



7.0 WATERSHED RESTORATION

During the past year, Frederick County has worked on a number of initiatives to monitor, assess, protect, and restore watersheds. The following sections provide monitoring and assessment results and summarize progress on County watershed protection and restoration efforts.

7.1 STREAM MONITORING TO IDENTIFY AND EVALUATE WATER QUALITY PROBLEMS

During the last year, Frederick County continued to build upon its previous efforts to identify and evaluate water quality problems in its priority watersheds (Appendix K) and subwatersheds by conducting, on a rotating basis, stream monitoring using both biological and physical habitat methods. Currently, monitoring is being conducted approximately every two to three years in the County's three highest priority watersheds: Lower Bush Creek, Ballenger Creek, and Lower Linganore Creek.

In 2005, the County continued its annual stream monitoring program in the Peter Pan Run tributary to Bush Creek. The County also continued its long-term monitoring by revisiting eight of the ten stations in Lower Linganore Creek watershed established during the 2001 watershed assessment study. Additional monitoring took place at two previously established stations in Ballenger Creek and at two new stations in Bennett Creek in support of on-going restoration and community outreach efforts. Results from 2005 stream monitoring in Peter Pan Run and other locations are presented in Sections 5.1.2 and 7.2, respectively.

In addition, the County continues to use stream biological and physical habitat data as a screening tool to help identify stormwater retrofit and stream restoration opportunities and to help develop recommendations to minimize and mitigate stormwater impacts. Most notably, these data are used extensively in the County's stormwater retrofit and stream restoration targeting studies for individual watersheds.

7.2 BIOLOGICAL AND PHYSICAL STREAM ASSESSMENT

In 2005, the County surveyed stream conditions at twelve locations in Ballenger, Linganore, and Bennett Creeks (Table 7-1, Figure 7-1). The Linganore Creek stations were last sampled in 2001 as part of the County's long-term watershed monitoring program.

The Ballenger Creek watershed is approximately 14,900 acres (23 square miles) in size and the creek is designated by MDE as Class III Natural Trout Waters (FCDPZ 1998). The creek drains eastward into the Monocacy River, which it joins near the Monocacy National Battlefield. Ballenger Creek was selected as the second watershed to be assessed under Frederick County's NPDES stormwater permit because of substantial growth in the north-central and eastern portions of the watershed, near the City of Frederick. The western half of the watershed contains large tracts of agricultural and forested land; however, residential uses are expanding.

Table 7-1. Stream stations monitored by Frederick County in 2005		
Site Name	Site Location	Rationale for Selection
<i>Ballenger Creek Watershed</i>		
BALL-04	Ballenger Creek at Ballenger Creek Elementary School	Resample long-term monitoring station in priority watershed; pre-restoration monitoring for stream stabilization project
BALL-07	Ballenger Creek above Ballenger Creek Elementary School	Comparison of pre- and post-restoration differences at BALL-04, located immediately downstream
<i>Linganore Creek Watershed</i>		
LING-01	Linganore Creek along Plantation Road, below lake	Resample long-term monitoring station in priority watershed
LING-02	Linganore Creek above Gas House Pike, above lake	Resample long-term monitoring station in priority watershed
LING-03	Linganore Creek below Town Branch confluence	Resample long-term monitoring station in priority watershed
LING-04	Tributary to Lake Linganore from Lake Merle at Glen Lane	Resample long-term monitoring station in priority watershed
LING-06	Tributary to Bens Branch at MD 75 & south of Lime Plant Road	Resample long-term monitoring station in priority watershed
LING-07	Bens Branch along Lime Plant Road	Resample long-term monitoring station in priority watershed
LING-08	Tributary to Lake Linganore along Eaglehead Drive	Resample long-term monitoring station in priority watershed
LING-09	Tributary to Linganore Creek at Ridgefield Drive	Resample long-term monitoring station in priority watershed
<i>Bennett Creek Watershed</i>		
BENN-03	Fahrney Branch at Kemptown Community Park, Kemptown Church Rd. (urban)	Pre-restoration monitoring for a proposed Potomac Conservancy project
BENN-04	Fahrney Branch, downstream of Rte. 75/Green Valley Rd. on Glen View Farms property (agriculture)	Pre-restoration monitoring for a proposed Potomac Conservancy project

The Lower Linganore Creek watershed is approximately 24,350 acres (38 square miles) in size, which is slightly less than half the drainage area for the entire Linganore Creek. Linganore Creek drains westward from just inside the western edge of Carroll County and passes through several earth dams in the central portion of the lower watershed. The Lower Linganore watershed is a mix of forested, agricultural, and residential land located east-northeast of the City of Frederick. Linganore Creek has been classified by MDE as Class IV, Recreational Trout Waters (FCDPZ 1998). This watershed was selected as the third to be assessed under Frederick County's NPDES stormwater permit. It was considered a high priority for assessment because of its close proximity to the City of Frederick, concerns for Lake Linganore water quality, and recent, significant residential development in the Lake Linganore area. A large majority of the remaining agricultural and forested land near the lake has been zoned for Planned Unit Development (PUD), indicating that the intensity of land use will likely continue to increase.

