6.989	24.149	6.605	124.715	24.878
Fecal Strep	2.348	0.485	25.669	9.663	67.770	19.920	69.229	6.641	165.086	36.530
NO ₃ +NO ₂ -N	0.323	0.075	0.404	0.113	0.391	0.098	0.407	0.115	1.525	0.402
TDS	94.153	19.562	69.483	25.147	44.123	25.241	92.256	33.437	300.0	103.4
TKN	0.785	0.071	1.565	0.343	0.773	0.164	0.901	0.198	4.025	0.775
TP	0.120	0.006	0.107	0.091	0.151	0.020	0.388	0.047	0.766	0.163
TSS	43.503	2.025	47.525	55.767	45.228	10.848	123.654	24.753	252.9	93.4

*All loadings are expressed in pounds per acre, except for *E. coli* and Fecal Strep which are in billions of colonies per acre. To compute total loads in pounds or billion colonies, unit-area loading was multiplied by the drainage area of monitoring station in acres

Dry Weather Screening

In 2012 the county selected 106 MS4 outfalls for dry weather screening in accordance with the general protocol outlined in “Fairfax County Dry Weather Screening Program: Site Selection and Screening Plan” (September 2012). Physical parameters were recorded at each outfall. Water was found to be flowing at 46 of the outfalls, and was tested for a range of pollutants (conductivity, surfactants, fluoride, pH, phenol, copper, and temperature) using field test kits. Of the outfalls tested, 23 required follow-up investigations because they exceeded the allowable limit for at least one pollutant. Of the 23 sites that required a retest, 11 have been completed. Upon retesting these sites, seven continued to exceed the screening criteria, and further testing was conducted in an attempt to track down the source. This track down procedure consisted of using the county’s GIS mapping system. A map of the county’s storm drainage system was printed from GIS and used to track the storm network upstream of each site. Staff recorded observations of flowing water and land use, and tested the water where flow was found. This procedure was followed up the network of storm sewer pipes until the source was found or there was no flowing water.

One of the track downs had very minimal flow and the source could not be determined. One of the sites resulted in finding that a building’s cooling tower had sprung a leak and was draining down through the roof drains. The cooling tower has since been fixed and the discharge eliminated. Another trackdown resulted in finding that a cooling tower on a second building had its drain pipe left open. The drain has since been closed which has eliminated the discharge. Another trackdown found that an interior water feature of a building had its drain valve accidentally left open. The building engineer closed the valve which resulted in elimination of the discharge. One retest resulted in finding that a T-shirt company located in the City of Fairfax had one of its drains connected to stormwater instead of sanitary. The dye from the company that should have been going to sanitary instead was turning the stream blue. The county and city staff are working with the company to correct the problem. The remaining two trackdowns are from fluoride exceedances and have been followed up to buildings and are assumed to be cooling tower discharges. The remaining 12 trackdowns are currently being investigated and consist of exceedances in pH, copper and fluoride limits.



Figure 4-1 Sampling a flowing outfall during dry weather screening. Photo by Fairfax County.

Wet Weather Screening

Wet Weather Screening/Monitoring was conducted during 2012 using the previously developed “Wet Weather Site Selection and Screening Plan” (2006). Eight sites have been monitored twice each for the analytes listed in Appendix A of the county’s MS4 permit and for metals. The preliminary water quality analysis indicates that the runoff from the eight sites is not a significant source of pollutants to the MS4. The Wet Weather Screening Program selected and field screened 20 sites and will monitor a total of 10 sites. These sites were identified in industrial, commercial and other high risk areas and ranked according to the county land use code and potential to contribute pollutants to the MS4.

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. Benthic macroinvertebrates are organisms lacking a backbone, which inhabit the stream bottom and are large enough to be seen with the naked eye. 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.

A probability-based site selection sampling methodology was used to identify randomly-selected stream bioassessment locations throughout Fairfax County. These sites were stratified and proportionally distributed throughout the county based on Strahler stream order applied to all perennially flowing streams in Fairfax County. This methodology eliminates any site selection bias and is commonly used as a cost-effective way of obtaining a statistically defensible determination of stream conditions at a countywide scale.

A total of 52 sites were sampled for benthic macroinvertebrates in 2012: 39 sites randomly selected within Fairfax County as part of the annual probabilistic monitoring program; 11 Piedmont reference

locations in Prince William National Forest Park; and two Coastal Plain reference sites in the Kane Creek watershed of Fairfax County. Of these 39 randomly selected sites, a total of 19 sites were also sampled for fish. Multi-metric Indices of Biological Integrity (IBIs) have previously been developed for both the aquatic benthic macroinvertebrate and fish communities within 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 sites are selected randomly for monitoring. At these sites, samples are collected for both benthic macroinvertebrates and fish (once 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 <http://www.fairfaxcounty.gov/dpwes/stormwater/streams/streamreports>. Figure 4-2 shows the locations of the 2012 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 versus reference conditions. An IBI has been developed for macroinvertebrate and fish communities. The macroinvertebrate IBI is applied to all randomly selected 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.

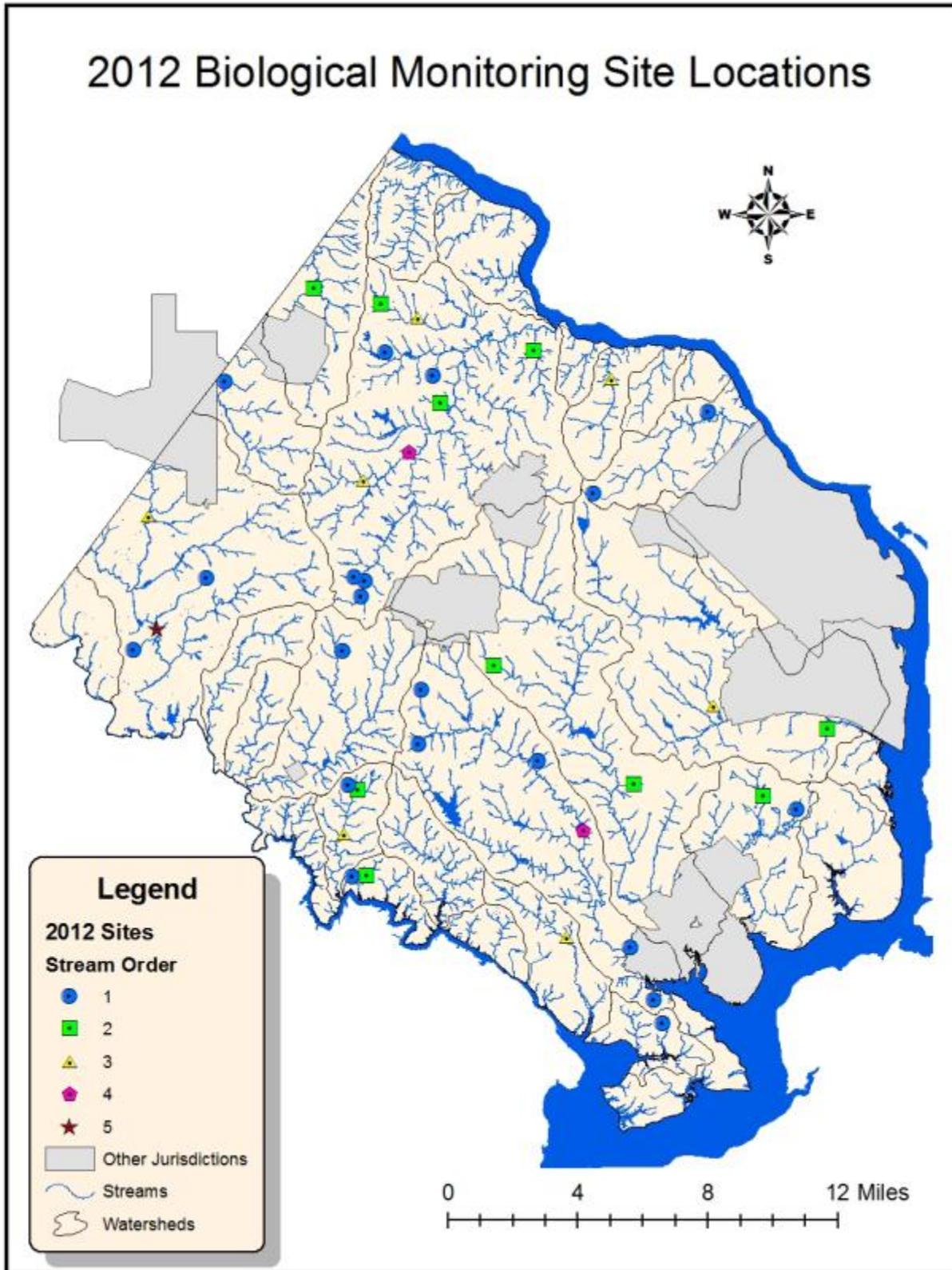


Figure 4-2 Location of 2012 biological monitoring sites.

