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Executive Summary

The *Accotink Creek Watershed Management Plan* provides a summary of the existing and future conditions of the Accotink Creek watershed in Fairfax County, Virginia and presents a strategy for restoring and preserving its natural resources. The plan was initiated by Fairfax County as part of a multi-year, multi-objective program to preserve and restore the County's natural environment and aquatic resources, and is consistent with the Fairfax County Board of Supervisors' Environmental Agenda adopted in June 2004. It has been prepared as part of the process of compliance with state and federal laws and mandates, including Virginia's Chesapeake Bay Initiatives and the federal Clean Water Act.

Fairfax County has a long history of planning at the watershed scale. The County's first series of watershed plans was completed in the 1970s. Since that time, land use has changed significantly and there have been many advances in the fields of stormwater management and ecological restoration. These advances have been reflected in the countywide goals for the program, which are consistent across all County watershed plans. These include:

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

Accotink Creek is approximately 52 square miles and is the second largest watershed in the County. It is a long, narrow watershed located in the center of the County and drains to Accotink Bay, and then into Gunston Cove and the Potomac River. To facilitate data management and promote local awareness of the streams, the watershed was subdivided into 16 Watershed Management Areas (WMAs) each approximately four square miles in size. These include seven major tributaries: Bear Branch, Crook Branch, Daniels Run, Hunters Branch, Long Branch Central, Long Branch North and Long Branch South. Because of long, narrow shape of the watershed, the remaining areas that drain directly to Accotink Creek mainstem were subdivided into eight WMAs: Mainstem 1 through 8. Finally, the area of land draining to tidewater was designated as the Potomac WMA.

The WMAs were further divided into subwatersheds with a target area of 100 to 300 acres. The subwatershed represents the smallest assessment unit for the watershed plan.

Approximately 11.7 square miles (23 percent) of the watershed are located in areas outside of the County jurisdiction and are not included in this plan. Because of this, the planning effort focused on only 14 of the 16 WMAs identified since the Potomac WMA is entirely within Fort Belvoir Military Reservation and the Daniels Run WMA is within the City of Fairfax.

Lake Accotink is located in the center of the watershed. It has a surface area of 68 acres and exerts significant influence on the drainage characteristics of the watershed.

Watershed Planning Process

The watershed planning process consisted of the following six steps:

1. Review and synthesis of previous studies and data compilation
2. Public involvement to gain input, provide education and build community support

3. Evaluation of current watershed conditions and evaluation of stormwater runoff and other impacts from present and ultimate development conditions
4. Development of non-structural and structural watershed improvement projects
5. Development of preliminary cost estimates, cost/benefit analysis and prioritization of capital projects
6. Adoption of the final watershed management plan by the Board of Supervisors

Previous Studies and Data Compilation

The 1970s watershed plans provided useful background information for land use changes, problems previously identified in the watershed and proposed solutions. The County's land use and parcel mapping data were used to determine the pattern of development. GIS layers were also used as the basis for developing watershed models. Indicators were used to determine the health of each subwatershed and determine the cause of any impairment. Monitoring results provided much of the data needed for the indicators, including information from the County's ongoing bioassessment program, the Stream Physical Assessment conducted in 2002 and water quality sampling results from the County stream monitoring programs and Virginia Department of Environmental Quality.

Public Involvement

The watershed plan development process was supported by two levels of public involvement. The first level consisted of two meetings open to the public: the Introductory and Issues Scoping Forum, held at West Springfield High School in October 2008, and the Draft Plan Review Workshop, held at Fairfax High School in September 2010. The second level of public involvement was provided by the Watershed Advisory Group (WAG), which met five times over the course of the process. The WAG was made up of local stakeholders who advised the planning team about community outreach opportunities, key issues affecting the watersheds and feedback on potential projects.

Existing Watershed Conditions

Current land-use mapping shows that the watershed is 87 percent developed, with 13 percent remaining as either open space (primarily along stream corridors) or water. The watershed is essentially built out with only four percent of the land use expected to change through redevelopment and conversion of open space to high-intensity commercial land use.

Overall, the watershed is 27 percent impervious. Imperviousness among the WMAs in the watershed ranges from three percent in the Potomac WMA to 41 percent impervious in the Long Branch North WMA. Imperviousness across the watershed is expected to increase by approximately 1.5 percent from future development.

Results of the 2002 Stream Physical Assessment ranked the watershed in the lower middle range of habitat quality when compared to other watersheds in the County. Ninety-one percent of stream channels were classified as unstable and experiencing severe bank erosion.

A set of measurable indicators was applied to develop a consistent project identification and prioritization process across the watershed. The indicators were grouped into the following categories:

- *Watershed Impact Indicators* − Measure the extent that reversal or prevention of a particular watershed impact, sought by the goals and objectives, has been achieved ("What's there now, and how is it doing?").

- *Source Indicators* − Quantify the presence of a potential stressor or pollutant source ("Is there a problem, and what's causing it?").

- *Programmatic Indicators* – After the plans are adopted, these will assess outcomes of resource protection and restoration activities ("What's the County doing about the problem, and how is it doing?").

The indicators were the key measures by which the condition of the watershed was assessed – comparing conditions at the subwatershed level and ranking them from best condition to worst. They provided a quantifiable method to determine why a particular subwatershed was in poor condition, whether from stream impacts, flooding, lack of buffers, forest, or wetlands, or high levels of stormwater pollution. This ranking helped to identify appropriate improvement projects and provided a method of measuring and prioritizing which projects would be most effective.

The subwatershed ranking analysis identified at least one impaired subwatershed in each of the 14 WMAs included in the analysis. Impairments included runoff impacts, flooding hazards, poor habitat health and water quality degradation. A majority of the subwatersheds in Daniels Run, Hunters Branch, Long Branch Central, Mainstem 4, Mainstem 5 and Mainstem 6 WMAs were in good condition. This is due to the influence of forested or undeveloped parcels, parks, golf courses and undeveloped areas within Fort Belvoir.

The remaining WMAs had a higher number of impaired subwatersheds. A subwatershed in the southwestern corner of the Long Branch North WMA was among the poorest quality overall due to low forest cover and high levels of impervious cover. Mainstem 3 had 11 of the lowest quality subwatersheds in the project and Mainstem 7 had six subwatersheds in industrial areas which scored poorly for water quality. Subwatersheds that scored poorly in the subwatershed ranking analysis were labeled as high priority subwatersheds because they represent the areas with the most need of restoration.

Watershed Restoration Strategies

Development of watershed restoration strategies involved two elements: determine where to prioritize restoration and preservation efforts and identify the specific practices and locations where improvements could be made.

The overall strategy for restoring and protecting the Accotink Creek watershed was developed with the assistance and input of the WAG. Group members contributed the following approaches for subwatershed prioritization:

- Preserve pristine areas from development or degradation
- Restore areas with limited impairment to expand wildlife populations
- Restore areas that are highly impaired due to specific and treatable factors

These recommendations highlight that targeting improvements only in the most impaired areas may not be the best watershed restoration method, and that other approaches to targeting improvements may work better. They also recognized that preventing impairments through preservation is more cost-effective than trying to restore an impaired system.

Specific restoration practices proposed for improvements were categorized as structural or non-structural. Structural practices are physical structures which are generally budgeted through the County's Capital Improvement Plan and involve engineering, design and construction. Non-structural practices are more programmatic in nature and usually focus on controlling stormwater runoff at the source.

Structural practices included:

- New Stormwater Management Ponds or Stormwater Pond Retrofits
- Stream Restoration
- Area-Wide Drainage Improvements
- Culvert Retrofits
- New BMP/LID or BMP/LID Retrofits
- Flood Protection Mitigation
- Outfall Improvements

Non-structural practices included:

- Buffer restoration
- Rain barrel and impervious disconnection programs
- Dumpsite and obstruction removals
- Community outreach and public education
- Land conservation coordination projects
- Inspection and enforcement projects
- Street sweeping programs
- Studies, surveys and assessments

To find potential project locations, a desktop assessment was first conducted to identify sites for structural projects. This initial assessment focused on sites for storage retrofits, which reduce or modify storm event peak flows, and onsite retrofits primarily to provide water quality improvements. Existing ponds and drainage areas above culverts were identified for storage retrofit. Onsite retrofit sites ranged from parking lots, rooftops, outfalls to inlets. Potential projects for stream restoration, flood mitigation and buffer restoration also were identified. In all, over 513 potential project sites were flagged for follow-up.