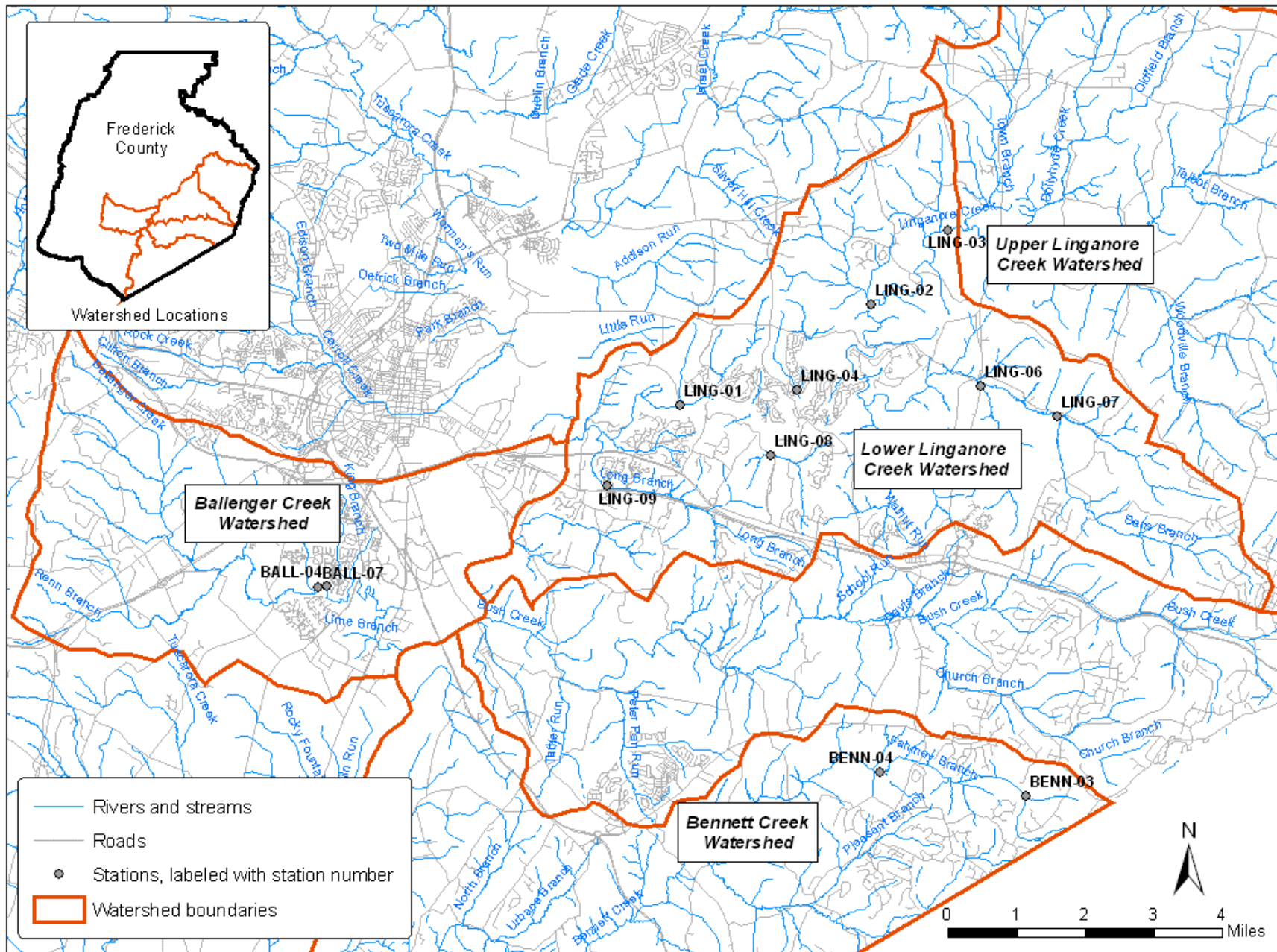


Figure 7-1. 2005 stream monitoring locations within Ballenger Creek, Bennett Creek, and Linganore Creek watersheds.

The Bennett Creek watershed is approximately 31,000 acres (48.5 square miles) of forested, agricultural, and residential land, south of the City of Frederick. It includes lands between the towns of Urbana and Buckeystown and southward. Bennett Creek drains westward into the Monocacy River, joining it one mile north of the Monocacy Natural Resources Management Area. The Creek and its tributaries have been classified by MDE as Class IV Recreational Trout Waters (MDE 2000). A portion of the aquifer in the Bennett Creek watershed has been designated a sole-source aquifer by the U.S. EPA (DUSWM 1998). This designation means it serves as a primary source of drinking water for at least 50% of the population in the area, and special attention is paid to avoid contamination from sources such as landfills. The aquifer has a recharge area of 180 square miles, spanning a large portion of Urbana, as well as parts of Montgomery and Howard Counties.

The county's stream monitoring program is an assessment of physical, chemical, and biological data, collected during designated index periods (Southerland et al. 1999, Morgan and Roth 2005). Sampling included collection of water quality data, benthic macroinvertebrate and fish sampling, and quantitative physical habitat assessment. Biological and physical monitoring methods employed in this survey are described in Section 5.1 of this report. Key findings are summarized below. Tables containing details of sampling results are found in Appendix L.

7.2.1 Water Quality

Water quality sampling conducted in March-April and June-September of 2005 generally showed good results. Temperature and conductivity results for all sites were within a normal range. Dissolved oxygen (DO) concentrations were all above 10.0 mg/L in the spring. Summer concentrations were slightly lower, as expected due to warmer water temperatures. All sites maintained DO levels that are typically considered healthy for aquatic biota. All were above Maryland's established minimum surface water criterion of 5.0 mg/L. pH values at several Linganore Creek sites (LING-01, LING-03, LING-07, LING-08, and LING-09) were elevated during spring sampling (>8.00). The pH levels at these stations dropped during summer sampling, returning to or near 7.0. This same pattern was observed at these Linganore Creek stations during the spring of 2001. This increase in spring pH may be the result of spring rains washing lime applications off nearby agricultural fields. The effects of the alkaline inputs are diminished during baseflow conditions in the summer.

7.2.2 Physical Habitat

While most MBSS spring habitat data were collected in late March and April 2005, cross-sectional surveys, longitudinal profiles, slope, and pebble counts were performed in June. The geomorphic data collected (and documented in Appendix L) provide a follow-up to previous surveys for existing stations and serve as a baseline for new stations to monitor changes over time. While geomorphic assessments do not rate habitat condition, MBSS habitat evaluations performed during summer sampling provide a scored assessment.

Substantial embeddedness is an issue at many of the sites sampled. Observations showed that in riffles at all but three of the stations, embeddedness was greater than 50%. Aquatic biota, particularly benthic macroinvertebrates, need the spaces between and beneath gravel and cobble substrate for attachment sites, feeding areas, and as shelter from predation. When large

quantities of silt and sediment fill in these spaces, it renders potentially good habitat useless, smothering biota and limiting their ability to survive in an area. Several sites were also characterized by low velocity/depth diversity.

7.2.3 Biological Assessment

As discussed in Section 5.1.2, biological assessment methods employed current MBSS fish and benthic protocols and IBIs. The MBSS IBI scores are divided into four classes ranging from Very Poor to Good (Table 7-2). A summary of benthic and fish IBI scores and classes for each sampled site is provided in Table 7-3.