Results

Figure 4-3 shows the results of the countywide distribution of macroinvertebrate and fish IBI scores, respectively.

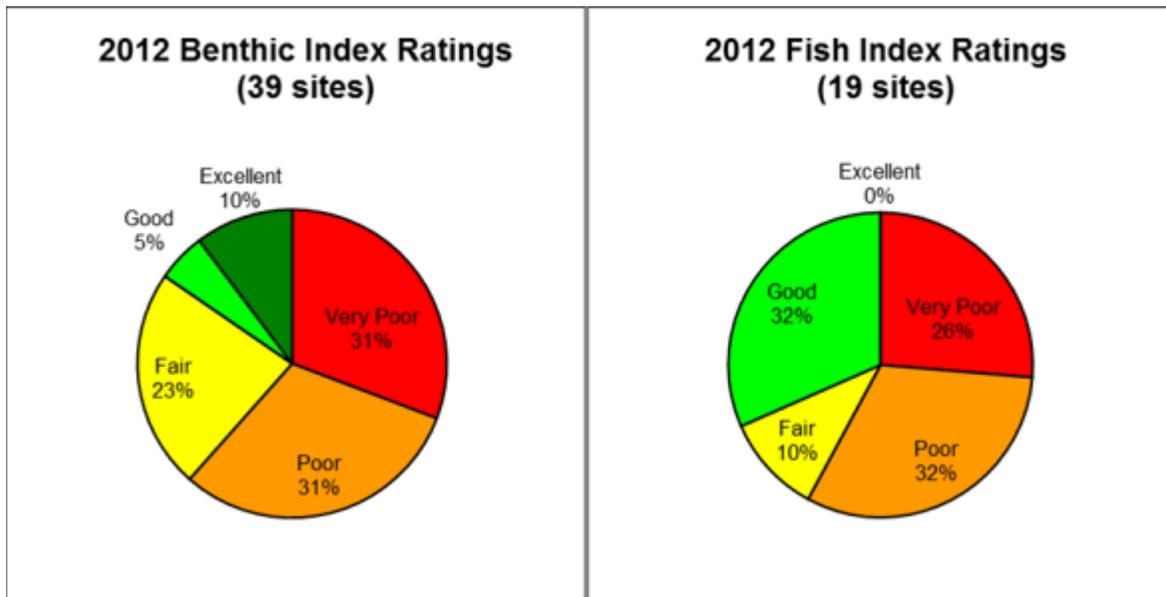


Figure 4-3 Countywide distribution of benthic macroinvertebrate and fish IBI ratings.

The benthic IBI scores show that 62 percent of the sites evaluated exhibited “poor” to “very poor” biological conditions while the fish IBI showed that 58 percent were scored “poor” to “very poor.” This is a decrease in the biological ratings compared to previous years. This may be a result of the random site selection (it is possible for a group of lower quality sites to be chosen in some years). Over the past nine years, a small increase in the benthic IBI scores has emerged. As future sampling results are added, a trend in biological integrity should begin to emerge. The countywide stream quality index, described in the following sub-section, is a way of tracking and evaluating these conditions over time.

Table 4-3 shows a breakdown (stratified by stream order) of the 2012 biological monitoring results for benthic macroinvertebrates and the scoring ranges for the rating categories. Table 4-4 shows the monitoring results at individual sites.

Table 4-3 2012 benthic macroinvertebrate sampling results by stream order.

Stream Order	Number of Samples	Minimum Score	Maximum Score	Standard Deviation	Mean IBI Score	Rating
1	20	8.0	78.9	21.2	32.0	Poor
2	10	9.9	99.5	34.5	44.0	Fair
3	6	19.8	83.1	22.0	47.0	Fair
4 & 5	3	27.7	48.6	10.9	36.4	Poor
ALL	39	8.0	99.5	23.4	37.6	Poor

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 4-4 2012 biological sampling results for individual monitoring sites.

Site ID	Watershed	Physiographic Province	Stream Order	Drainage Area in Acres	Drainage area in Miles ²	Benthic IBI*	Benthic Rating	Fish IBI*	Fish Rating
AC1202	Accotink Creek	Piedmont	2	588.9	0.92	16.3	Very Poor	28.6	Poor
AC1203	Accotink Creek	Piedmont	2	376.2	0.59	9.9	Very Poor	0.0	Very Poor
CA1201	Cameron Run	Coastal Plain	2	1786.0	2.79	23.4	Poor	0.0	Very Poor
CA1202	Cameron Run	Piedmont	3	1572.0	2.46			21.4	Poor
CU1201	Cub Run	Triassic Basin	1	125.1	0.20	19.5	Very Poor	N/A	N/A
CU1202	Cub Run	Triassic Basin	3	7688.1	12.01	32.9	Poor	28.6	Poor
CU1203	Cub Run	Triassic Basin	1	102.5	0.16	27.6	Poor	N/A	N/A
CU1204	Cub Run	Triassic Basin	5	24260.4	37.91	33.0	Poor	28.6	Poor
DC1201	Dogue Creek	Coastal Plain	2	1140.2	1.78	38.3	Poor	57.1	Good
DC1202	Dogue Creek	Coastal Plain	1	164.4	0.26	15.2	Very Poor	N/A	N/A
DF1201	Difficult Run	Piedmont	1	292.6	0.46	34.9	Poor	N/A	N/A
DF1202	Difficult Run	Piedmont	1	212.0	0.33	42.2	Fair	N/A	N/A
DF1203	Difficult Run	Piedmont	3	1503.5	2.35	49.6	Fair	N/A	N/A
DF1204	Difficult Run	Piedmont	4	4266.6	6.67	48.6	Fair	64.3	Good
DF1205	Difficult Run	Piedmont	2	392.3	0.61	26.1	Poor	0.0	Very Poor
DF1206	Difficult Run	Piedmont	1	19.7	0.03	50.8	Fair	N/A	N/A
DF1207	Difficult Run	Piedmont	3	1665.5	2.60	57.2	Fair	42.9	Fair
DF1208	Difficult Run	Piedmont	2	417.7	0.65	80.4	Excellent	64.3	Good
DF1209	Difficult Run	Piedmont	1	230.9	0.36	44.7	Fair	N/A	N/A
DF1210	Difficult Run	Piedmont	2	516.7	0.81	28.9	Poor	64.3	Good
DF1211	Difficult Run	Piedmont	1	69.0	0.11	8.0	Very Poor	N/A	N/A
HC1201	Horsepen Creek	Triassic Basin	1	782.3	1.22	51.4	Fair	28.6	Poor
KC1201	Kane Creek	Coastal Plain	1	57.0	0.09	44.9	Fair	N/A	N/A
MB1201	Mill Branch	Piedmont	3	1791.6	2.80	39.1	Poor	21.4	Poor
PC1201	Pohick Creek	Piedmont	1	87.2	0.14	10.2	Very Poor	N/A	N/A
PC1202	Pohick Creek	Piedmont	4	9954.6	15.55	27.7	Poor	71.4	Good
PC1203	Pohick Creek	Coastal Plain	1	90.7	0.14	17.9	Very Poor	N/A	N/A
PC1204	Pohick Creek	Piedmont	1	152.2	0.24	12.7	Very Poor	N/A	N/A
PC1205	Pohick Creek	Coastal Plain	1	114.0	0.18	75.5	Good	N/A	N/A
PC1206	Pohick Creek	Piedmont	1	99.0	0.15	10.9	Very Poor	N/A	N/A
PH1201	Popes Head Creek	Piedmont	1	37.5	0.06	22.0	Poor	N/A	N/A
PM1201	Pimmit Run	Piedmont	1	131.1	0.20	15.1	Very Poor	N/A	N/A
PM1202	Pimmit Run	Piedmont	1	201.0	0.31	15.1	Very Poor	N/A	N/A
RD1201	Ryans Dam	Piedmont	1	92.0	0.14	42.6	Fair	N/A	N/A
RD1202	Ryans Dam	Piedmont	2	221.5	0.35	99.5	Excellent	N/A	N/A
SC1201	Scotts Run	Piedmont	3	2582.9	4.04	19.8	Very Poor	0.0	Very Poor
SU1201	Sugarland Run	Triassic Basin	2	1795.9	2.81	20.3	Poor	71.4	Good
WR1201	Wolf Run	Piedmont	1	54.0	0.08	78.9	Good	N/A	N/A
WR1202	Wolf Run	Piedmont	2	529.0	0.83	96.7	Excellent	42.9	Fair
WR1203	Wolf Run	Triassic Basin	3	1992.3	3.11	83.1	Excellent	7.1	Very Poor

* Benthic and Fish IBIs have a maximum score of 100: Sites with benthic IBI's of N/A had samples that did not produce enough macroinvertebrates to calculate an IBI score. They were automatically given a Very Poor rating. Fish surveys were only conducted at sites with drainage areas greater than 300 acres.