Non-structural projects were identified from field assessment of potential pollutant sources in a sampling of residential and commercial areas.

Candidate sites for stormwater retrofits and stream restoration were subsequently assessed in the field to identify any site constraints that would prevent improvements from being implemented or to note potential opportunities that would make improvements more likely to be successful. The result of the field assessment was either a rough concept for the improvement or a decision that the project was either not feasible or the constraints outweighed the potential benefits. Planning-level cost estimates were developed for the feasible projects and smaller projects were grouped together based on cost and location.

Prioritization, Benefits and Costs of Plan Implementation

Projects were prioritized for implementation using a score based upon the weighted average of the indicators and other factors: impact indicators (30 percent), source indicators (30 percent), location in a priority subwatershed (10 percent), upstream/downstream sequencing (20 percent) and implementability (10 percent). Each project's final score was used to determine whether the project fell into a high or low priority phase. Projects in the high priority phase would be constructed in the 0 to 10 year timeframe, and low priority projects in an 11 to 25 year timeframe.

This plan identified 120 high priority projects (subsequently called 10–year projects) for concept design and cost estimation. A project fact sheet was created for each of the high priority projects and provides a description of the project, benefits and constraints, a schematic design and a cost estimate, and can be found in Section 5. An additional 109 lower priority projects were identified for the 25-yr plan. These projects do not have individual project fact sheets, but information can be found under their individual WMA in Section 5. Finally, 20 non-structural projects were identified.

In order to assess the benefits of the Accotink Creek Watershed Management Plan, hydrologic, hydraulic and pollutant loading modeling was conducted for existing conditions and future conditions with and without the proposed projects. All projects were modeled for pollutant loading reductions. Only the 10-year projects were modeled for hydrologic and hydraulic benefits.

The benefits of the plan include eliminating the overtopping of at least one road crossing, reducing flooding potential, restoration of twelve miles of streams and one mile of stream buffers. Pollutant loads would be reduced by as much as 3,032 tons per year of sediment, 9,914 pounds per year of nitrogen and 2,758 pounds per year of phosphorus for the 10-yr implementation plan. The full 25-yr plan implementation would reduce pollutant loading by 3,149 tons per year of sediment, 12,376 pounds per year of nitrogen and 3,244 pounds per year of phosphorous. These benefits will help meet the County's goals for water quality and stream improvements and provide a positive impact on the residents and conditions of the watersheds.

The total estimated cost for the structural projects for the 10-year plan is $75 million. Full plan implementation of structural projects is $87 million. All proposed projects are presented in the table below.

Table ES-1: Summary of Watershed Strategies

Priority Structural Projects (Ten Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
AC9101	Stormwater Pond Retrofit	Mainstem 8	Village of Mount Air neighborhood	$90,000
AC9102	Stormwater Pond Retrofit	Long Branch South	Intersection of Telegraph Rd and Fairfax County Pkwy	$256,000
AC9105	Stormwater Pond Retrofit	Long Branch South	Pinewood Station neighborhood	$168,000
AC9106	Stormwater Pond Retrofit	Long Branch South	Backlick Rd and Cinder Bed Rd	$195,000
AC9110	Stormwater Pond Retrofit	Long Branch South	Amberleigh neighborhood	$227,000
AC9111	Stormwater Pond Retrofit	Long Branch South	Amberleigh neighborhood	$75,000
AC9112	Stormwater Pond Retrofit	Long Branch South	Springfield Industrial Park	$305,000
AC9113	Stormwater Pond Retrofit	Long Branch South	Springfield Industrial Park	$161,000
AC9114	Stormwater Pond Retrofit	Long Branch South	Springfield Industrial Park	$732,000

Priority Structural Projects (Ten Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
AC9120	Stormwater Pond Retrofit	Long Branch South	Franconia/Springfield Metro	$1,753,000
AC9123	Stormwater Pond Retrofit	Mainstem 7	Gateway 95 Business Park	$62,000
AC9126	Stormwater Pond Retrofit	Mainstem 7	Alban Industrial Center	$126,000
AC9133	Stormwater Pond Retrofit	Mainstem 6	Hunter Village neighborhood	$107,000
AC9136	Stormwater Pond Retrofit	Mainstem 6	Kenwood Oaks neighborhood	$111,000
AC9139	Stormwater Pond Retrofit	Mainstem 5	Westhaven neighborhood	$63,000
AC9144	New Stormwater Pond	Long Branch Central	Lake Accotink Park	$879,000
AC9147	New Stormwater Pond	Long Branch Central	Kings Park Shopping Ctr	$248,000
AC9148	New Stormwater Pond	Long Branch Central	Long Branch Stream Valley Park	$823,000
AC9161	Stormwater Pond Retrofit	Mainstem 3	Patriot Village neighborhood	$86,000
AC9162	Stormwater Pond Retrofit	Mainstem 3	Patriot Village neighborhood	$79,000
AC9172	New Stormwater Pond	Mainstem 2	End of Libeau Ln	$989,000
AC9175	Stormwater Pond Retrofit	Crook Branch	Hunters Glen and Ridgelea Hills neighborhoods and Bethlehem Lutheran Church	$211,000
AC9178	Stormwater Pond Retrofit	Mainstem 2	Prosperity Heights neighborhood	$401,000
AC9181	Stormwater Pond Retrofit	Long Branch North	Prosperity Business Campus	$249,000
AC9182	Stormwater Pond Retrofit	Bear Branch	Mantua Park	$54,000
AC9183	New Stormwater Pond	Bear Branch	Kena Shriners Temple	$274,000
AC9195	Stormwater Pond Retrofit	Mainstem 1	Oakton Village neighborhood	$67,000
AC9196	Stormwater Pond Retrofit	Mainstem 1	Four Winds at Oakton Condominium	$176,000
AC9199	Stormwater Pond Retrofit	Mainstem 1	Rosehaven Estates	$64,000
AC9200	Stream Restoration	Mainstem 6	Downstream from Greeley Blvd / Hunter Village Park	$643,000
AC9201	Stream Restoration	Mainstem 5	Accotink Stream Valley Park	$707,000
AC9202	Stream Restoration	Mainstem 5	Charlestown neighborhood	$822,000
AC9203	Stream Restoration	Mainstem 5	Lake Accotink Park	$193,000
AC9204	Stream Restoration	Mainstem 5	Lake Accotink Park	$1,317,000
AC9205	Stream Restoration	Mainstem 4	Lake Accotink Park	$1,343,000
AC9206	Stream Restoration	Mainstem 4	Kings Park neighborhood	$875,000
AC9207	Stream Restoration	Mainstem 4	Kings Park	$527,000
AC9208	Stream Restoration	Long Branch Central	Long Branch Falls Park	$600,000
AC9209	Stream Restoration	Long Branch Central	Long Branch Stream Valley Park	$1,476,000
AC9210	Stream Restoration	Mainstem 3	Wakefield Park neighborhood	$1,441,000