Class	Range
Good	4.0 – 5.0
Fair	3.0-3.9
Poor	2.0-2.9
Very Poor	1.0-1.9

Station	Benthic IBI Score	Benthic IBI Rating	Fish IBI Score	Fish IBI Rating
BALL-04	2.75	Poor	4.67	Good
BALL-07	2.25	Poor	5.00	Good
BENN-03	2.75	Poor	3.67	Fair
BENN-04	3.25	Fair	3.67	Fair
LING-01	2.25	Poor	3.33	Fair
LING-02	1.75	Very Poor	3.67	Fair
LING-03	2.50	Poor	3.67	Fair
LING-04	3.00	Fair	3.33	Fair
LING-06	2.00	Poor	4.33	Good
LING-07	3.00	Fair	5.00	Good
LING-08	1.50	Very Poor	3.33	Fair
LING-09	1.50	Very Poor	4.67	Good

The IBI ratings for benthic macroinvertebrate and fish communities yielded different ratings of stream condition at several sites. The disparity between benthic IBI scores and fish IBI scores may be explained by physical factors. BALL-04 and BALL-07 are highly embedded, with heavily eroded streambanks, and have only marginal-quality epifaunal substrate for use by stream insects. These sites are characterized by large pools and slow deep runs. This limits the

available habitat for many benthic macroinvertebrate species, yet provides ideal habitat for a variety of fish.

LING-01, LING-02, and LING-09 do not have the same sediment issues as the Ballenger sites, but they too are characterized by deep runs and pools that are better suited to fish than to stream insects. A general lack of benthic habitat seems to be an issue here. LING-06 and LING-07 have more suitable habitat for benthic macroinvertebrates, but embeddedness has shown a marked increase (approximately 30%) between 2001 and 2005. A combination of sediment issues and habitat availability accounts for many of the discrepancies between the Benthic and fish IBI scores.

7.3 IMPLEMENTATION OF RESTORATION EFFORTS IN FREDERICK COUNTY

Watershed restoration projects are driven by regulatory and voluntary requirements. The purpose of these projects is to reduce pollution to water bodies and to provide ancillary benefits, such as improving habitat. Some projects count towards NPDES requirements and some do not. In this section, we describe the regulations, types of pollutant reductions, circumstances under which the County counts projects towards NPDES permit requirements, and the strategy for project implementation.

7.3.1 Regulations

In Frederick County, there are currently four main regulatory drivers that influence restoration efforts within the County. The primary regulation driving restoration projects is the National Pollutant Discharge Elimination System Program of the Clean Water Act, addressed in this Annual Report. Under the County's NPDES permit for its municipal separate storm sewer system (MS4), it is required to reduce discharges to the MS4 in urban areas. The County is also required to restore areas degraded by urban stormwater and to treat 10% of the untreated urban impervious areas.

Total Maximum Daily Load (TMDL) regulations require sources of pollutants in impaired water bodies to limit their releases. Earlier TMDLs, like those for sediment and phosphorus for Lake Linganore, do not set specific discharge limits for MS4s. They do, however, allocate a load to nonpoint non-agricultural sources within the MS4. More recent TMDLs explicitly set loads for the MS4s. The County does not currently have one of the more recent TMDLs, but TMDL development for the Upper Potomac region is underway; TMDLs that result from the process will likely have explicit limits for MS4s. Thus, it is in the best interest of the County to track the pollutant reductions associated with its restoration projects.

Safe Drinking Water Act regulations set higher standards for water bodies that are used as a public drinking water supply. The Linganore TMDL is more stringent because the water body is used for this purpose. Restoration activities are being targeted in the Linganore area and are carefully tracked for this reason.

The Chesapeake Bay 2000 Agreement (C2K) is a voluntary agreement between Bay states and has been signed by the Board of County Commissioners of Frederick County. C2K calls for

voluntary reductions of bay pollutants and increased restoration activities such as riparian buffer plantings.

7.3.2 Tracking Pollutants

Frederick County Government has focused its restoration tracking on the following:

- **Nutrient Reductions:** Phosphorus is the limiting nutrient in the eutrophic Lake Linganore and is the subject of a TMDL. Phosphorus and nitrogen reductions from all restoration projects are quantified and tracked.
- **Sediment Reductions:** Lake Linganore also has a TMDL for sediment. Sediment loads are tracked for all projects with the caveat that sediment tracking numbers are crude and can be off by an order of magnitude depending on site conditions.
- **Impervious Area Reductions:** As required by its NPDES permit, the County has calculated the number of acres of untreated stormwater from urban areas and plans to reduce this number by 10%. The County's 2003 estimate remains unchanged, with 6,725 acres of untreated impervious acres in Frederick County; hence, the County's 10 percent untreated goal is 672 acres. However, it should be noted that the number of treated acres might be a conservative estimate because the amount of treated area in the calculation includes only those SWM facilities for which the County has approved as-built plans. As such, areas currently being developed would be considered "untreated" until their SWM facilities are approved.
- **BMP Statistics:** General statistics on BMP implementation include BMP type and size/quantity of BMP implemented (e.g., acres, linear feet, or some other metric). These metrics are especially helpful in meeting the C2K agreement and calculating pollutant reductions for other requirements. Estimates of BMP pollutant removal efficiency, usually taken from documents prepared by the Chesapeake Bay Program, are used to calculate removals by sources and are tracked by the County.

7.3.3 NPDES vs. Non-NPDES Tracking

Frederick County Government has taken a role in a wide variety of watershed restoration efforts, and although the degree of participation varies by effort, we present all projects in which the County has a role (Table 7-4). The projects are sorted in the following manner:

- **Frederick County NPDES Capital Improvement Program (CIP) Projects** count towards NPDES requirements and are conducted primarily as a result of NPDES requirements. These projects are closely monitored for success and cost/benefit.
- **Frederick County NPDES Community Projects** count towards NPDES goals. These projects are sponsored by Frederick County Government. They may have some physical monitoring element or may rely on calculated BMP efficiencies. They have significant community involvement, such as planting events. They are not funded by the CIP and therefore are not subject to the restrictions of CIP funding. Funding may be internal or external.