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 number of 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 “poor” and “fair” and an index score of one corresponds to “very poor.”

Table 4-5 and Figure 4-4 shows the SQI for all years probabilistic monitoring has been employed. The 2012 SQI shows a decrease in overall stream quality from 2011. This index will be reported annually to evaluate long-term trends in the overall health of streams. Over the past nine years of sampling, a very small increase in the SQI has emerged. As more data are reported annually, emerging trends can be identified with greater certainty.

Table 4-5 Countywide SQI for sampling years 2004-2012 showing percentage of sites in each rating category.

Sampling Year	Very Poor	Poor	Fair	Good	Excellent	Index Value
2004	40	30	17	13	0	2.03
2005	15	32.5	32.5	7.5	12.5	2.70
2006	36.4	34	15.9	11.4	2.3	2.09
2007	17.5	32.5	15	20	15	2.83
2008	35	25	17.5	15	7.5	2.35
2009	38	35	15	8	5	2.08
2010	15	40	22	15	8	2.63
2011	17.5	27.5	22.5	20	12.5	2.83
2012	31	31	23	5	10	2.33

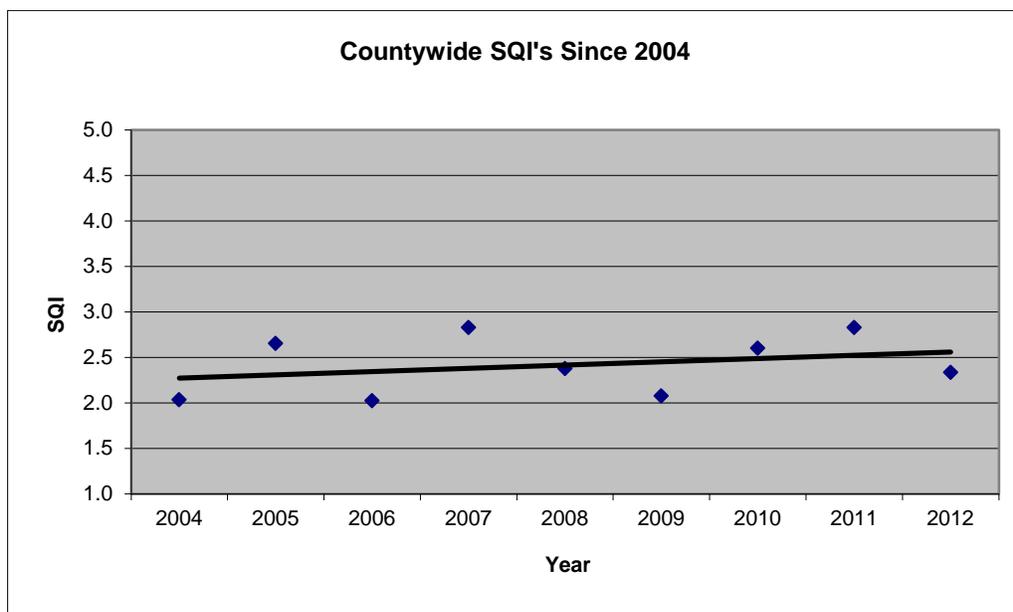


Figure 4-4 Trends in the countywide stream quality index.

The benthic IBI was calculated from 2004 to 2008 by comparing data collected in the county against the reference data collected that same year. Now that there is five years' worth of reference data available, the Benthic IBI is calculated using the cumulative reference data collected over the past five years. This process will reduce the variability in the IBI created by yearly disturbances to the reference sites (i.e. drought). This change is the reason previous years' reports show different SQIs than the ones shown in Table 4-5.

Table 4-6 presents a summary of biological monitoring data collected countywide since 2004. 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 http://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 <http://www.fairfaxcounty.gov/dpwes/stormwater/reports.htm>.

Table 4-6 Overall watershed conditions for sampling years 2004-2012 combined.

Watershed	Number of Benthic Sites	Average IBI	Rating	Number of Fish Sites	Average IBI	Rating
Accotink Creek	26	26.1	Poor	18	32.9	Poor
Belle Haven	4	23.4	Poor	1	21.4	Poor
Bull Run	3	51.9	Fair			
Cameron Run	23	27.1	Poor	13	15.9	Very Poor
Cub Run	21	31.6	Poor	17	42.4	Fair
Dead Run	4	22.2	Poor	1	14.3	Very Poor
Difficult Run	82	40.6	Fair	40	50.9	Fair
Dogue Creek	8	30.1	Poor	5	45.7	Fair
Horsepen Creek	6	29.1	Poor	2	21.4	Poor
Johnny Moore Creek	5	47.7	Fair	2	39.3	Fair
Kane Creek	5	61.8	Good	1	42.9	Fair
Little Hunting Creek	7	21.5	Poor	6	22.6	Poor
Little Rocky Run	8	19.8	Very Poor	4	60.7	Good
Mill Branch	8	48.2	Fair	3	19	Very Poor
Nichol Run	9	60.6	Good	1	57.1	Good
Occoquan	4	87.9	Excellent			
Old Mill Branch	1	75.5	Good			
Pimmit Run	10	16.5	Very Poor	4	5.4	Very Poor
Pohick Creek	50	30.8	Poor	20	57.1	Fair
Pond Branch	6	57.2	Fair	2	50	Fair
Popes Head Creek	21	57.3	Fair	11	64.9	Good
Ryans Dam	3	77.6	Good			
Sandy Run	11	65	Good	1	64.3	Good
Scotts Run	3	19.4	Very Poor	2	3.6	Very Poor
Sugarland Run	8	41.1	Fair	5	51.4	Fair
Turkey Run	1	17.1	Very Poor			
Wolf Run	10	80.6	Excellent	4	33.9	Fair
Fairfax County	347	39	Poor	163	45.5	Fair

Bacteria Monitoring

In 2012 the Fairfax County Stormwater Planning Division (SWPD) continued its bacteria monitoring program while ensuring that it is consistent with current standards and practices and uses the most effective procedures. In 2012 SWPD completed its eighth year collecting data for the bacteria monitoring program since acquiring the program from the Fairfax County Health Department.

As recommended by the U.S. Environmental Protection Agency, the bacterium *Escherichia coli* (*E. coli*) is used by Fairfax County as the water quality indicator for fecal contamination in surface water.

To determine levels of *E. coli* in county streams, grab samples of stream water were taken at 36 sites in 15 watersheds throughout the county. Staff collected samples four times during the year.

According to the Virginia Department of Environmental Quality (VDEQ), the following standard now applies for recreational contact with 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.

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 unitless at a state level.

E. coli 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 2012, 42 percent of Fairfax County’s bacteria monitoring locations were consistently below VDEQ’s standard of 235 units per 100 mL of water (Figure 4-5). Fairfax County concurs with officials from the VDEQ 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.