Priority Structural Projects (Ten Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
AC9211	Stream Restoration	Mainstem 3	Truro neighborhood	$179,000
AC9212	Stream Restoration	Mainstem 3	Truro neighborhood	$754,000
AC9213	Stream Restoration	Mainstem 3	Truro neighborhood	$1,011,000
AC9214	Stream Restoration	Mainstem 3	Wakefield Park	$621,000
AC9215	Stream Restoration	Mainstem 3	Mill Creek neighborhood	$345,000
AC9216	Stream Restoration	Mainstem 3	Lafayette Forest neighborhood	$811,000
AC9217	Stream Restoration	Mainstem 3	Lafayette Forest neighborhood	$903,000
AC9218	Stream Restoration	Mainstem 3	Pleasant Ridge neighborhood	$651,000
AC9219	Stream Restoration	Mainstem 2	Pine Ridge Park	$1,664,000
AC9220	Stream Restoration	Crook Branch	Ridgelea Hills neighborhood	$234,000
AC9221	Stream Restoration	Crook Branch	Mantua and Ridgelea Hills neighborhoods	$1,801,000
AC9222	Stream Restoration	Crook Branch	Mantua Hills and Stockbridge neighborhoods	$829,000
AC9223	Stream Restoration	Mainstem 2	Pine Ridge neighborhood	$958,000
AC9224	Stream Restoration	Long Branch North	I-66 and Prosperity Ave	$257,000
AC9225	Stream Restoration	Bear Branch	South Side Park	$3,273,000
AC9226	Stream Restoration	Long Branch South	Windsor Estates	$608,000
AC9227	Stream Restoration	Long Branch South	Windsor Estates	$675,000
AC9229	Stream Restoration	Mainstem 4	Flag Run Park, Lake Accotink Park / I-495	$1,383,000
AC9230	Stream Restoration	Mainstem 3	Wakefield Park	$748,000
AC9231	Stream Restoration	Mainstem 3	Wakefield Park	$781,000
AC9232	Stream Restoration	Mainstem 3	Wakefield Park	$697,000
AC9233	Stream Restoration	Mainstem 3	Wakefield Park	$703,000
AC9234	Stream Restoration	Long Branch North	Sutton Place and Mantua Woods neighborhoods	$1,026,000
AC9235	Stream Restoration	Long Branch North	Sutton Place and Copeland Pond neighborhoods	$1,035,000
AC9236	Stream Restoration	Long Branch North	Merrifield View neighborhood	$1,016,000
AC9237	Stream Restoration	Long Branch North	Fairhill on the Boulevard neighborhood	$624,000
AC9238	Stream Restoration	Long Branch North	Dunn Loring Woods neighborhood and Prosperity Business Campus	$2,736,000
AC9239	Stream Restoration	Bear Branch	Covington / Villa Lee Park, Arrowhead Park	$3,225,000
AC9240	Stream Restoration	Bear Branch	South Side Park neighborhood	$2,241,000
AC9241	Stream Restoration	Hunters Branch	Stonehurst / Eakin Community Park	$2,176,000
AC9242	Stream Restoration	Hunters Branch	Lee Hwy and Hermosa Dr	$389,000

Priority Structural Projects (Ten Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
AC9300	Area-Wide Drainage Improvements	Mainstem 7	Pohick Estates neighborhood	$799,000
AC9301	Area-Wide Drainage Improvements	Long Branch South	Windsor Park	$1,040,000
AC9302	Area-Wide Drainage Improvements	Mainstem 4	Ravensworth neighborhood	$731,000
AC9303	Area-Wide Drainage Improvements	Mainstem 4	Kings Park neighborhood	$1,475,000
AC9304	Area-Wide Drainage Improvements	Mainstem 3	Ravensworth Park and Bristow neighborhoods	$1,681,000
AC9305	Area-Wide Drainage Improvements	Long Branch Central	Canterbury Woods neighborhood	$1,647,000
AC9306	Area-Wide Drainage Improvements	Long Branch Central	Willow Woods neighborhood	$757,000
AC9307	Area-Wide Drainage Improvements	Long Branch Central	Woodland Forest neighborhood	$528,000
AC9308	Area-Wide Drainage Improvements	Long Branch Central	Canterbury Woods and Long Branch neighborhoods	$358,000
AC9309	Area-Wide Drainage Improvements	Long Branch Central	Springbrook Forest, Willow Woods and Woods of Ilda neighborhoods	$1,117,000
AC9310	Area-Wide Drainage Improvements	Long Branch Central	Springbrook Forest and Rutherford neighborhoods	$1,885,000
AC9311	Area-Wide Drainage Improvements	Mainstem 3	Ramblewood neighborhood	$422,000
AC9312	Area-Wide Drainage Improvements	Crook Branch	Westchester and Briars of Westchester neighborhoods	$1,191,000
AC9313	Area-Wide Drainage Improvements	Crook Branch	Langhorne Acres neighborhood	$718,000
AC9314	Area-Wide Drainage Improvements	Long Branch North	Dunn Loring Village neighborhood	$467,000
AC9315	Area-Wide Drainage Improvements	Bear Branch	Hideaway Park neighborhood	$283,000
AC9316	Area-Wide Drainage Improvements	Mainstem 1	Hawthorne Village Apts, Five Oaks Place and Cedar Grove Park neighborhoods	$1,039,000
AC9400	Culvert Retrofit	Mainstem 4	Queensberry Ave	$74,000
AC9401	Culvert Retrofit	Mainstem 4	I-495	$84,000
AC9405	Culvert Retrofit	Long Branch Central	Old Forge Park	$29,000
AC9406	Culvert Retrofit	Long Branch Central	Long Branch Park	$84,000
AC9409	Culvert Retrofit	Mainstem 1	Oakton High School	$65,000
AC9501	BMP/LID	Long Branch South	Newington Industrial Park	$59,000
AC9502	BMP/LID	Long Branch South	Newington Rd	$102,000
AC9503	BMP/LID	Long Branch South	Franconia/Springfield Metro	$100,000
AC9505	BMP/LID	Long Branch South	Francis Scott Key Middle School	$132,000
AC9506	BMP/LID	Long Branch South	Commercial Parking Lot	$114,000

Priority Structural Projects (Ten Year Implementation Plan)				
Project #	**Project Type**	**WMA**	**Location**	**Cost**
AC9508	BMP/LID	Long Branch South	Robert E. Lee High School	$176,000
AC9509	BMP/LID	Mainstem 7	Lockport Industrial Park	$213,000
AC9510	BMP/LID	Mainstem 7	Lockport Industrial Park	$723,000
AC9511	BMP/LID	Mainstem 7	Deer Park parking lot	$63,000
AC9512	BMP/LID	Mainstem 7	HRM Automotive	$106,000
AC9514	BMP/LID	Mainstem 6	Cardinal Forest Plaza	$142,000
AC9515	BMP/LID	Mainstem 6	Old Keene Mill Shopping Center	$204,000
AC9529	BMP/LID	Long Branch Central	Canterbury Woods Elementary School	$44,000
AC9535	BMP/LID	Mainstem 3	Wakefield Chapel Estates	$188,000
AC9538	BMP/LID	Mainstem 3	Northern Virginia Community College parking lot	$388,000
AC9539	BMP/LID	Mainstem 3	Annandale Terrace Elementary School	$118,000
AC9541	BMP/LID	Mainstem 3	Little River Shopping Center	$100,000
AC9545	BMP/LID	Mainstem 2	Eakin Park and Byzantine Church parking lot	$79,000
AC9546	BMP/LID	Crook Branch	Mantua Elementary School	$109,000
AC9547	BMP/LID	Crook Branch	Providence Presbyterian Church and Pixie Ct	$95,000
AC9548	BMP/LID	Crook Branch	Ridgelea Hills neighborhood	$398,000
AC9550	BMP/LID	Long Branch North	Industry Lane and Lee Hwy	$364,000
AC9551	BMP/LID	Long Branch North	Stenwood Elementary School	$50,000
AC9553	BMP/LID	Hunters Branch	Pan Am Shopping Center	$304,000
AC9558	BMP/LID	Mainstem 1	Mosby Woods Elementary School	$100,000
AC9562	BMP/LID	Mainstem 1	AT&T office building	$328,000
AC9600	Flood Protection/Mitigation	Long Branch South	Culvert under railroad behind Industrial Park	$450,000
			Total Cost	$75,052,000