Table 7-4. Current and planned watershed restoration projects within Frederick County										
Type of Project	Restoration Project Name	Year of Implementation	Watershed	Type of Treatment	Project Size	Size Treated by Project	Reduction			
							Sediment/ Total Suspended Solids (TSS) (lbs/yr)	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)	Treated Impervious Area (acres)
Frederick County NPDES Capital Improvement Projects (CIPs)										
1	Ballenger Elementary School Stream Restoration	2006-2007	Ballenger Creek	stream restoration	400 linear feet	400 linear feet	1147.50	9.00	1.60	4.00
2	Urbana High School Low Impact Development Retrofit	2006-2007	Lower Bush Creek	rain gardens, bioretention	School = 57.32 acres	~10 acres	1739.00	26.10	4.90	10.00
3	Linganore Creek Project	2007-2008	Linganore Creek	To be determined						
Subtotal							2886.50	35.10	6.50	14.00
Frederick County NPDES Community Projects										
4	Libertytown Stewards Project (CBT Grant):	2005-2006	Upper Linganore Creek							
	a) Liberty Village Rain Gardens	2005-2006	Upper Linganore Creek	rain garden	400 ft ²	0.25 acres	25.00	0.20	0.20	0.25
	b) Liberty Elementary School Rain Garden	2006	Upper Linganore Creek	rain garden	500 ft ²	0.25 acres	37.00	0.50	0.10	0.25
	c) St. Peter the Apostle Roman Catholic Church Stream Restoration	2006	Upper Linganore Creek	riparian buffer planting	600 linear feet/3.74 acres	7.48 acres	734.03	30.26	2.33	7.48
5	Backyard Buffer (County General Funds)	ongoing	All watersheds	riparian buffer planting	2500 ft ² /bag distributed	46 acres	4515.00	185.00	14.40	46.00
Subtotal							5311.03	215.96	17.03	53.98
Frederick County Non-NPDES Community Projects										
6	Holding Our Ground: Water Quality and Stewardship in Linganore Creek Watershed (NFWF/319 Funds)	2006	Upper and Lower Linganore Creek	To be determined						
7	Linganore Total Maximum Daily Load (TMDL) Urban Demonstration Project (319(h) Incremental Funds)	Winter/Spring 2006-2007	Upper and Lower Linganore Creek within TMDL Drainage	riparian buffer	3 miles or 18.18 acres	36.36 acres				
				stormwater retrofits	50 acres	50 acres	203.00	141.00	173.00	86.40
Subtotal							203.00	141.00	173.00	86.40

Table 7-4. Continued											
Type of Project	Restoration Project Name	Year of Implementation	Watershed	Type of Treatment	Project Size	Size Treated by Project	Reduction				
							Sediment/ Total Suspended Solids (TSS) (lbs/yr)	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)	Treated Impervious Area (acres)	
<i>Monocacy & Catoctin Watershed Alliance (MCWA)/NPDES Partnership Projects</i>											
8	Bennett Creek Restoration Initiative (CBT Grant)	June 2005- August 2006	Bennett Creek (Fahrney and Pleasant Branches)	riparian buffer planting*	19.2 acres	38.4 acres	19436.00	162.00	63.60	19.20	
				livestock fencing	23,970 linear feet	19 acres	12248.00	103.00	40.10	0.00	
				rain gardens	up to 4	1 acres	100.00	0.80	0.80	1.00	
				wetland restoration	1 acres	10 acres	1596.00	17.40	3.00	10.00	
				forest stewardship plans	up to 10						
				permanent protection/ease-ments*	up to 100 acres					50.00	
9	Cloverhill Restoration	2005	Tuscarora Creek	riparian buffer planting	3.15 acres	6.3 acres	1696.00	25.00	1.90	6.30	
10	Waterford Park Restoration	2005, ongoing	Carroll Creek	riparian buffer planting	2 acres	4 acres	393.00	16.00	1.30	4.00	
				retire highly erodible land*	8.5 acres	8.5 acres	2546.00	25.00	8.10	4.30	
11	State Highway Administration (SHA) Tuscarora Creek Stream Restoration (TEP Funds)	Fall 2007	Ballenger Creek	stream restoration	1,300 linear feet	1.5 acres	3315.00	26.00	4.60	1.50	
12	Frederick County Tree Re-enforcement Project (Ag)	2005	All watersheds	riparian buffer planting	6,500 trees 7.5 acres	7.5 acres	1952	58.00	6.40	7.50	
						Subtotal	43282.00	433.20	129.80	103.80	
							TOTAL ALL PROJECTS	51682.5	825.3	326.3	258.20
							Total NPDES	51479.5	684.3	153.30	171.80
* Agricultural initiatives, land conservation, and but-for scenarios count 50% per MDE. Riparian projects treat 2 times the number of acres planted.											

- **Frederick County Non-NPDES Community Projects** are similar to the projects above with one exception: the type of funding used prohibits these projects from counting towards NPDES requirements; instead, they are used to meet goals of C2K and TMDLs. Federal 319(h) funding, for example, cannot be used to meet NPDES requirements.
- **Monocacy & Catoctin Watershed Alliance (MCWA)/NPDES Partnerships Projects** are those that include participation and/or facilitation by Frederick County Government, but also include significant partner support. Frederick County is counting its efforts with these projects towards its NPDES restoration goals, but for the purpose of accounting with C2K, the County asks MDE not to record “credit” for the projects.

7.3.4 Implementation Strategy and Timeline

As mentioned in prior Annual Reports, the County identifies opportunities for watershed restoration largely through its Stormwater Retrofit and Stream Restoration (R/R) Assessments conducted on a watershed by watershed basis. To date, R/R assessments have been completed in Lower Bush and Ballenger Creek watersheds, and a third is currently underway in the Linganore Creek Watershed.

There are a number of current and planned watershed restoration projects taking place within Frederick County that reduce nitrogen, phosphorus, sediment, and impervious area (Table 7-4). Briefly described in Sections 7.4 through 7.7, Frederick County Government is currently implementing or partnering on eleven projects. Based on BMP pollutant efficiency numbers from the Bay Program and other sources, it is estimated that upon completion of NPDES-related projects, nitrogen will be reduced by 684.3 lbs/yr, phosphorus by 153.3 lbs/yr, sediment by 51,479.5 lbs/yr, and the total treated impervious area will equal 171.8 acres. Frederick County continues to work towards restoration and BMP implementation in an effort to decrease the amount of nutrients leaving the landscape.

7.4 WATERSHED ASSESSMENT AND RESTORATION IN LOWER BUSH CREEK

Frederick County completed a baseline watershed assessment for Lower Bush Creek in 2001 (Roth *et al.* 2001a). A number of recommendations to improve water quality were made in this report and the County continues its efforts to implement these recommendations, and other initiatives, to improve watershed conditions in Lower Bush Creek. Actions implemented during the past year included:

- The County continues to bolster its erosion and sedimentation control program by coordinating with MDE on program improvements.
- The Alliance’s partners are currently working to develop additional watershed public outreach materials, and education workshops with homeowners’ associations and other organizations in high growth areas.
- Continued to review project plans and enforce requirements for stormwater management through the Division of Permitting and Development Review.