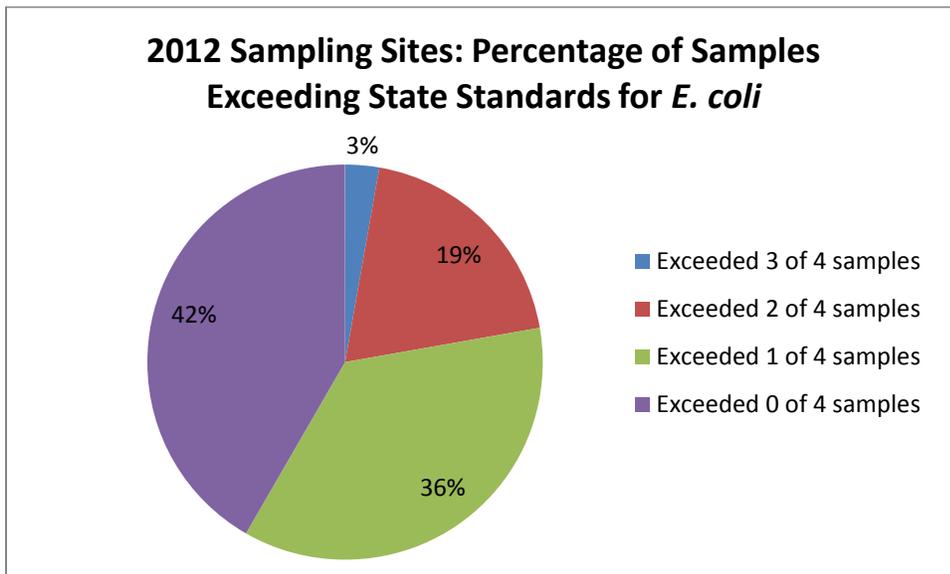


Figure 4-5 Percentage of sites exceeding Virginia’s instantaneous water quality standard for *E. coli*.

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.”

Water Chemistry Results	
Temperature (°C)	
Minimum.....	1.45
Maximum.....	28.5
Average	12.9
Dissolved Oxygen (mg/L)	
Minimum.....	2.6
Maximum.....	19.0
Average	9.9
Specific Conductance (µs/cm)	
Minimum.....	69
Maximum.....	1390
Average	334.8

Figure 4-6 Water chemistry results associated with the bacteria monitoring program
Past Annual Reports on Fairfax County Streams and monitoring methods are available on the Stream Quality Assessment Program page located at www.fairfaxcounty.gov/dpwes/stormwater/streams/assessment.htm.

USGS Monitoring Network

In June 2007 a joint funding agreement between the SWPD and the United States Geological Survey (USGS) was signed by the Board of Supervisors (BOS). This agreement established a study designed to be an ongoing, long-term (five-ten year) monitoring effort to describe countywide 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 and stormwater management programs.

In July 2012, the BOS approved the expansion of this network to provide wider coverage across the county. Under this scheme, the monitoring network is maximized spatially and established within watersheds having the greatest potential for implementation of watershed improvement projects. The expansion included one automated station and five less-intensely monitored sites.

The monitoring network designed to fulfill the objectives of the study will consist of five automated continuous water-resources monitoring stations and fifteen less-intensely monitored sites. The first four automated stations were constructed in 2007 and achieved full operational capability in 2008. The fifth station is currently under construction and should be fully operational in the second quarter of 2013. Instruments at these stations collect streamflow data every five minutes and water-quality (water temperature, pH, specific conductance, and turbidity) data every 15 minutes; data are then transmitted via satellite and posted to a USGS web page hourly. These automated stations also capture storm event samples to be analyzed for sediment and nutrient concentrations. Additionally, samples are collected monthly at all twenty sites under various hydrologic conditions and analyzed for the same suite of constituents. Nutrient analyses are conducted by the Fairfax County Environmental Services Laboratory and the suspended sediment analyses are conducted by the USGS Eastern Region Sediment Laboratory.

Data for this study is compiled based on the USGS 'Water Year', which for 2012 runs from October 1, 2011 through September 30, 2012. Samples from the expanded network began on October 9, 2012, so they are excluded from the data below.

Continuous Data Collection

- Continuous water-quality and streamflow data were collected at the four intensive monitoring stations throughout the water year with no significant interruptions in data collection.
- Streamflow data were collected at five minute intervals, resulting in as many as 105,000 measurements per year.
- Continuous water-quality data (water temperature, specific conductance, pH, and turbidity) were collected at 15-minute intervals, resulting in as many as 35,000 measurements per year.
- All data collected can be accessed online at <http://va.water.usgs.gov/projects/goog/fairfax.htm>.

Discrete Data Collection

- Grab samples were collected monthly at all 14 monitoring stations, resulting in 186 samples collected and analyzed (including QA samples). Water level and water-quality parameters were measured at the time of sampling and samples were analyzed for nutrients and suspended sediment concentration.
- Storm event samples were collected using automated samplers at the four intensive monitoring stations. These samples were collected in response to elevated turbidity and streamflow conditions during storms, resulting in the collection of 105 samples that were analyzed for the same suite of nutrients and suspended sediment concentration as the monthly grab samples.
- A total of 52 manual streamflow measurements were made across the 14 sites to support the maintenance of the streamflow rating curve for each site.

Interpretation of water-quality conditions and trends requires multiple years of data for statistically rigorous evaluation; thus, these analyses are not yet available for this study. This cooperative study is a progressive and unique effort to characterize conditions in urban and suburban streams that is expected to facilitate an understanding of watershed-scale responses to management practices which has yet to be accomplished by other studies.

Volunteer monitoring

Northern Virginia Soil and Water Conservation District (NVSWCD) continued its successful volunteer stream monitoring program in 2012. This program supplements the county's stream bio-assessment 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. The program also builds awareness of watershed issues among participants. Trained volunteers assess the ecological health of streams using the enhanced Virginia Save Our Streams (SOS) 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 more than 100 certified monitors. Data collected by volunteers are shared with Fairfax County, the VDEQ, Virginia Save Our Streams, and other interested organizations or individuals. The data help to confirm findings of biological monitoring performed by county staff, provide information on trends, and can serve as a first alert in areas where the county may monitor only once in five years. Approximately 30 volunteers collected data at 25 sites four times during 2012. In addition, 34 public stream monitoring workshops and field trips were held throughout the county and 532 county residents attended. At each workshop or field trip biological monitoring was performed and information was presented on stream ecology, stormwater runoff, urban hydrology and watersheds. A monthly *Watershed Calendar*, listing training and other events of interest, was emailed to approximately 1000 recipients.

Volunteer monitors and monitoring sites that had been part of the former Audubon Naturalist Society's Water Quality Monitoring Program have been integrated into the Volunteer Stream Monitoring Program coordinated by NVSWCD.

Reston Association is among the organizations that participate in the monitoring program using the SOS protocol, and they submit data on Reston streams to NVSWCD. Currently, 11 sites are monitored by RA staff and 10 volunteers.

Several FCPA Resource Management sites participate in the county stream quality monitoring program directly, as well as through training and sponsoring citizen volunteer monitors to include Riverbend Park and Ellanor C. Lawrence Park. Five nature centers and an imbedded naturalist at Cub Run RECenter provide water quality and environmental education to hundreds of thousands of park visitors each year.

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

In early 2012 the Virginia Department of Environmental Quality (VDEQ) released its draft summary of water quality conditions in Virginia from January 1, 2005, to December 31, 2010. This report is released on a bi-annual basis. The goals of Virginia's water quality assessment program are to determine whether water bodies meet water quality standards and then develop and implement a plan to restore waters identified as impaired. 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 VDEQ's draft 2012 Water Quality Assessment Integrated Report can be found at <http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2012305b303dIntegratedReport.aspx>. Please refer to this website for the most up to date listing of impaired waters in Virginia. Water bodies are often 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). The Commonwealth identifies fish impairments based on fish tissue data for which there are numeric criteria that set the threshold for impairment. Benthic impairments are identified based on the Virginia Stream Condition Index and anything below 60 is considered impaired. 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.

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 VDEQ and submitted to the U. S. Environmental Protection Agency for approval. The TMDL consists of a waste load allocation, or point source contribution, a load allocation, or non-point source contribution, and a margin of safety.

To date, the following TMDLs have been established in Fairfax County and have assigned reductions to the county's MS4:

- Bacteria (Fecal Coliform and/or *E. coli*):
 - Accotink Creek
 - Four Mile Run
 - Bull Run (includes Cub, Johnny Moore and Little Rocky Runs)
 - Pope's Head Creek
 - Difficult Run
 - Hunting Creek (includes Cameron Run and Holmes Run)

- Sediment (Benthic Impairment):
 - Bull Run (includes Cub, Johnny Moore and Little Rocky Runs)
 - Pope's Head Creek
 - Difficult Run
- PCBs: Tidal Potomac (includes Accotink Creek, Belmont Bay, Dogue Creek, Four Mile Run, Gunston Cove, Hunting Creek, Little Hunting Creek, Occoquan River and Pohick Creek)

In December 2010 the EPA published the final TMDL for the Chesapeake Bay watershed, in which Fairfax County is the most populous local jurisdiction. This multi-state initiative set restrictions on nitrogen, phosphorus and sediment pollution throughout the 64,000-square-mile watershed. Virginia submitted their final Phase II Watershed Implementation Plan (WIP) to EPA in March 2012. The WIP identified the following initiatives to provide significant progress in meeting nutrient reduction goals:

- Nutrient credit expansion,
- Agricultural resource management plans,
- Revised stormwater management regulations,
- Stormwater program improvements and MS4 permitting, and
- Urban nutrient management.