Long Term Structural Projects (25 Year Implementation Plan)			
Project #	**Project Type**	**WMA**	**Location**
AC9100	Stormwater Pond Retrofit	Mainstem 8	Landsdowne neighborhood
AC9103	Stormwater Pond Retrofit	Long Branch South	Gateway 95 Business Park
AC9104	Stormwater Pond Retrofit	Long Branch South	Shirley Industrial Complex
AC9107	Stormwater Pond Retrofit	Long Branch South	Landsdowne neighborhood
AC9108	Stormwater Pond Retrofit	Long Branch South	Amberleigh Park
AC9109	Stormwater Pond Retrofit	Long Branch South	Island Creek Park
AC9115	Stormwater Pond Retrofit	Long Branch South	Next to Assembly of God Church

Long Term Structural Projects (25 Year Implementation Plan)			
Project #	**Project Type**	**WMA**	**Location**
AC9116	Stormwater Pond Retrofit	Long Branch South	Devonshire Townhomes
AC9117	Stormwater Pond Retrofit	Long Branch South	Walker Lane Condo
AC9118	Stormwater Pond Retrofit	Long Branch South	Fleet Industrial Park
AC9119	Stormwater Pond Retrofit	Long Branch South	Behind Gilders St
AC9121	Stormwater Pond Retrofit	Long Branch South	Sunrise Assisted Living
AC9122	New Stormwater Pond	Long Branch South	I-95 and Franconia Rd Interchange
AC9124	Stormwater Pond Retrofit	Mainstem 7	Newington Commerce Center
AC9125	Stormwater Pond Retrofit	Mainstem 7	Terra Grande neighborhood
AC9127	Stormwater Pond Retrofit	Mainstem 7	Alban Industrial Center
AC9128	Stormwater Pond Retrofit	Mainstem 7	Terra Grande
AC9129	Stormwater Pond Retrofit	Mainstem 7	VA 95 Industrial Park
AC9130	New Stormwater Pond	Mainstem 7	Alban Road
AC9131	Stormwater Pond Retrofit	Mainstem 6	Bonniemill Acres neighborhood
AC9132	Stormwater Pond Retrofit	Mainstem 6	Shirley Springs neighborhood
AC9134	Stormwater Pond Retrofit	Mainstem 6	Rolling Forest neighborhood
AC9135	Stormwater Pond Retrofit	Mainstem 6	Bethnal Pl and Caton Woods Ct
AC9137	Stormwater Pond Retrofit	Mainstem 5	Behind Villa Park Rd
AC9138	Stormwater Pond Retrofit	Mainstem 5	Toyota Dealership on Amherst Ave
AC9140	Stormwater Pond Retrofit	Mainstem 5	Brookfield Park
AC9141	Stormwater Pond Retrofit	Mainstem 5	Highland Business Park
AC9142	New Stormwater Pond	Mainstem 4	Behind Morrissette Dr
AC9145	New Stormwater Pond	Long Branch Central	Canterbury Woods Swim Club
AC9146	Stormwater Pond Retrofit	Long Branch Central	Woodland Forest neighborhood
AC9149	Stormwater Pond Retrofit	Long Branch Central	Dunleigh neighborhood
AC9150	Stormwater Pond Retrofit	Long Branch Central	Burke Professional Center
AC9151	Stormwater Pond Retrofit	Long Branch Central	Long Branch Swim and Racquet Club
AC9152	Stormwater Pond Retrofit	Long Branch Central	Chestnut Hills West neighborhood
AC9153	Stormwater Pond Retrofit	Long Branch Central	Behind Wrought Iron Ct
AC9154	Stormwater Pond Retrofit	Long Branch Central	Lee Meadows neighborhood
AC9155	New Stormwater Pond	Long Branch Central	Sweet Briar Forest neighborhood
AC9156	Stormwater Pond Retrofit	Long Branch Central	Korean Presbyterian Church
AC9157	Stormwater Pond Retrofit	Long Branch Central	George Mason Park
AC9158	Stormwater Pond Retrofit	Long Branch Central	Somerset South neighborhood
AC9159	New Stormwater Pond	Mainstem 3	Howery Field Park
AC9160	Stormwater Pond Retrofit	Mainstem 3	Chapel Lake
AC9165	Stormwater Pond Retrofit	Mainstem 3	Camelot Greens
AC9166	Stormwater Pond Retrofit	Mainstem 3	Lafayette Forest

Long Term Structural Projects (25 Year Implementation Plan)			
Project #	**Project Type**	**WMA**	**Location**
AC9167	Stormwater Pond Retrofit	Mainstem 3	Lafayette Park West
AC9168	Stormwater Pond Retrofit	Mainstem 3	Adams Walk
AC9169	Stormwater Pond Retrofit	Mainstem 3	Wachovia Building on Woodland Rd
AC9170	Stormwater Pond Retrofit	Mainstem 3	Lafayette Village
AC9171	Stormwater Pond Retrofit	Mainstem 2	Holmes Run Village neighborhood
AC9173	Stormwater Pond Retrofit	Mainstem 2	Silk Vision and Surgery Center
AC9174	Stormwater Pond Retrofit	Crook Branch	Greater Washington Jewish Community Foundation
AC9176	Stormwater Pond Retrofit	Crook Branch	Briars at Westchester neighborhood
AC9179	Stormwater Pond Retrofit	Long Branch North	Luther Jackson Middle School
AC9184	Stormwater Pond Retrofit	Bear Branch	Behind Barkley Gate Ln and Armistead Park neighborhood
AC9185	New Stormwater Pond	Bear Branch	Covington neighborhood
AC9186	New Stormwater Pond	Hunters Branch	Vienna Moose Lodge
AC9187	Stormwater Pond Retrofit	Mainstem 1	Behind Blake Park Ct
AC9188	Stormwater Pond Retrofit	Mainstem 1	Country Creek neighborhood
AC9189	New Stormwater Pond	Mainstem 1	East Blake Lane Park
AC9190	Stormwater Pond Retrofit	Mainstem 1	Behind Oakton Pond Ct
AC9191	Stormwater Pond Retrofit	Mainstem 1	Behind Cyrandall Pl
AC9192	Stormwater Pond Retrofit	Mainstem 1	Edgemoore neighborhood
AC9193	Stormwater Pond Retrofit	Mainstem 1	Oakdale Woods Ct
AC9194	Stormwater Pond Retrofit	Mainstem 1	Behind Miles Stone Ct
AC9197	Stormwater Pond Retrofit	Mainstem 1	Borge St and Oakton Meadows
AC9198	Stormwater Pond Retrofit	Mainstem 1	Silver Stone Ct and While Flint Ct
AC9402	Culvert Retrofit	Mainstem 4	Lake Accotink Park
AC9403	Culvert Retrofit	Mainstem 4	Lake Accotink Park
AC9404	Culvert Retrofit	Long Branch Central	Red Fox Dr
AC9407	Culvert Retrofit	Mainstem 3	Between Private Ln and Queen Elizabeth Blvd
AC9408	Culvert Retrofit	Bear Branch	South Side Park
AC9500	BMP/LID	Mainstem 8	Pohick Industrial Park
AC9504	BMP/LID	Long Branch South	Shopping area opposite Springfield Mall
AC9507	BMP/LID	Long Branch South	Springfield Mall
AC9513	BMP/LID	Mainstem 6	West Springfield Elementary School
AC9516	BMP/LID	Mainstem 5	Lee Valley Apts
AC9517	BMP/LID	Mainstem 5	Garfield Elementary School
AC9518	BMP/LID	Mainstem 5	Springfield United Methodist Church
AC9519	BMP/LID	Mainstem 5	Springfield Plaza
AC9520	BMP/LID	Mainstem 5	Springfield Plaza
AC9521	BMP/LID	Mainstem 5	Saint Bernadette Church and School
AC9522	BMP/LID	Mainstem 5	Grace Presbyterian Church
AC9523	BMP/LID	Mainstem 4	North Springfield Elementary School
AC9524	BMP/LID	Mainstem 4	Church of Jesus Christ and behind Rexford Ct
AC9525	BMP/LID	Mainstem 4	Tivoli Condominiums