- Continued annual monitoring of stream stations in Peter Pan Run.

7.4.1 Implementation of Restoration Efforts in Lower Bush Creek Watershed

The County continues its involvement with watershed restoration projects within the Lower Bush Creek watershed. These efforts, summarized below, build upon the existing work within the watershed conducted by the County and other organizations. An assessment of retrofit and restoration opportunities has also been conducted in the Lower Bush Creek watershed (Perot et al. 2003) and will provide guidance for future restoration measures.

7.4.1.1 CIP Project - Urbana High School LID Retrofit

DPW is using County General Funds from the Capital Improvement Program (CIP) budget for the Lower Bush Creek watershed to design and install a Low-Impact Development (LID) retrofit project at the Urbana High School. Based on a preliminary site visit and discussions with two teachers and the school's principal, the following LID practices are being considered:

- rain gardens,
- bioretention cells,
- vegetated swales, and
- landscape planters.

The goals of the project are to reduce untreated impervious area and to improve water quality. Project design is currently underway by Tetra Tech, Inc., and installation is planned for summer/fall 2006.

7.5 WATERSHED ASSESSMENT AND RESTORATION IN BALLENGER CREEK

Frederick County continues to implement recommendations from the previously completed Watershed Assessment of Ballenger Creek (Roth *et al.* 2001b). Actions implemented during the past year included:

- Coordination and communication within County agencies. Coordination among respective County agencies continues to take place on a regular and informal basis, most notably through a Brown Bag "Conservation Network" lunch; development of a Water Resource Management Task Force, with broad stakeholder participation, is also underway.
- Karst Overlay Zones. The County continues to track sinkhole formation and repair using a customized spatial database and uses the 2004 Maryland Geological Survey karst map showing karst prone areas. These data were used in the Ballenger Creek R/R Assessment to guide placement and the type of retrofits recommended.
- The County retained a consultant and began design work for a stream stabilization project on Ballenger Creek behind the Ballenger Creek Elementary School site.

- Collaborated with Ballenger Creek Trail Project to identify stormwater retrofits and stream restoration opportunities that can be incorporated into the trail design, particularly on parcels owned by (or dedicated to) the County along the stream.
- Continued monitoring of two stream stations on Ballenger Creek during 2005 to collect pre-restoration data at the Ballenger Creek Elementary School site.

7.5.1 Implementation of Restoration Efforts in Ballenger Creek Watershed

The County has initiated a number of efforts to improve watershed conditions within Ballenger Creek. These efforts, summarized below, build upon the existing work within the watershed conducted by the County and other organizations.

7.5.1.1 Stormwater Retrofit/Stream Restoration Assessment

The R/R assessment, a study begun in 2004 to identify and evaluate specific opportunities for improved stormwater management controls and stream restoration in Ballenger Creek watershed, was completed in August 2005. Elements of this study (Perot et al. 2005) included a review of existing watershed information (including recent SCA stream walk data), map review to target efforts and solutions to the most promising areas, field investigations to refine proposed concepts for solutions, an April 2005 public workshop to solicit input from local stakeholders on problem areas and solution types, prioritization of opportunities, and development of a report containing recommendations and conceptual plans for the best watershed restoration opportunities.

The assessment identified 74 candidate project sites that could be used to improve watershed conditions. Prioritization of these candidate projects identified 15 “Tier I” sites that presented the best opportunities for the County’s CIP program (Table 7-5); detailed fact sheets outlining conceptual plans were included in the report for these sites. The report also identified 14 “Tier II” projects that would also present good opportunities for the County, and 45 “CR” sites that would be good opportunities for the County’s Community Restoration partners.

The County considers its consultant’s recommendations as a preliminary prioritization and expects to further refine these priorities selecting from among these candidates based on additional factors and priorities that would influence successful implementation. The County anticipates selection of a subset of high priority sites to pursue further through subsequent feasibility assessment(s) that would collect additional site-specific information, update ownership information and evaluate landowner cooperation, identify additional project constraints, further refine project approach and design, and determine if additional action is warranted for each high priority candidate site.

Opportunities for watershed improvement are not solely limited to these 15 Tier I sites because alternate avenues for implementation exist via the County’s Community Restoration partners. Many of the Community Restoration and Tier II opportunities are ideally suited for implementation by these groups and organizations, which can often leverage additional public support, outside sources of funding, and other resources to put projects “on the ground.” Where possible, the County will lend support to these projects and programs.

Table 7-5. Summary of candidate Tier I Sites for watershed restoration in Ballenger Creek, sorted in declining order by Total Score. Scores incorporated severity and extent of observed problems, potential educational benefit, and citizen concern.