The VDEQ is currently developing bacteria TMDLs for the Sugarland, Mine and Pimmit Run watersheds. The TMDLs are scheduled to be finalized in early 2013.

Upon approval of a TMDL, Virginia law requires the development of an implementation plan (IP). The IP should describe actions (best management practices) to implement the allocations contained in the TMDL. Non-point sources are not regulated and reductions are generally achieved through incentive and cost-share programs. Point source allocations are addressed through 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 pollutants 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. Additional information on the VDEQ water quality and TMDL programs is available at <http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs.aspx>.

5. Public Outreach and Education

Fairfax County partners with several organizations to enhance public outreach and education campaigns with the goal of improving and protecting the environment. In 2012 the following organizations contributed to the county's outreach efforts:

- Alice Ferguson Foundation: organizes the Potomac River Watershed Cleanup
- Clean Fairfax Council: assists with watershed cleanups
- Clean Virginia Waterways: coordinates the annual Virginia Waterways Cleanup part of Ocean Conservancy's International Coastal Cleanup.
- Earth Sangha: assists and provides volunteers for tree plantings
- Fairfax County Public Schools
- Fairfax ReLeaf: assists with tree planting
- Metropolitan Washington Council of Governments (M-COG): regional stormwater education
- Northern Virginia Soil and Water Conservation District (NVSWCD): provides support for outreach activities
- Northern Virginia Regional Commission (NVRC): through the efforts of the Clean Water Partners which includes Fairfax County and neighboring jurisdictions, the commission coordinates regional pollution prevention outreach through radio public service announcements (PSAs), web pages, banner ads on Google and follow-up surveys of residents
- Reston Association: provides support for outreach activities
- Virginia Department of Forestry: assists with tree plantings

The county implements a public education program with the goal of providing information to its residents and encouraging public involvement in the following areas related to stormwater management:

Illicit Discharges and Improper Disposal

The county's MS4 is designed to collect and transport stormwater to local water bodies. The MS4 is not intended to receive any other substances unless they are specifically permitted by the Commonwealth. The county's education program is designed to help residents recognize discharges that are not allowed in the MS4 and report them to the appropriate county or state authorities.

Fairfax County's Stormwater website includes a page entitled "What's that Stuff in the Stream?" which provides descriptions and pictures of different stream conditions to help residents distinguish between what is a natural occurrence and what may be an indicator of an illicit discharge. This page, and others, was updated in 2012 in an effort to improve accessibility for residents.

Local Water Quality Improvement Initiatives

Fairfax County offers educational opportunities promoting individual and group involvement in local restoration and cleanup efforts. Residents are also encouraged to consider best management practices, such as rain gardens and other low impact development practices, to retrofit residential areas without adequate stormwater controls.

SWPD posted numerous messages on the county's environmental Facebook page on such topics as water quality, trash in streams, "Friends of Trees", water reuse, rain barrels and stream restoration. Several stream restoration and other completed projects were posted to SlideShare and gained 1,500 views.

Watershed Cleanups

Staff from the Stormwater Planning Division (SWPD), Solid Waste Management Program (SWMP), Wastewater Management (WWM), Fairfax County Park Authority (FCPA) and the Northern Virginia Soil and Water Conservation District (NVSWCD) continued to support large and small-scale volunteer cleanups coordinated by the Alice Ferguson Foundation, Clean Virginia Waterways and Clean Fairfax Council.



Figure 5-1 Youth volunteers begin clean-up near the Fort Hunt Tributary of Little Hunting Creek as part of the fall 2012 Clean Virginia Waterways event. Photo by Raytheon.

In the spring of 2012 approximately 110 sites were established throughout the county for the Alice Ferguson Foundation's annual Potomac River Watershed Cleanup. These cleanups were advertised in the SWMP's e-mail subscription for public school teachers and the FCPA's Parktakes Magazine, as well as on the internet. Cleanups were conducted at numerous state, county and local parks, schools, the county wastewater treatment plant and other locations. More than 2,270 volunteers removed an estimated 49,475 pounds of bagable trash and 21,285 pounds of bulk trash. An estimated 11,315 plastic shopping bags were counted.

According to Clean Virginia Waterways, a total of 801 volunteers participated in the International Coastal Cleanup in Fairfax County during September and October 2012. At 36 sites, 17,421 pounds of trash and marine debris were removed. Plastic bags, beverage bottles, food wrappers and containers, and litter from recreational activities and fast food consumption (i.e. cups, plates, forks etc.) were the most commonly collected trash items in the county.

Clean Fairfax Council documented the following metrics regarding litter and clean-up activities:

- "Report a Litterer" reports (via anonymous fill-in form at Clean Fairfax Council website or the "Report a Litterer" hotline – 106
- Total number of clean up events either planned or supported – 67
- Total number of volunteers at clean up events – 2,343
- Total number of volunteer hours – 6,652
- Cubic yards of garbage collected – 1,004

The FCPA organized and/or assisted with a number of stream cleanups in 2012:

- Riverbend Park: three watershed cleanups with a total of 140 people
- Fairfax Trails and Streams cleaned Pimmit Run stream valley on a regular basis along with two big cleanups spring/fall.
- Burke Lake Park: High school cross country teams organized a lake shore cleanup day and collected approximately 50 bags of lake shore trash. Several patrons also collected lakeside trash.
- Lake Accotink Park: Staff organized two Watershed Clean-up Days on April 14 and October 13, 2012 attracting more than 130 volunteers. The Mobile Crew removed 17.9 tons of debris from the lake at the marina in April and 40.5 tons in November. Throughout the year, the park supported numerous individual and small-group volunteers who collected trash in the park. Friends of Accotink Creek organized bi-annual cleanups at twelve points along Accotink Creek, in Fairfax County and Fairfax City parks. Northern Virginia Kayak Club conducted an Earth Day clean-up of the lake.
- Huntley Meadows Park: Over 100 bags of trash were removed from the park during five separate stream cleanups in 2012 that included Dogue Creek, Barnyard Run and Little Hunting Creek watersheds.

NVSWCD and SWMP assisted in a cleanup of Little Hunting Creek in April 2012 where 139 volunteers picked up 245 bags of trash, 27 tires and 49 shopping carts.

Reston Association coordinated two major stream cleanups during 2012 with 141 volunteers collecting approximately 175 bags of trash. They also sponsored two lake cleanups on May 23 and June 2, 2012, during which 46 volunteers removed trash and debris from 6 miles of shoreline along Lake Anne, Thoreau and Audubon.

The Lake Barcroft Water Improvement District collected litter from the lake, which was then moved offsite by the Solid Waste Management Program. These actions keep trash and other debris from moving downstream and into the Potomac River.

In 2012 the multi-agency trash workgroup (consisting of representatives from SWPD, SWMP, NVSWCD and CFC) continued to test and refine the Trash Assessment For Improved Environments (TAFIE) stream condition assessment protocols and data forms. As part of a cooperative effort to evaluate litter problems prior to a stream restoration project in Flatlick Branch, NVSWCD completed a TAFIE survey in a 100-foot reach within the project site. Surveyors counted 193 pieces of trash, mostly plastics. Six bags of trash were removed. Valuable information about the types and probable sources of trash was also recorded. Phase I of this stream restoration project will be occurring in 2013. The workgroup plans to reach out to retailers/vendors located near the site to raise awareness of the litter issue and encourage support for the upcoming restoration project.

Other TAFIE assessments conducted in 2012 included sites at Accotink/Royal Thomas Way (spring and fall), Providence REC Center (spring and fall), Huntley Meadows (spring) and Shaw Park Court (fall).

During 2012 the workgroup outlined a public education plan for TAFIE for 2013. TAFIE forms and guidance were provided to elementary schools by request and to individuals seeking volunteer services for the Virginia Master Naturalist certification program.

The county continued to promote the voluntary Virginia Adopt-a-Stream Program implemented by the Virginia Department of Conservation and Recreation. Links to information about the program are included on the county's Web pages dedicated to litter and volunteer stream cleanups.