Long Term Structural Projects (25 Year Implementation Plan)			
Project #	**Project Type**	**WMA**	**Location**
AC9526	BMP/LID	Mainstem 4	West Springfield Business Center
AC9527	BMP/LID	Mainstem 4	Kings Park Elementary School
AC9528	BMP/LID	Long Branch Central	Holy Spirit Catholic Church and Canterbury Woods Swim Club
AC9530	BMP/LID	Long Branch Central	Long Branch Swim and Racquet Club Parking Lot and St. Stephens United Methodist Church
AC9531	BMP/LID	Long Branch Central	Rutherford Area Swim Club
AC9532	BMP/LID	Long Branch Central	Rutherford Park
AC9533	BMP/LID	Long Branch Central	Rutherford Park
AC9534	BMP/LID	Mainstem 3	Annandale District Govt Center
AC9536	BMP/LID	Mainstem 3	Wakefield Forest Elementary School
AC9537	BMP/LID	Mainstem 3	Wakefield Chapel Park
AC9543	BMP/LID	Mainstem 2	Camelot Elementary School / Pine Ridge Park
AC9544	BMP/LID	Mainstem 2	Silk Vision and Surgery Center
AC9549	BMP/LID	Mainstem 2	Arlington Blvd & Williams Dr
AC9552	BMP/LID	Long Branch North	Thoreau Middle School and Stenwood Elementary School
AC9554	BMP/LID	Hunters Branch	Vienna Metro Station parking lot
AC9555	BMP/LID	Hunters Branch	Nottoway Park
AC9556	BMP/LID	Hunters Branch	Vienna Moose Lodge
AC9557	BMP/LID	Hunters Branch	Madison High School
AC9559	BMP/LID	Mainstem 1	End of Bickley Ct
AC9560	BMP/LID	Mainstem 1	Behind Courthouse Wood Ct
AC9561	BMP/LID	Mainstem 1	Vistas Condominiums
AC9700	Outfall Improvement	Mainstem 3	Wakefield Park
AC9701	Outfall Improvement	Mainstem 3	Wakefield Park
AC9702	Outfall Improvement	Mainstem 4	Lake Accotink Park

Non-Structural Projects			
Project #	**Project Type**	**WMA**	**Location**
AC9800	Buffer Restoration	Long Branch South	Intersection of Telegraph Rd and Fairfax County Pkwy
AC9801	Buffer Restoration	Long Branch South	Springfield Industrial Center
AC9802	Buffer Restoration	Mainstem 2	Accotink Stream Valley Park
AC9803	Buffer Restoration	Crook Branch	Upstream of Prosperity Ave / Lake Accotink Park
AC9804	Buffer Restoration	Crook Branch	Downstream of Prosperity Ave
AC9805	Buffer Restoration	Mainstem 2	Eakin Community Park
AC9806	Buffer Restoration	Long Branch North	Behind Amberley Ln
AC9900	Community Outreach/Public Education - Storm Drain Marking	Multiple	Watershed-wide
AC9902	Inspection/Enforcement Enhancement Project - Vehicle Maintenance	Multiple	Watershed-wide

Non-Structural Projects			
Project #	**Project Type**	**WMA**	**Location**
AC9903	Inspection/Enforcement Enhancement Project - Outdoor Materials Storage	Multiple	Watershed-wide
AC9904	Rain Barrels	Multiple	Watershed-wide
AC9906	Inspection/Enforcement Enhancement Project	Multiple	Watershed-wide
AC9907	Community Outreach/Public Education - Lawn Care Outreach	Multiple	Watershed-wide
AC9908	Inspection/Enforcement Enhancement Project - Dumpster Maintenance	Multiple	Watershed-wide
AC9909	Rain Barrels	Multiple	Watershed-wide
AC9910	Street Sweeping Program	Multiple	Watershed-wide
AC9913	Dumpsite/Obstruction Removal	Multiple	Watershed-wide
AC9914	Community Outreach/Public Education - Turf Management	Multiple	Watershed-wide
AC9935	Community Outreach/Public Education	Multiple	Watershed-wide
AC9936	Studies and Assessments – Floatables Control	Multiple	Watershed-wide

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1 Introduction to Watersheds

A watershed is an area of land that drains all of its water to a specific lake or river. As rainwater and melting snow run downhill, they carry sediment and other materials into our streams, lakes, wetlands and groundwater.

The boundary of a watershed is defined by the watershed divide, which is the ridge of highest elevation surrounding a given stream or network of streams. A drop of rainwater falling outside of this boundary will enter a different watershed and will flow to a different body of water.

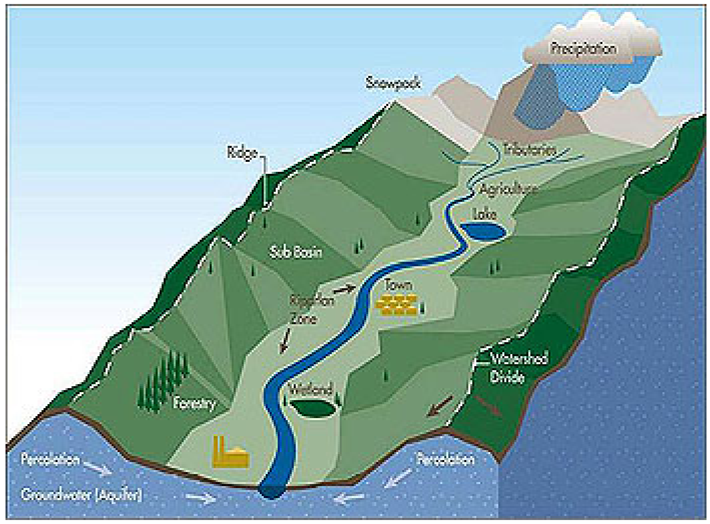
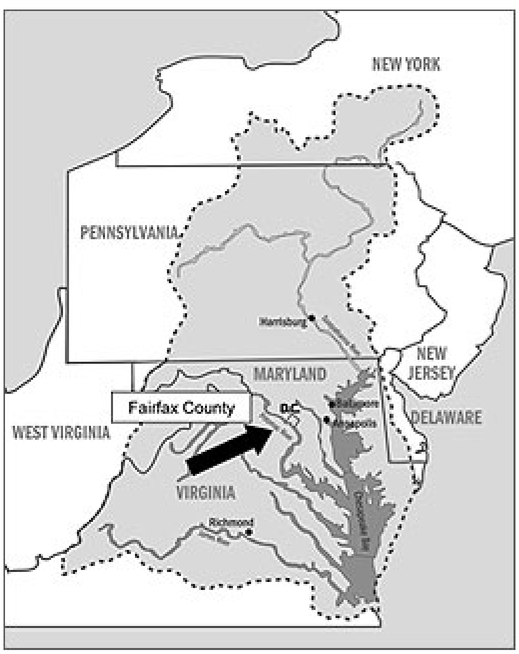


Figure 1-1: Diagram of a watershed

Streams and rivers may flow through many different types of land use in their paths to the ocean. In the above illustration from the U.S. Environmental Protection Agency, water flows from agricultural lands to residential areas to industrial zones as it moves downstream. Each land use presents unique impacts and challenges on water quality.

Figure 1-2: The Chesapeake Bay watershed



The size of a watershed can be subjective; it depends on the scale that is being considered.

The image to the left depicts the extent of the Chesapeake Bay watershed, "the big picture" that is linked to our local concerns. This watershed covers 64,000 square miles and crosses into six states: New York, Pennsylvania, Delaware, West Virginia, Maryland, Virginia and the District of Columbia.

One of the watersheds that comprise the Chesapeake Bay watershed is the Potomac River watershed. Fairfax County, as shown on the map, occupies approximately 400 square miles of the Potomac River watershed. This area contains 30 smaller watersheds. Think of watersheds as being "nested" within each successively larger one.