Site No.	Total Score (max. 100)	Location	Summary of Proposed Action	Total Planning Level Cost Estimate (± 30%)
5-5	68	Mainstem near Ballenger Cr. Trail loop	Natural stream channel design restoration of channel geometry and riparian buffer enhancement.	\$260,000 - \$630,000*
2-11	64	Pike Branch behind Ballenger Cr. Middle School	Establish hydrologic connections between wetland and stream. Construct off-line bioretention cells at end of 13 stormwater pipe outfalls. Retrofit existing stormwater pond. Remove invasive species and enhance riparian buffer. Build walking/biking path to better connect school and development.	\$833,000
5-2	60	Ballenger Cr. Elem. Sch. - Reach 1	Natural stream channel design restoration and riparian buffer enhancement. Restore outdoor classroom utility.	\$160,000 - \$420,000*
5-10	60	Ballenger Cr. Elem. Sch. - Reach 2	Natural stream channel design restoration and riparian buffer enhancement. Replace streambank concrete lining at sewer line crossing. Remove debris jam and accumulated trash.	\$200,000 - \$490,000*
2-2	57	Ballenger Cr. Middle School	Build linear rain gardens along the shoulder of Ballenger Creek Pike. Create grass filter strips with infiltration trench, and rain gardens in parking lot islands/borders. Divert roof drainage to rain gardens behind school. Reduction of overall non-used field areas by conversion to tree stands/greenways.	\$92,000
4-1	54	Ballenger Cr. Park	Incorporate linear rain gardens along entrance road. Create rain gardens and filter strips in northern parking lot islands/borders and rain gardens and infiltration trench in southern parking lot. Create rain garden at outfall below baseball fields. Reduce overall non-used lawn areas by conversion to tree stands/greenways.	\$144,000
5-1	53	Ballenger Cr. Elem. School	Incorporate linear rain gardens between sidewalks and Kingsbrook Drive. Create rain gardens and infiltration trenches in parking lot islands/borders. Create rain gardens in planting beds in front of school and near asphalt play areas. Increase buffer/greenway between residential community and school grounds.	\$107,000
5-7	53	Ballenger Cr. Trail - loop and parking area	Incorporate LID techniques into current park planning effort. Build off-line bioretention cells at three existing discharges from the adjacent residential community. Preserve existing trees in place. Depress open space areas slightly (e.g., 1 inch) and enhance soils to facilitate depression storage and infiltration.	\$113,000
6-3	49	Adult Detention Center	Depress open space areas slightly (e.g., 1 inch) and enhance soils to facilitate depression storage and infiltration. Create infiltration trenches in parking areas. Develop linear rain gardens along road front in depression near entrance and in existing drainage swales. Add rain garden in a traffic island adjacent to the parking areas.	\$63,000
6-4	49	Dept. Utilities & Solid Waste Mgmt. office	Replace culverts beneath parking lots and retrofit stormwater outfall with an off-line bioretention facility. Repair scour hole and restore intermittent channel. Incorporate linear rain gardens along Marcie's Choice Lane. Create rain gardens in parking lot islands/borders. Install green roofed carports in parking areas.	\$213,000
5-12	47	Robin Meadows Subdivision	Build off-line bioretention gardens at 12 stormwater pipe outfalls within the subdivision and rain gardens at three other locations. Plant a wildflower meadow throughout the bottom of the wide swales. Stabilize the streambank where the flow from the central swale enters the stream, located near the end of Mallard Lane.	\$240,000
2-5	46	Frederick Village Subdivision	Plant 50-foot wide riparian woodland buffer around pond and along streams. Plant wildflower meadows in open space. Build off-line bioretention cells at end of five stormwater pipe outfalls.	\$171,000
2-6	46	Foxcroft II Subdivision	Plant wildflower meadows in open space. Build off-line bioretention cells at four stormwater outfalls.	\$69,000
2-1	44	Orchard Grove Elem. School	Incorporate linear rain gardens along Hanover Drive. Create grass filter strips with infiltration trenches and rain gardens in parking lot islands/borders. Convert planting beds into rain gardens to receive redirected roof drainage. Install two rain gardens in lawn areas at stormdrain inlets. Increase buffer/greenway between residential community and school grounds. Include shade trees in parking areas.	\$190,000
5-9	44	Ballenger Cr. Trail above New Design Rd.	Construct linear rain gardens along New Design Road and an off-line bioretention cell at a stormwater pipe outfall. Preserve existing trees and enhance the riparian buffer. Depress open space areas slightly (e.g., 1 inch) and enhance soils to facilitate depression storage and infiltration.	\$109,000

* Greater than 30% level of uncertainty due to complexity of site conditions; collection of additional data on site conditions and stressors will enable more refined cost estimates during future planning stages.

7.5.1.2 CIP Project - Ballenger Creek Elementary School Stream Restoration

Using County General Funds from the CIP budget, DPW is currently working on a stream restoration project behind the Ballenger Creek Elementary School. The project site is located on a section of Ballenger Creek that runs through County property adjacent to the school. The goal of the project is to improve the condition of approximately 450 linear feet of stream to improve watershed water quality, in-stream and riparian habitat, and aesthetic conditions. Specific objectives of the proposed project include:

- Restore the stream channel and riparian area by utilizing natural stream channel design principals;
- Create a stream channel and floodplain that is dynamically stable, provides hydrologic and sediment transport continuity, and if possible reestablish floodplain connectivity;
- Create a range of aquatic habitats and associated riparian areas to enhance and support the existing ecological community;
- Work within site constraints and other considerations, including development of a design consistent with local geology and avoid or minimize disturbance to existing trees, footbridge, sewer line, and other structures;
- Improve the aesthetic value of the site; and
- Identify and incorporate educational needs into the project to facilitate future learning opportunities associated with the stream and the restoration project

Project design is currently underway by Brightwater/Ecosite/CCJM Joint Venture; construction is planned for Summer 2006.

7.5.1.3 Maryland State Highway Administration - Tuscarora Creek Stabilization between MD 180 and US 340/US 15 Interchange

The Maryland State Highway Administration (SHA) has received funds from the Transportation Enhancement Program (TEP) to restore a small, unnamed tributary to Tuscarora Creek located between MD 180, the US 340/US 15 interchange, and Elmer Derr Road.

The project involves stream stabilization along 1,300 linear feet of channel. Work will include rock vanes, imbricated riprap walls, rock step-pools, and realignment of the stream channel. Currently, the upper part of the channel is primarily a concrete-lined trapezoid, with dislodged sections of concrete, steep and actively eroding banks, and no access to the floodplain. The proposed solution for this reach is a Rosgen 'B' channel, which typically has a higher slope and less sinuous channel. Proposed restoration along the lower reach, below a large culvert under the US 340/US 15 interchange, includes creating a plunge pool to dissipate energy as the stream leaves the culvert before it heads into a more natural stream channel. The channel proposed for this section is a Rosgen 'C' type stream with floodplain access, lower valley slope, and a more meandering pattern.

Project completion is targeted for October 2007.

7.6 WATERSHED ASSESSMENT AND RESTORATION IN LINGANORE CREEK

Frederick County completed an assessment of Lower Linganore Creek watershed in June 2002 (Perot *et al.* 2002b). Actions implemented during the past year to address recommendations from the final water quality plan included the following:

Programmatic Opportunities

- Active participation in the development of a Source Water Protection Plan for Linganore Creek. The County's Department of Comprehensive Planning is currently working on an action plan that builds on the more general recommendations of the source water protection Task Force Report; this effort is anticipated to be completed in 2006.
- Continue interagency coordination efforts. The County continues to improve interagency coordination through multiple initiatives, as mentioned above.
- Monitor implementation of conservation plans within Agricultural Preservation Districts. Improvements to this monitoring process continue, and in 2005, additional staff was put in place to increase inspections.
- Review and update/obtain easement and site maintenance agreements to obtain adequate access to SWM facilities. Completed in 2003.
- Conduct retrofit and restoration assessment to identify and prioritize BMP opportunities. This effort is currently in progress. SCA stream walks were completed in 2005 and an R/R study was initiated in September 2005. The County anticipates completion of this study in late spring 2006.