Clean Fairfax Council made 50,000 impressions (i.e., web hits, tweets, Facebook) with its online content about litter and the environment.

Stream Buffer Restoration

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

NVSWCD's 2012 seedling sale helped promote urban reforestation, habitat enhancement and water quality protection, selling 7,600 native tree and shrub seedlings. The sale offered a variety of eight seedlings chosen to help homeowners restore their landscape.

As part of the county's buffer restoration program, Earth Sangha donated and/or installed 899 native woody plant seedlings, 459 native grass and wildflower plants and 26 pounds of meadow seed mix in 2012. Table 5-1 includes examples of restoration projects. Earth Sangha sold at a discount 302 native woody plants and 233 native grass and wildflower plants to FCPA sites from seedlings grown in their nursery in Springfield. In addition, they donated plants to approximately 25 local schools and 30 other parklands, ecological organizations and HOA's.

Table 5-1 2012 Earth Sangha buffer restoration activities.

<i>Site</i>	<i>Number of Plants</i>	<i>Volunteer Hours</i>	<i>Staff Hours</i>
Waples Mill Park	48 tree seedlings	100	20
Rutherford Park	70 pots of native grasses and wildflowers	111	19
Riverbend Park	125 woody plants, 40 herbaceous plants	42	8
ECLP	60 woody plants	184	37
Hidden Pond Nature Center	96 woody plants		
Huntley Meadows Parks	161 woody plants, 12 pounds of native grass seed mix		
Urban Forest of Fairfax	105 tree seedlings (these seedlings were paid for)		
NVSWCD Riparian Buffer Mitigation Project	260 woody plants		

The FCPA, Fairfax ReLeaf and the Virginia Department of Forestry (VDOF) hosted independent stream buffer restorations in the county in 2012. The Park Authority continues to maintain and monitor the previous riparian buffer enhancement projects installed in the last five years. To date there are 37 projects on parkland throughout the county. These projects have focused on the conversion of mowed grass to areas of native trees and shrubs typical of riparian areas. Park Authority staff completed additional planting projects in the RPA unrelated to the county's buffer planting program. Examples of such projects in 2012 include the planting of 165 native shrubs, grasses and forbs at Riverbend Park and the planting of 161 native trees plus 12 pounds of native seed mix at Huntley Meadows Park with support from Earth Sangha.

In 2012 Fairfax ReLeaf planted 4,206 trees in Fairfax County through more than 60 projects. They also distributed 2,514 trees in the county.

The VDOF continues to plant riparian buffers in watersheds throughout Fairfax County in support of the county's riparian buffer initiative. In 2012 VDOF worked with volunteers from organizations such as Fairfax ReLeaf, Eagle Scouts, homeowner associations and school groups and planted approximately 5,300 seedlings in the county. The Tree Stewards program, initiated in 2011, is designed to create a

cadre of trained volunteers to lead community tree plantings and provide information on the benefits and care of trees. An additional 10 Tree Stewards were trained in 2012.



Figure 5-2 Volunteerfest® invasives removal event in Pohick Stream Valley Park. Photo by FCPA.

The FCPA, with strong volunteer support, continued the aggressive management of invasive, non-native plants on over 50 acres of parkland as part of the Invasive Management Area (IMA) program. More than half of the management sites are within the Resource Protection Area, where the invasive species interfere with forest function of critical riparian buffer vegetation. Six hundred and four native plants, trees, shrubs and ground covers were planted at 11 IMA sites in 2012. The FCPA also contracts for herbicide removal of invasive species at selected sites. In 2012, approximately 392 acres were treated with selective herbicide for the support of invasive species eradication.

Reston Association managed an invasive species program at Lake Thoreau including the treatment of Eurasian water milfoil, yellow floating heart, and floating pondweed. Removal of purple loosestrife continued on all RA lakes and *Miscanthus* grasses were removed from Lake Newport dam.

Community Low Impact Development

NVSWCD provides information to residents to help them manage their land and protect water quality by controlling stormwater, preventing erosion and encouraging native vegetation. One of their online resources, *You and Your Land-a Homeowner's Guide for the Potomac Watershed*, provides comprehensive information to aid homeowners in the economical care and maintenance of their property. NVSWCD also published a *Residential LID Landscaping Guide* for homeowners, which provides design and installation information for several low impact development practices appropriate for solving common drainage problems. It includes sources of supplies and plant materials and is available in hard copy and electronic formats. NVSWCD, partnering with the Park Authority, continued to distribute copies of their manual *Rain Garden Design and Construction: A Northern Virginia Homeowner's Guide*. It has all the instructions and calculations needed for a homeowner to build a rain garden on his or her own property. The manual is available in hard copy and electronic formats.

NVSWCD presented two rain garden workshops during 2012. The workshops covered rain garden function, design, location, costs, construction, maintenance, planting and materials. The workshops were attended by 59 county residents and industry professionals.

NVSWCD coordinated a regional rain barrel initiative for Northern Virginia with neighboring jurisdictions. Eight “build-your-own” rain barrel workshops, four pre-made rain barrel sales and one “train the trainer” event attracted a total of 324 county residents and resulted in the distribution of 405 barrels. NVSWCD continued to partner in an Artistic Rain Barrel program to renew interest in rain barrels and other best management practices. Twenty teams of students painted and decorated rain barrels, which were auctioned at an Earth Day event.

NVSWCD coordinated two “build-your-own” composter workshops using surplus barrels from the rain barrel program. Thirty participants constructed thirty tumbler-style composters.

In addition, NVSWCD organized the Watershed Friendly Garden Tour in June 2012, showcasing low impact development practices including green roofs, porous pavers, rain gardens, composting, rain barrels, native species, wildlife habitat and more, inspiring visitors to adopt these practices in their own yards and schools.



Figure 5-3 A homeowner-installed rain garden featured on the 2012 Watershed Friendly Garden Tour. Photo by NVSWCD.

In 2012 the storm drain marking program continued to facilitate environmental stewardship and educate the public about non-point source pollution prevention. Staffed by NVSWCD and funded by Fairfax County, the program costs approximately \$12,000 per year for plastic markers and glue. During each storm drain marking project, volunteers engage in outreach and placing a pre-printed label with a “no dumping” message on the storm drains in their neighborhoods. In 2012 the storm drain marking program coordinated 25 projects that placed markers on 3,059 storm drains and educated 10,000 households on ways they could take action to protect water quality. Each household received a flier about the causes and prevention of non-point source pollution and how to properly dispose of used motor oil, pet waste, paint, fertilizer, yard debris and other pollutants. In 2012, 500 volunteers contributed 2,500 hours to the program.

In 2012 NVSWCD disseminated information on county environmental programs and events monthly via two email lists, the *Green Breakfast* groups (565 recipients) and the *Watershed Calendar* group (an average of 1,000 recipients). NVSWCD also continued to publish *Conservation Currents* which featured

articles on rain gardens, stream restoration and stewardship. NVSWCD sent 2,500 print copies per issue, mainly to homeowner associations who are encouraged to reprint articles in their newsletters. Many articles are also posted on the NVSWCD website and there is a growing list of e-subscribers.

Reston Association (RA) provides watershed education opportunities for the public at its Walker Nature Education Center. The nature center conducts programs for all ages that promote watershed appreciation and conservation, including stream and lake explorations, rain barrel workshops and fishing programs. A summary of RA's activities in 2012 follows:

- Distributed 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"
- Hosted two stream restoration community meetings
- Conducted four stream walks
- Met with clusters (group of single-family, townhouse or multifamily dwellings in a community) to gain approvals for the stream restoration design plans
- Held two rain barrel workshops in May and September where 57 barrels were made
- Continued with the second annual Kids' Trout Fishing Day with 271 kids fishing
- Worked with Lake Anne Elementary School Bayscapers Club and Langston Hughes Middle School Earth Force Club on water quality
- Collected macroinvertebrates with the Lorien Woods School
- Assessed the Snakeden Branch stream restoration with the South Lakes High School IB students
- Included watershed education, stream and lake exploration, and fishing and boating activities at eight of its summer camp programs for children ages three to 16. These programs served 1,265 campers between June 25 and August 24
- Worked with scouts to install a rain garden near Lake Thoreau off Ridge Heights Road and South Lakes Drive

Every Reston lake has a permanent wayside exhibit with information about the lake's watershed and the flora and fauna that is supported by the lake. There is also a permanent wayside exhibit at the nature center at Snakeden Branch that includes watershed and stream restoration information. There is a Stormwater Trail at Brown's Chapel with educational signs explaining rain gardens, native plant gardens, rain barrels and permeable pavement sidewalks as part of the demonstration project. These interpretive signs are for all ages.