Each watershed in Fairfax County was subdivided to facilitate data management and to promote local awareness of the streams. Watersheds were divided into Watershed Management Areas (WMAs) approximately four square miles in size. WMAs are usually named for the local major tributary. These areas are further divided into subwatersheds, ranging in size from 100 to 300 acres. Subwatersheds represent the smallest modeling unit for watershed planning.

Beginning in the early 1940s, Fairfax County shifted from an agricultural community to an urbanized one whose population exceeds that of several states. While the County continued to develop, the condition of streams and aquatic life declined. In 1999, a Stream Protection Strategy (SPS) was initiated to monitor stream health and establish a baseline of countywide stream conditions. The results of the baseline monitoring effort indicated that only 25 percent of the County's streams were in good to excellent biological health. Stream condition is determined using an Index of Biological Integrity (IBI) that evaluates ecological health based on the community structure of bottom-dwelling aquatic invertebrates.

The baseline study found that roughly 75 percent of streams within the County had areas negatively impacted by impervious conditions within their watersheds. Due to increasing urbanization prior to implementation of modern stormwater controls, impervious land area rapidly increased, contributing to the degradation of the streams.

Introduction to Watershed Planning

The County's comprehensive stormwater management program is currently undergoing a transformation that addresses watershed health using a holistic approach. The mission for the stormwater program is dictated by the need to preserve and restore the natural environment and aquatic resources, which is consistent with the Fairfax County Board of Supervisors' Environmental Agenda adopted in June 2004. The County must also comply with all applicable local, state and federal laws and mandates. These include County ordinances and policies, Virginia's Chesapeake Bay Initiatives and the federal Clean Water Act. Under the Virginia Pollutant Discharge Elimination System (VPDES) the County has an individual Municipal Separate Storm Sewer System (MS4) Permit. This permit requires the creation of watershed management plans to facilitate compliance with the Clean Water Act. In addition, the County is doing its part to fulfill Virginia's commitment to the Chesapeake Bay 2000 Agreement to restore the ecological health of the Chesapeake Bay Watershed.

Fairfax County's first set of watershed plans were completed in the 1970s. Land use has changed significantly since that time. Additionally, there have been many advances in technology and development in the field of stormwater management which have resulted in updates to stormwater policies and regulations. New plans were needed to reflect these changes and to plan for a future in which Fairfax County recognizes that there is a direct link between the vitality of ecological resources and the quality of life for our residents.

The current watershed plans provide more targeted strategies for addressing stream health given current and future land uses and evolving regulations. These plans are one of several tools that enable the County to address program requirements and to improve and maintain watershed health. Each watershed plan includes a prioritized 25-year list of proposed capital improvement projects in addition to non-structural programs and projects. These projects and programs may lead to new and/or revised ordinances, public facilities manual requirements and policies. The plans promote the use of new and innovative practices in stormwater management such as Low Impact Development (LID) techniques and stream restoration using natural channel design. To maximize the effectiveness of these plans, community engagement and involvement from diverse interests were emphasized during the development process.

Watershed management plans were developed by grouping the County's 30 watersheds into 13 planning units (Figure 1-3). Watershed planning began in 2003. By 2007, roughly 50 percent of the County land area had completed watershed plans. This plan is part of the second group of watershed plans, which was initiated in 2007 for the remaining land area.

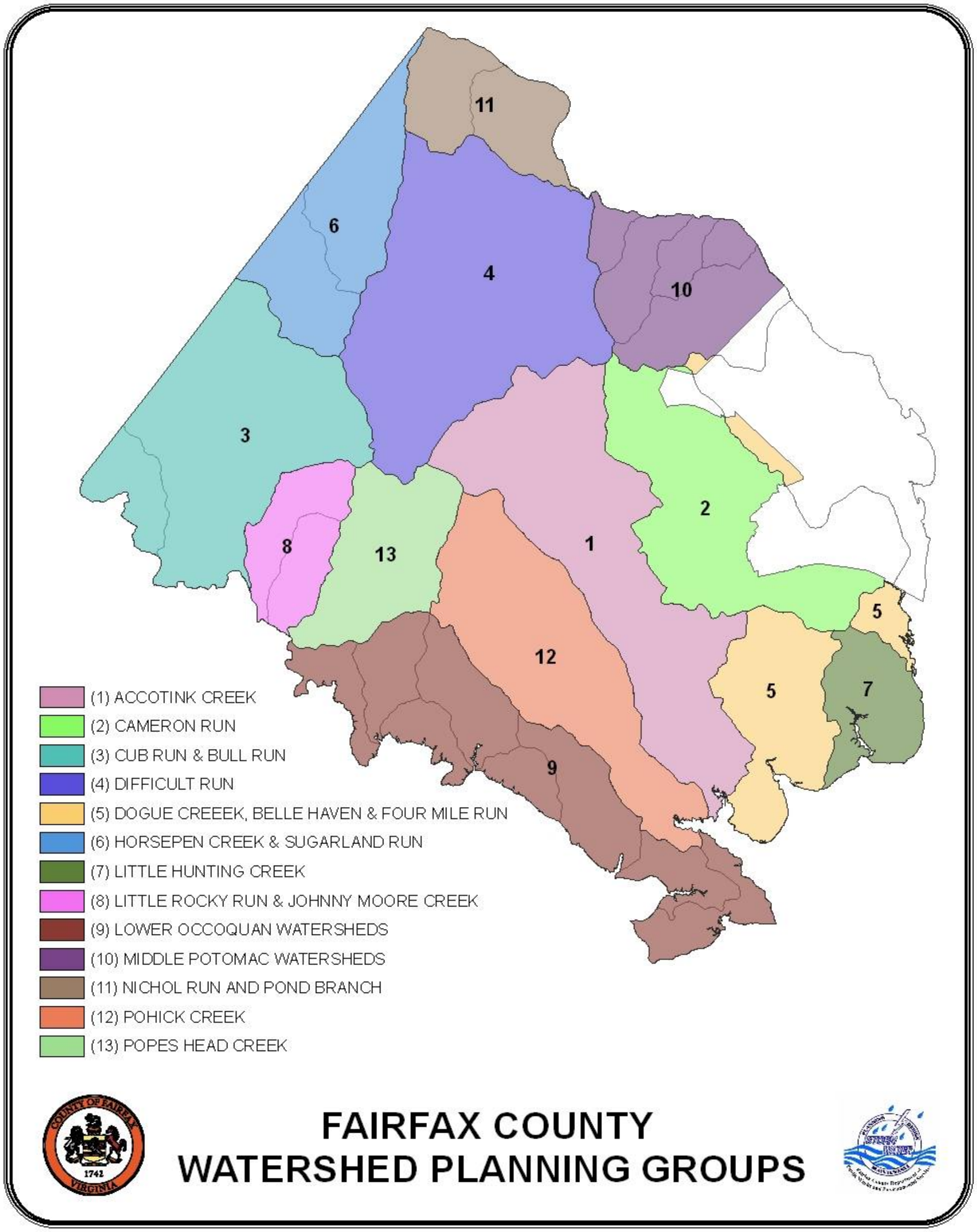


Figure 1-3: Watershed planning groups in Fairfax County

In general, the watershed management planning process consists of the following steps:

1. Review and synthesis of previous studies and data compilation
2. Public involvement to gain input, provide education and build community support
3. Evaluation of current watershed conditions and projection of stormwater runoff from present and ultimate development conditions
4. Development of non-structural and structural watershed improvement projects
5. Development of preliminary cost estimates, cost/benefit analysis and prioritization of capital projects
6. Adoption of the final watershed management plan by the Board of Supervisors

The watershed management planning process has been supported by the Board of Supervisors since its inception in 2003. In fiscal year 2006, the Board of Supervisors dedicated $0.01 per $100 of assessed value from the County's real estate tax revenue towards the overall stormwater management program. This supported the ongoing development and implementation of watershed plans and eventually evolved into the adoption of a stormwater service district starting in fiscal year 2010. The Board recently approved increasing the dedicated amount to a penny and a half for fiscal year 2011.