Best Management Practices

- Facilitate local SWM control efforts in older developments near lake. LLCA and Linganore HOA continue to coordinate with the County on their road and LID improvement projects; County to identify opportunities for Community Restoration projects via the R/R study started in September 2005.
- Notify NRCS/SCD of livestock access to streams. Efforts to reduce livestock impacts to the stream were initiated as part of the WRAS. NRCS/SCD are WRAS partners and are addressing opportunities at SCA-identified livestock access sites as they arise.
- Address observed maintenance issues in one development. Completed in 2002.
- Opportunities to improve water quality on County-owned properties (i.e., Linganore High School and County Public Safety Training Facility). Sites are being evaluated in the on-going Restoration/Retrofit Assessment.
- Continue to inspect and encourage the reduction of sediment and erosion from unpaved construction roads. Efforts to address this issue are on-going as opportunities arise.

Stream Corridor Restoration

- Investigate feasibility of restoring Bens Branch across from Millime Court. This site was evaluated through the Stream Corridor Assessment in 2005 and its priority is being reviewed in the on-going Restoration/Retrofit Assessment.
- Investigate feasibility of restoring Bens Branch at Gas House Pike. This site was evaluated through the Stream Corridor Assessment in 2005 and its priority is being reviewed in the on-going Restoration/Retrofit Assessment.

Further Investigations at Specific Sites

- Contact MDE and USEPA to determine if additional investigation of possible contamination issues associated with automobile scrapyards facility is warranted. Completed in 2002.

Long-term Monitoring

- Continued periodic monitoring of stream stations in Lower Linganore Creek. Monitoring to take place again at regularly scheduled intervals. Eight of the Lower Linganore Creek monitoring stations were re-sampled in 2005.

7.6.1 Implementation of Restoration Efforts in Lower Linganore Creek Watershed

The County has initiated a number of efforts to improve watershed conditions within Lower Linganore Creek. These efforts, summarized below, build upon the existing work conducted by the County and other organizations, within the watershed.

7.6.1.1 Stormwater Retrofit/Stream Restoration Assessment

Versar, Inc. is currently working on a stormwater retrofit/stream restoration assessment for the County's Upper and Lower Linganore Creek Watersheds. This assessment is scheduled for completion in April 2006. The results of the Assessment will be used to identify CIP project(s) that will reduce untreated urban impervious surfaces and improve water quality and habitat. Special emphasis will be placed on the reductions of sediment and phosphorus to Lake Linganore, which has TMDLs for these pollutants. Design funds for the Linganore CIP become available at the beginning of FY'07 in July 2006. The Assessment will also help to identify areas to target demonstration projects in urban areas to be funded by an EPA Section 319 grant described later in this section.

7.6.1.2 Libertytown Stewards Project

Frederick County secured \$25,000 in grant funding from the Chesapeake Bay Trust (CBT) for three or more community restoration projects in Libertytown. Town Branch, a tributary of Linganore Creek, runs through Libertytown. It was given the highest priority for targeted stream

restoration action in the Lower Monocacy Watershed Restoration Action Strategy (WRAS). The following actions are underway via the project.

- *Liberty Village Rain Gardens:* Liberty Village Cohousing Community is a residential community that adjoins Libertytown Park; the park contains a wetland and a tributary to Town Branch. The homeowners' association agreed to participate by helping install and plant two rain gardens on its property. The first garden covers 420 square feet and was designed by the Potomac Conservancy, a project partner. It will treat a drainage area of approximately ¼ acre with 45-percent impervious cover. The garden was installed on November 30, 2005, and includes nine native shrubs. Herbaceous plantings will be installed during Spring 2006. Members of Liberty Village were required to sign maintenance agreements as a stipulation for project funding.
- *Liberty Elementary School Rain Garden:* The Liberty Elementary School principal, staff, and Parent Teacher Student Association (PTSA) approved the installation of a 500-square-foot rain garden designed to treat approximately ¼ acre with 72-percent impervious cover. Two local Master Gardener volunteers and Cub Scout Pack 1062 will participate in the planting and have committed to assist with maintenance. Potomac Conservancy designed the rain garden; installation is anticipated during Spring 2006.
- *Stream Buffer Restoration on Town Branch at St. Peter the Apostle Roman Catholic Church:* The DNR Forest Service designed a Forest Stewardship Plan for the church's property through which Town Branch flows. The plan includes planting 600-linear-feet of a 35-foot-wide buffer with 185 native trees and 200 native shrubs. The church has agreed to the plan and an Eagle Scout will be managing the planting process during Fall 2006. Twenty community volunteers will assist the Eagle Scout during the planting process.

7.6.1.3 Holding Our Ground: Water Quality and Stewardship in Linganore Watershed

The National Fish and Wildlife Foundation (NFWF) is providing \$40,000 in funding to improve water quality in the Linganore Creek watershed by facilitating installation of five miles of riparian buffer and to support educational initiatives targeted to increase stewardship ethics among watershed citizens. The County will develop a GIS-based, Watershed "House Call" Program template, target properties for analysis, and conduct on-site presentations. Pre-visit analysis, mapping, and on-site "House Calls" will analyze a minimum of 750 acres of riparian properties, roughly divided in half between developed and agricultural areas. The County will continue to update its Landowner Tracking database of riparian property owners and their participation in the program. Quarterly E-newsletters will be published to further promote watershed stewardship.

7.6.1.4 Linganore Creek TMDL - Urban Demonstration Project

The County is in the final period of negotiation with MDE for a \$216,237 grant for its Linganore Creek TMDL - Urban Demonstration Project under the EPA 319 (h) program. The Urban

Demonstration Project, anticipated to begin during 2006, is a comprehensive treatment of urban nonpoint source pollution. In this project, key landowners will be targeted and offered increased technical assistance in the design and installation of BMPs for sediment and phosphorus control. The project will support enhancing riparian-forest buffers and using on-site approaches to reduce nonpoint source pollution.