VDOF works regularly with Fairfax County to conduct watershed and water quality presentations to students, homeowners, professionals and organizations. Rain garden presentations and workshops are given for 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 72 such activities presented by VDOF in 2012.

Pesticides, Herbicides and Fertilizers

Home lawns in Virginia comprise nearly 62 percent of the 1.7 million acres of managed turfgrass in the state and account for \$1.7 billion in annual expenditures. Many homeowners apply chemical fertilizers and pesticides to keep their lawns healthy and green. Without proper training, it is easy to over apply or inappropriately apply chemical inputs leading to run-off into local streams and waterways. Excessive use and misapplication of chemical fertilizer can lead to excess nitrogen and phosphorous which can potentially reach storm drains or sewers and ultimately compromise ground or surface waters. This trend paired with high levels of residential development dramatically increases the potential overall impact on water quality. Ultimately the water quality of the Chesapeake Bay is compromised.

In 2008 the Virginia Cooperative Extension (VCE) started a Master Gardener volunteer program to provide educational and technical services to homeowners with regard to home lawn management. The volunteers developed a survey of garden centers and the lawn care products they have for homeowner purchase. Fairfax County created the Home Turf Nutrient Management program to bring awareness to local water quality as it is impacted by residential lawn care practices. In 2012 VCE Master Gardeners received 30 hours of training on turf best management practices. VCE Extension Specialist trainings were held to train volunteers on turf nutrient management practices. Sixty-five homeowners had their lawns measured, 75 soil tests were submitted, and 63 urban nutrient management plans were written and given to their respective homeowner.

As a member of the multi-jurisdictional Northern Virginia Clean Water Partners, Fairfax County supported a Metro DC-wide blog that targets residential gardeners. In partnership with the members of the Community Engagement Campaign, the Clean Water Partners co-hosted the Green Gardeners Photo Contest. Participants submitted photos reflecting eco-friendly landscaping practices and visitors to the site voted for their favorite photo. Approximately 930 votes were cast. The two winners received a prize package featuring gardening supplies. In 2012 the Clean Water Partners also conducted a campaign featuring banner ads that promote alternatives to chemical fertilizer use.

Proper Disposal of Used Oil, Household Hazardous Waste and Household Yard Waste

The Fairfax County Solid Waste Management Program (SWMP) plays an important role in protecting surface water resources through its outreach efforts to promote responsible waste management practices. The SWMP supports education of residents and business owners about how they can reduce the volume of waste they generate, and how to dispose of and recycle it properly.

Putting hazardous household wastes in the trash or down the drain contributes to the pollution of surface waters. The Fairfax County Solid Waste Management Program (SWMP) is responsible for the county's Household Hazardous Waste (HHW) Management Program where county residents are given the opportunity to properly dispose of hazardous waste (such as used motor oil, antifreeze, and other automotive fluids) at no charge. The program is supported by funding generated by the SWMP at a cost of about \$650,000 each year. The SWMP has two permanent HHW facilities that are open four days a week. The Fairfax County HHW program also accepts fluorescent lamps for disposal from county residents. SWMP staff continued to distribute an updated educational brochure describing the energy-saving benefits of using these lamps and how to dispose of them properly at the end of their useful life. The information is also made available on the county's recycling website.

The SWMP continued to collaborate with the industry-funded Rechargeable Battery Recycling Corporation Program to make collection of rechargeable batteries available at offices of all members of the Fairfax County Board of Supervisors and at major county buildings. Rechargeable batteries are also accepted at the county's HHW facilities. SWMP continued to maintain the Know Toxics Web site in partnership with NVRC and the Northern Virginia Waste Management Board as part of a regional public information program to educate business owners about federal and state regulations that require proper disposal or recycling of spent fluorescent lamps, rechargeable batteries and computers and related electronics. The Know Toxics web site provides a resource where businesses can learn how to legally and appropriately dispose of these materials.

In 2012 the SWMP continued its monthly electronics recycling program for county residents known as *Electric Sunday*. The SWMP dedicates one Sunday per month where residents can drop off used computers and televisions in order to have them recycled. During its four years of operation, about 4,000,000 pounds of electronic waste were prevented from being introduced into the Fairfax County environment, significantly reducing the opportunity to negatively impact stormwater runoff. The county's HHW programs are open on Sunday to coincide with the *Electric Sunday* events.

SWMP partnered with the Metropolitan Washington Council of Governments (MWCOG) on its annual Go Recycle radio campaign. This campaign provides two weeks of intensive announcements on five major Washington DC radio stations to address recycling issues.

SWMP gave 45 presentations about solid waste and recycling practices to community groups and business leaders and hosted 35 group tours at its solid waste management facilities.

SWMP continued updating and revising the “Recycling and Trash” portion of the county web site to ensure the most up-to-date information for county residents.

Fairfax County’s Solid Waste Management Program continues to provide support and education in the public school system regarding litter prevention and support for recycling. In 2012 the program:

- Continued to maintain SCRAPmail (Schools/County Recycling Action Partnership). This e-mail subscription allows interested teachers, students and school administrators to receive periodic news items, event announcements, and updates and reviews on environmental education resources available to county schools.
- Continued to electronically distribute SCRAPBook, which is a compendium of resources dedicated to conducting environmental education in the schools from DPWES. This document is available on the SWMP website.
- Sent information about recycling to approximately 150,000 Fairfax County Public School students
- Gave 52 presentations to schools throughout the county
- Continued to give presentations containing a recycling message in support of the Sewer Science program for Fairfax County high school students. Presented the Sewer Science program to 44 classes at 12 high schools in the county.
- Awarded Johnie Forte environmental grants to 13 schools to fund school environmental projects involving litter prevention, litter control or recycling
- Dedicated a portion of its website specifically for students in the county to educate and familiarize them with the practice of recycling

Pet Waste

The Northern Virginia Clean Water Partners continued its Dog Blog and Facebook pages for dog owners. During 2012 the blog and Facebook pages had more than 88,000 views, up from about 24,000 views in 2011. Based on the success of the 2010 and 2011 contests, the Partners held the Third Annual Dog Blog Essay Contest. Eleven non-profit organizations submitted an entry into the “Bark Your Piece” contest, which resulted in 10,360 votes. The three winning organizations received \$5,000 in grants to use toward veterinary care, spaying and neutering, dog food and pet owner education.

In April 2012 two radio ads featuring messages on the importance of picking up pet waste and general household stormwater pollution reduction measures aired on three popular radio stations, including one Spanish speaking station a total of 236 times. These ads reached approximately 54,563 Northern Virginia residents and resulted in over 200 visits to the website, <http://www.onlyrain.org>.

Educational Opportunities for Students

Fairfax County provides educational and outreach opportunities for students throughout the year, including Science Honor Society meetings and high school Science Fairs. The following are examples of how county staff engages with 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 program is a collaborative effort of three DPWES programs: Solid Waste Management, Stormwater Management, and Wastewater Management. 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 individual can make a difference in the health of the environment. The Sewer Science program was presented to 44 classes at 12 high schools in the county.

Stormy the Raindrop Educational Campaign

Stormwater Planning Division designed the program to appeal to children in elementary school and younger with messages about local streams and watersheds and pollution prevention. Over the past several years, the program has used public appearances by a costumed raindrop character, puppet shows, coloring and activity books and a web page to reach young audiences. In 2012 the program accomplished the following:

- The county distributed approximately 1,000 copies of the Stormy the Raindrop activity books at various libraries, district offices and events. The activity books are available on Stormwater Management’s website at: <http://www.fairfaxcounty.gov/dpwes/stormwater>.
- In addition, the county distributed 30 reusable bags with the Stormy the Raindrop image and “Preventing litter in streams one bag at a time” printed at the top of the bag to a community event.
- The Stormy the Raindrop educational campaign was a Best of Category winner in the National Association of Counties 2012 Achievement Awards.
- The county created an educational public service announcement (PSA) in 2012 on “Stormy the Raindrop” watershed education. The program airs on Fairfax County channel 16 and is posted to YouTube.