The following provisions address the funding and implementation of projects and programs in Fairfax County watershed plans. These provisions as recommended by the Board were developed for the Popes Head Creek Watershed Management Plan in February 2006 and have been applied to the Accotink Creek Watershed Management Plan:

> i. Projects and programs (both structural and non-structural) will first undergo appropriate review by County staff and the Board (please see iii below) prior to implementation. Board adoption of the Watershed Management Plan will not set into motion automatic implementation of projects, programs or initiatives that have not first been subject to sufficient scrutiny to ensure that the projects that are funded give the County the greatest environmental benefit for the cost.
>
> ii. Road projects not related to protection of streambeds or banks or water quality will not be funded out of the stormwater and watershed budget.
>
> iii. The Watershed Management Plan provides a conceptual master-list of structural capital projects and a list of potential non-structural projects for the watershed. Staff will, on a fiscal year basis, prepare and submit to the Board a detailed work plan to include a description of proposed projects and an explanation of their ranking, based on specific criteria. Criteria used to assemble this list will include, but are not limited to, cost-effectiveness as compared to alternative projects, a clear public benefit, a need to protect public or private lands from erosion or flooding, a need to meet a specific watershed or water quality goal, and ability to be implemented within the same fiscal year that funding is provided. Staff also intends to track the progress of implementation and report back to the Board periodically.
>
> iv. Each project on the annual list of structural projects will be evaluated using basic value-engineering cost effectiveness principles before implementation and the consideration of alternative structural and non-structural means for accomplishing the purposes of the project will be considered before implementation. This process will ensure the County's commitment to being a fiscally responsible public entity.
>
> v. Obstruction removal projects on private lands will be evaluated on a case-by-case basis for referral to the Zoning Administrator and/or County Attorney for action as public

nuisances; and otherwise to determine appropriate cost-sharing by any parties responsible for the obstructions.

vi. Stream restoration projects on private lands will be evaluated to determine means for cost-sharing by land owners directly responsible for degradation due to their land uses.

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2 Watershed Planning Process

2.1 Watershed Goals and Objectives

The County's first six comprehensive watershed management plans outlined intentions for protecting, maintaining or improving streams and the measures that could be taken to meet them. Although the plans conveyed similar aims overall, there were some differences in the way goals and objectives were developed. As a result of these differences, the initial six plans were analyzed the initial six plans to identify common themes in order to create standardized goals and objectives for the remaining watershed management plans. Standardization improved efficiency in the planning process and achieved greater consistency among the plans.

As part of the standardization process, the County selected three overarching goals, or intended outcomes of the watershed management plans:

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

Ten objectives were developed related to the three goals. Each objective may achieve one or more goals, and each goal may be achieved by one or more objectives. These ten objectives were grouped into five categories based on certain aspects of watershed management the objectives could influence:

1. **Hydrology** - healthy movement and distribution of water through the environment in a way that is protective of streams and human dwellings
2. **Habitat** - suitable environment for sustaining plants and animals
3. **Stream water quality** - general chemical and physical properties of surface waters
4. **Drinking water quality** - quality of water used for human consumption
5. **Stewardship** - the roles the County, other jurisdictions and members of the general public can play in caring for the environment

Under the new approach, County staff and the public had the flexibility to add objectives that were unique and important to a particular watershed, but all plans included the standard goals and objectives as a baseline (Table 2-1).

Table 2-1: Countywide Objectives

Objective	Linked to Goal(s)
CATEGORY 1. HYDROLOGY	
1A. Minimize impacts of stormwater runoff on stream hydrology to promote stable stream morphology, protect habitat, and support biota.	1
1B. Minimize flooding to protect property and human health and safety.	2
CATEGORY 2. HABITAT	
2A. Provide for healthy habitat through protecting, restoring, and maintaining riparian buffers, wetlands, and instream habitat.	1
2B. Improve and maintain diversity of native plants and animals in the County.	1
CATEGORY 3. STREAM WATER QUALITY	
3A. Minimize impacts to stream water quality from pollutants in stormwater runoff.	1, 2
CATEGORY 4. DRINKING WATER QUALITY	

Objective	Linked to Goal(s)
4A. Minimize impacts to drinking water sources from pathogens, nutrients, and toxics in stormwater runoff.	2
4B. Minimize impacts to drinking water storage capacity from sediment in stormwater runoff.	2
CATEGORY 5. STEWARDSHIP	
5A. Encourage the public to participate in watershed stewardship.	3
5B. Coordinate with regional jurisdictions on watershed management and restoration efforts such as Chesapeake Bay initiatives.	3
5C. Improve watershed aesthetics in Fairfax County.	1, 3

Standardizing the goals and objectives made it easier to integrate plan recommendations into a countywide data management system for prioritizing projects, tracking implementation and evaluating the long-term influence of the plans on the health of County streams.

2.2 Indicators

Since accomplishment of objectives cannot be directly measured, indicators that are able to detect changes in the watershed were developed. Indicators are used to assess the condition of the environment, as early-warning signals of changes in the environment, and to diagnose causes of ecological problems. Observed indicators are based upon data and observations collected in the field/area of interest, and are useful in assessing existing watershed conditions. Predictive indicators respond in a predictable manner to ecosystem stressors, and can be used in models of hydrologic and ecosystem processes (such as soil erosion, pollutant loading, etc.) to compare existing and future conditions.

Each indicator was measured by one or more metrics. A metric is an analytical benchmark that responds in a predictable way to increasing human, climatic or other environmental stress. Metrics may be actual numeric values (such as pH or Dissolved Oxygen values) or parameters that have been scored to a numeric scale (such as 1 – 10).

The indicators used by Fairfax County may be grouped into the following categories:

- **Watershed Impact Indicators** – Measure the extent that reversal or prevention of a particular watershed impact, sought by the goals and objectives, has been achieved ("What's there now, and how is it doing?").
- **Source Indicators** – Quantify the presence of a potential stressor or pollutant source ("Is there a problem, and what's causing it?").
- **Programmatic Indicators** –After the plans are adopted, these will assess outcomes of resource protection and restoration activities ("What's the County doing about the problem, and how is it doing?").

2.2.1 Watershed Impact Indicators

One or more watershed impact indicators for each objective were identified, including predictive and observed indicators. These indicators and the objectives to which they are linked are shown in Table 2-2.

Table 2-2: Watershed Impact Indicators

Objective	Indicators
1A Stormwater Runoff	Observed: Benthic Communities, Fish Communities, Aquatic Habitat Predictive: Channel Morphology, Instream Sediment, Hydrology
1B Flooding Hazards	Observed: Flood Complaints Predictive: Number of Road Hazards, Magnitude of Road Hazards, Residential Building Hazards, Non-residential Building Hazards
2A Habitat Health	Observed: Aquatic Habitat Predictive: RPA Riparian Habitat, Headwater Riparian Habitat, Protected Wetland Habitat
2B Habitat Diversity	Observed: Benthic Communities, Fish Communities Predictive: None
3A Stream Water Quality	Observed: *E. coli*, Benthic Communities, Fish Communities Predictive: Upland Sediment, Instream Sediment, Nitrogen, Phosphorus
4A Drinking Water Quality	Observed: *E. coli* Predictive: Nitrogen, Phosphorus, Upland Sediment
4B Storage Capacity	Observed: None Predictive: Upland Sediment, Instream Sediment
5A Public Participation	Programmatic Indicators to be tracked by the County
5B Regional Coordination	Programmatic Indicators to be tracked the County
5C Aesthetics	Programmatic Indicators to be tracked the County

For predictive indicators, three scenarios were considered. Metrics and scores were calculated for:

- Existing Conditions
- Future without project implementation
- Future with project implementation

The future condition metrics and scores reflect the simulated conditions at ultimate build-out based on the County's 25-year Comprehensive Plan.