The project anticipates creating demonstration BMPs to treat 30 acres of urban land, and establishing approximately three-miles of riparian buffer that would encompass 18 acres and effectively treat a total of 36 acres. Project sites will include schools, regional parks, golf courses, and other publicly owned property. Interpretive signs will be posted to help citizens learn about the restoration projects and the benefits associated with improved stormwater management.

7.7 RESTORATION PROJECTS IMPLEMENTED THROUGH PARTNERSHIPS

Frederick County continues to work towards its watershed restoration goals by working with the Monocacy & Catoctin Watershed Alliance and other local partnerships. The following sections outline progress made in implementing restoration projects through these partnerships.

7.7.1 Backyard Buffers

The Potomac Watershed Partnership (PWP) continued to sponsor the Backyard Buffer program for the third year and assisted 68 households during 2005. The County assisted in program implementation by paying printing costs for the program's brochure, for public distribution, and by identifying landowner names and addresses in priority watersheds to target with mailings. County staff also publicized the program during community and public meetings during 2005.

PWP partners spent about \$2,000 for seedlings, a similar amount for stakes, and a lesser amount for bags, tags, and information packets that included six pages of information on why it is important to plant buffers, how to plant them, and where to go for more information. The County spent \$1,182 in printing costs for the brochure.

The Backyard Buffer packets distributed to participants include 25 tree/shrub seedlings of 5 different species. If seedlings are planted as instructed, with 6' x 6' spacing, one packet will cover 2,500 square-feet of land. Participants have the option to receive more than one packet of seedlings if desired.

7.7.2 Cloverhill Restoration

The Cloverhill Homeowner Association in the Tuscarora Creek watershed, located in the Upper Monocacy watershed, sought assistance from the County to address streambank erosion in Jones Branch where it flows through the common-area park land. The County's WRAS Coordinator contacted other partners about the group's need for help and enlisted a collaborative effort to address this problem. The Maryland Forest Service walked the site and developed a phased-restoration Forest Stewardship Plan for the project. Community Commons' School Yard Habitat project identified two school grow-out stations that partnered and planted trees and shrubs on

part of the site. The Interstate Commission on the Potomac River Basin (ICPRB) helped the group successfully develop a grant application to the Chesapeake Bay Trust; this grant paid for saplings, mulch, arboretum type tags, and a 3' x 5' interpretive sign for the project.

Phase 1 of the project included tree-planting on two acres as well as planting 1,000 linear feet of riparian buffer along Jones Branch. Students from Catoctin High School and Thurmont Middle School (58 students and four teachers) planted 200 trees (including black gum, red oak, green ash and bitternut hickory) and 23 shrubs from their school grow-out station on April 6, 2005. On April 23, adult volunteers planted 1,200 shrub seedlings (including hazelnut, silky dogwood, redbud, and winterberry), 60 sapling-sized trees, and 20 balled and burlapped trees. An interpretive sign was installed during the summer 2005. Additional phases of the project, included as objectives in the Upper Monocacy WRAS, are anticipated for the future.

7.7.3 Waterford Park Restoration

The nonprofit Friends of Waterford Park contacted the Frederick Forestry Service to get assistance in improving the health of the 18-acre Waterford Park in the City of Frederick in the Carroll Creek watershed. The DNR Forester prepared a Forest Stewardship Plan for the park that addresses the health and needs of three distinct forest stands within the park: a new tree planting area, the Rock and Carroll Creek confluence area, and an open fields area. The County assisted the nonprofit group by arranging for an Invasive Management Field training session with specialists during early September 2005.

Following the Stewardship Plan recommendations, an all-inclusive weed control strategy was adopted, and residents initiated some control of Japanese hops, honeysuckle, and mile-a-minute growing throughout the park. Another project initiated is the establishment of a native-grass cover crop throughout large parts of the park disturbed during a recent sewer line installation. A tree replacement program is also being planned to replace some dead trees.

A streambank stabilization project was recently conducted on a beautiful autumn day in Waterford Park by members of The Friends of Waterford Park, Frederick City Personnel, the Frederick County Forestry Board, and the Maryland Forest Service. This is part of a comprehensive program designed to enhance the ecological and aesthetic benefits of this lovely open area. The park is a natural area located on the western edge of Frederick City bordered by Rock Creek Park at Baughman's Lane, Rock Creek Drive, Route 15, and the Waterford Subdivision. This natural area is part of the Frederick City Greenways system.

The County arranged for a wetland specialist from the U.S. Fish and Wildlife Service to meet the project sponsors and walk the site, assessing certain areas for wetland restoration or enhancement potential.

7.7.4 Bennett Creek Restoration Initiative

The Potomac Conservancy, a member of the WRAS Steering Committee and the MCWA, partnered with the County to seek and receive funding for a Bennett Creek Restoration Initiative. The initiative grew out of community meetings, SCA data analysis, and planning work during

the development of the Lower Monocacy WRAS plan. The Bennett Creek watershed adjoins Montgomery County and has considerable and growing development pressures; it was one of two priority watersheds in the Lower Monocacy WRAS plan. Two stream corridors in this watershed, Pleasant and Fahrney Branches, were selected for targeted outreach to riparian owners.

The County's Community Restoration Coordinator has assisted the Potomac Conservancy in its landowner contacts and initial site visits. To this date, assistance will be provided to three landowners who have agreed to install additional fencing and stream buffers, fencing livestock out of the stream in each case, with additional project locations anticipated in the future. Windsor Knolls Middle School will be the site of a retrofit of an existing SWM pond, as well as other restoration activities, including invasive species control and stream buffering. Funding under the grant covers outreach and education and pays for restoration supplies and labor to fill gaps in existing programs such as the Conservation Reserve Enhancement Program (CREP).

Two baseline monitoring sites have been established and sampled by the County's consultant to help measure the effectiveness of the restoration work once installed.

7.7.5 Frederick County Tree Re-enforcement Project

Frederick County Government partnered with the Maryland DNR Forest Service to plant 6,500 tree seedlings in 2005. The county contributed \$1,500 to the effort, which restored 7.5 acres of agricultural property with riparian plantings. The Seedling Distribution is included as Appendix Q. Agricultural restoration counts 50% of urban restoration per MDE. Riparian plantings treat 2 acres per acre planted according to CBP calculations.

Evaluation: Frederick County has plans to meet 171.8 acres of impervious area reduction out of the 672 required under the current permit. It has also made strides to meet watershed restoration requirements of the permit watershed by watershed.