Figure 5-4 Fairfax County Supervisor Penelope Gross (Mason District) and Stormy the Raindrop celebrate the NACo 2012 Achievement Award

Field Guide

In 2012 SWPD began developing a field guide entitled *A Field Guide to Fairfax County Plants and Animals* with help from Fairfax County Public Schools. The guide includes general information on plant (vascular and non-vascular) and animal (invertebrate and vertebrate) species found in Fairfax County as well as educational activities related to watersheds and stormwater management. The guide was intended to be used as an additional resource for all 5th grade students in conjunction with the new *Fields of Science* curriculum for 5th grade being introduced in spring 2013.

Reston Association’s Watershed Education Programs for Students

Reston Association offers a watershed field trip program for students in grades four through seven. During the field trip, students learn about watersheds and explore an area of the Difficult Run

watershed. Students conduct biological inventories and perform water quality tests at Lake Audubon, The Glade and Snakeden Branch. They also discuss ways that residents can protect the watershed. In 2012, Reston Association conducted the elementary watershed field trip for 220 students.

At the secondary level, Reston Association partnered with the United States Geological Survey (USGS) to conduct watershed education field trips for seventh grade students from Langston Hughes Middle School. 125 students conducted field studies in the Beaver Management Area of The Glade Stream Valley. RA continued the water quality monitoring Group 4 program with over 400 South Lakes High School students and also conducted water sampling experiments in Snakeden Branch with a smaller group of 52 South Lakes High School students.

Reston Association also loans a traveling watershed education trunk to area schools which includes an interactive watershed model. In 2012 the trunk was loaned to Reston elementary schools for use with 145 students.

Envirothon

Envirothon is a hands-on natural resources competition for high school teams. Training takes place throughout the year and competitions are held at the local, regional, state and national levels. NVSWCD sponsors the local program in Fairfax County. In 2012, NVSWCD provided training to teams from George Marshall High School, Langley High School, Centreville High School and Hidden Pond Nature Center in the local Envirothon competition held at Hidden Oaks Nature Center. The top two teams from the local competition represented Fairfax County in the regional competition, and Hidden Pond advanced on to represent the county at the state competition, where the team placed second overall.

Other Educational Activities

Fairfax County's public education program raises awareness about stormwater challenges throughout the county, educates residents about watersheds and the need for stormwater management, and offers opportunities for residents to become involved in efforts to restore and protect Fairfax County's waterways. Educational presentations help residents to recognize connections between water quality problems in local streams and impacts on the Occoquan Reservoir, the Potomac River and the Chesapeake Bay. In 2012 the county gave presentations to homeowner's associations, school groups (teachers and students), civic associations, Fairfax Master Naturalist trainees, Board of Supervisor's town hall meetings, resource fairs and various environmental events.

In 2012 Fairfax County participated as an exhibitor or environmental educator at approximately 20 public events, including: Fall for Fairfax, Earth Day/Arbor Day, Vienna Green Expo, resource fairs and environmental fairs. SWMP provided financial and operational support for the annual Earth Day/Arbor Day event, the "Greenology" exhibit at Celebrate Fairfax, Fall for Fairfax, 4-H fair held at Frying Pan Park and the Alice Ferguson Foundation's Trash-Free Potomac River Watershed Initiative.

In 2012 the county distributed educational fact sheets on such topics as rain gardens and rain barrels, reforestation plots, car washing, detention basins, pervious pavement and pavers, water quality swales and cigarette butt litter.

The county created educational public service announcements (PSA) in 2012 on topics such as plastic bags, "Stormy the Raindrop" watershed education, cigarette butts and flood prevention. These programs air on Fairfax County channel 16 and are posted to You Tube.

Staff contributed several proposed projects and environmental benefits articles to homeowners' association newsletters and web sites.

Stormwater, wastewater and urban forestry staff provided approximately 50 media interviews for print, television and radio news. Topics included: stormwater tax district, water quality, Chesapeake Bay TMDLs, the MS4 permit, illicit discharges, industrial and high risk runoff, drinking water quality, trash

and litter, the stormwater management value of trees, Accotink Creek, flooding, how stormwater ponds function, revitalization of Kings Park West (now Rabbit Branch Park), break-away street signs, Tropical Storm Lee, repetitive loss properties, and wastewater management's participation with the Potomac Environmental Research and Education Center.

Podcast messages were aired through the county's web site for a weekly audience of about 350 listeners on topics such as fats, oil and grease (FOG), pet waste, litter rain barrels, swimming pool water and fertilizers.



Figure 5-5 Educational booth on display at Fall for Fairfax. Photo by Fairfax County.

Northern Virginia Soil and Water Conservation District

In 2012 NVSWCD Provided displays and publications about environmental landscaping, stream restoration, volunteer monitoring, soils, storm drain marking, rain barrels and other environmental topics at 7 events. NVSWCD distributed a total of 2,763 brochures, publications and other information to colleagues and the public.

NVSWCD gave 53 presentations to audiences in industry, government, youth and the general public, in which 2,844 people learned about rain gardens and other low impact development techniques, water conservation, best management practices for horse-keeping operations, soil concepts, art with soils, stream cleanups, water quality monitoring, award-winning erosion and sediment controls on construction sites, ecological concepts and nonpoint source pollution. Two of the workshops focused on the design and installation of rain gardens.

NVSWCD demonstrated the Enviroscape watershed model eight times to 196 students in schools and scout programs.

Fairfax County Park Authority

Five FCPA nature centers and an imbedded naturalist at Cub Run RECenter provide water quality and environmental education to hundreds of thousands of park visitors each year. For example, Huntley

Meadows Park staff held the annual Wetlands Awareness Day on May 5, 2012 to educate citizens on the importance of maintaining healthy wetlands.



Figure 5-6 The annual Wetlands Awareness Day at Huntley Meadows Park. Photo by FCPA.

The Meaningful Watershed Educational Experience (MWEE) outreach program covered topics such as runoff, water quality, benthic macroinvertebrates, soil permeability and availability of potable water. This program was presented to five elementary schools reaching 308 students and 22 adults. The program was also presented to three middle schools reaching 1,341 students and 150 adults.

FCPA also assisted in the following watershed programs in 2012:

- Two homeschool programs reaching 15 children per day.
- Five “Rain on my Watershed” school programs reaching approximately 300 students.
- One Wetlanders week long summer camp for 14 children and a Wetlanders program for seven through nine year olds for three/hours day focusing on watershed activities.
- Presented the “Secrets of Soil” to nine schools at Green Spring Gardens reaching a total of 638 students exploring the secrets of soil from erosion to weathering and bedrock to topsoil.

Technical Support and Training

Land Development Services

- Conducted a training course on erosion and sediment controls for the Engineering and Surveyors Institute.
- Participated in a stormwater pond inspection training session.

Northern Virginia Soil and Water Conservation District

- Provided technical advice directly to homeowners and homeowner associations during 117 site visits to advise on solving drainage and erosion problems.
- Provided soils information to 76 consultants, realtors and homeowners. In addition, the Web Soil Survey and the county’s GIS department make soils information easily accessible to professionals and the public.

- Technical assistance was provided to county agencies 77 times to solve problems and assist with projects.
- Responded to 2,165 information inquiries by telephone, email and office visits.

6. Flood Response

Stormwater Management proactively responds to flooding threats using the guidance provided by the county's flood response plan. The county annually reviews and updates this plan to incorporate operational changes, communications strategies and other actions. Electronic devices installed at 18 dams and in the Huntington and Belle View communities are also used to closely monitor the potential for flooding. Training, monitoring information and instructions, inundation flood maps and safety equipment are provided to staff involved in field monitoring.

The Fire and Rescue Department invited staff from the Stormwater Planning Division and the Maintenance and Stormwater Management Division to join them in flood response training at Fire Station 9 in Alexandria to discuss flooding in the Huntington and Belleview communities. The training was intended to help both organizations determine when to take key actions during a flooding event. Some of the actions discussed included when residents should move vehicles, shelter in place or be evacuated. They also discussed how to provide information to residents.

A FEMA-required newsletter that included information about the natural and beneficial functions of floodplains specific to Fairfax County was mailed to 20,000 county residents who live in or adjacent to county floodplains. The county website was updated to provide relevant information on floodplains, flood insurance, flood preparedness and flood safety.



Figure 6-1 May 2012 joint training of Fire and Rescue Department and Stormwater Management employees for flood response at the Huntington and Belleview communities

7. Literature Cited

Fairfax County Department of Public Works and Environmental Services (DPWES). 2007. Fairfax County Dry Weather Screening Program: Site Selection and Screening Plan. Fairfax County Department of Public Works and Environmental Services, Stormwater Planning Division. Fairfax, Virginia. September.

This page was intentionally left blank