The watershed impact indicator scores were used at multiple stages of watershed planning. First, they were used to assess current and future conditions without project implementation in the watershed. Indicator scores were then used to identify management needs and problem areas during subwatershed ranking (see Section 2.3). Once candidate projects were identified, the indicators were used to prioritize projects alongside cost and feasibility.

2.2.2 Source Indicators

Source indicators were used to evaluate the sources and stressors that impact watershed processes. Examples include:

- Numeric Source Indicators
    - o Amount of Channelized/Piped Streams
    - o Amount of Directly Connected Impervious Area (DCIA) (predictive)
    - o Amount of Impervious Surface (predictive)
    - o Number of Stormwater Outfalls
    - o Number of Sanitary Sewer Crossings
    - o Streambank Buffer Deficiency
    - o Total amount of Nitrogen (predictive)

- Total amount of Phosphorus (predictive)
    - Total Suspended Solids (predictive)
- Field Reconnaissance Observations
    - Hot Spot Investigations
    - Neighborhood Source Assessments
    - All other field reconnaissance observations

The contributions of these indicators to existing and future watershed impacts were evaluated. Metrics and scores were developed for all source indicators under existing conditions. In addition, three scenarios were considered for the predictive indicators, as noted in the list above. Metrics and scores were calculated for these scenarios:

- Existing Conditions
- Future without project implementation
- Future with project implementation

The future condition metrics and scores reflect the simulated conditions at ultimate build-out based on the County's 25-year Comprehensive Plan.

Like the watershed impact indicators, source indicator scores were used to rank subwatersheds according to their problems and needs and to assist with candidate project identification.

2.2.3 Programmatic Indicators

Programmatic indicators will be used by the County to help evaluate watershed management needs. These indicators illustrate the extent and location of existing and past management efforts. The following types of management in the watershed were inventoried during plan development:

- Detention Facilities
- Stream Restoration
- Riparian Buffer Restoration
- BMP Facilities
- Low Impact Development
- Inspection and Maintenance of Stormwater Management Facilities
- Inspection and Repair of Stormwater Infrastructure and Outfalls
- Dumpsite Removal
- Regional Ponds
- Volunteer Monitoring
- Subarea Treatment (used in watershed modeling studies)

Information for these indicators will be considered to identify and evaluate watershed management needs for individual watersheds and for the County as a whole.

2.2.4 Composite Scores

After metric values were translated into scores, objective, composite and overall composite scores were calculated for use in subwatershed ranking. Weighting factors were used when calculating composite scores to give more importance to certain indicators and objectives. First, watershed impact indicators were grouped by objective. Each metric score was multiplied by a predetermined weighting factor specific to that indicator, and the products were summed within objectives to generate an objective composite score for each objective. Each objective composite score was then multiplied by a predetermined weighting factor specific to that objective, and the products were summed to generate an overall composite score. A similar process was used for source indicators, but without an objective composite score (since source indicators are not directly linked to objectives).

2.3 Subwatershed Ranking

The composite scores calculated under the methods previously described were used to identify problem areas in the watershed and rank subwatersheds for management priority. Subwatersheds were further categorized based on which management opportunities were most likely to restore functions to the problem areas identified. The resulting data were then utilized to identify key issues and select projects that would achieve the watershed planning goals and objectives.

The subwatershed ranking procedure involved reviewing watershed impact objective, composite, overall composite and source indicator scores. Since some of the indicators are predictive, i.e. based on modeling, it was possible to pose “what if?” questions and test future scenarios with and without management actions. Existing management facilities and programs which were inventoried for programmatic indicators and data collected during field reconnaissance were also considered. The ranking process consisted of the following steps:

1. Used the watershed impact overall composite scores and identified subwatersheds that were potential problem areas under existing and future conditions.
2. Used the watershed impact objective composite scores and identified subwatersheds that were potential problem areas under existing and future conditions for each objective.
3. Reviewed source indicator composite scores and identified additional problem areas.
4. Used individual source indicator scores to identify potential sources of impacts in downstream problem areas.
5. In combination with the above data, used the programmatic indicator data inventory to identify subwatersheds where management was most needed.
6. Consulted available field reconnaissance data throughout the above steps to confirm that results reflected conditions in the field.

All this information was combined to rank subwatersheds in order from the most problematic (higher priority for management actions) to the least problematic (lower priority for management actions). Subwatershed ranking provided guidance as to where management was most needed and could be applied successfully, but the final determination was ultimately based on best professional judgment.

2.4 Stormwater Modeling

Storm events are classified by the amount of rainfall, in inches, that occurs over the duration of a storm. The amount of rainfall depends on how frequently the storm will statistically occur and how long the storm lasts. Based on many years of rainfall data collected, storms of varying strength have been established based on the duration and probability of that event occurring within any given year. In general, smaller storms occur more frequently than larger storms of equal duration. Hence, a 2-year, 24-hr storm (having a 50 percent chance of happening in a given year) has less rainfall than a 10-year, 24-hr storm (having a 10 percent chance of happening in a given year). Stormwater runoff (which is related to the strength of the storm) is surplus rainfall that does not soak into the ground. This surplus rainfall flows (or ‘runs off’) from roof tops, parking lots and other impervious surfaces and is ultimately received by storm drainage systems, culverts and streams.

Modeling is a way to mathematically predict and spatially represent what will occur with a given rainfall event. There are two primary types of models that are used to achieve this goal; hydrologic and hydraulic:

- *Hydrologic models* take into account several factors; the particular rainfall event of interest, the physical nature of the land area where the rainfall occurs and how quickly the resulting stormwater runoff drains this given land area. Hydrologic models can describe both the quantity of stormwater runoff and resulting pollution, such as nutrients (nitrogen and phosphorus) and sediment that are transported by the runoff.
- *Hydraulic models* represent the effect the stormwater runoff from a particular rainfall event has on both man-made and natural systems. These models can both predict the ability man-made culverts/channels have in conveying stormwater runoff and the spatial extent of potential flooding.

Table 2-3 shows three storm events and the rationale for being modeled:

Table 2-3: Modeling Rationale

Storm Event	Modeling Rationale
2-year, 24-hr	Represents the amount of runoff that defines the shape of the receiving streams.
10-year, 24-hr	Used to determine which road culverts will have adequate capacity to convey this storm without overtopping the road.
100-year, 24-hr	Used to define the limits of flood inundation zones

2.4.1 Hydrologic Model (SWMM)

The Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) was first developed in the early 1970s. Over the past 30 years, the model has been updated and refined and is now used throughout the country as a design and planning tool for stormwater runoff. Specifically, SWMM is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas.

The runoff component of SWMM operates on a collection of subwatershed areas where rain falls and runoff is generated. The routing (or hydraulic) portion of SWMM transports this runoff through a conveyance system of pipes, channels and storage/treatment devices. SWMM tracks the quantity and quality of runoff generated within each subwatershed, and the flow rate and depth of water in the conveyance system during a simulation period.

2.4.2 Pollution Model (STEPL)

While the SWMM model can calculate pollutant loads, the Spreadsheet Tool for Estimating Pollutant Load (STEPL) was used to determine pollutant loads for the watershed planning effort. Also developed by EPA, STEPL employs simple algorithms to calculate surface runoff. This includes nutrient loads, such as nitrogen and phosphorus, and sediment loads from various land uses. STEPL also calculates load reductions that would result from the implementation of various Best Management Practices (BMPs). The nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff as influenced by factors such as land use distribution and management practices. Sediment loads are calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using known BMP efficiencies.

2.4.3 Hydraulic Model (HEC-RAS)

The Hydrologic Engineering Centers River Analysis System (HEC-RAS) hydraulic model was initially developed by the U.S. Army Corps of Engineers (USACE) in the early 1990s as a tool to manage the rivers and harbors in their jurisdiction. HEC-RAS has found wide acceptance as the standard for simulating the hydraulics of water flow through natural and/or manmade channels and rivers. HEC-RAS is commonly used for modeling water flowing through a system of open channels with the objective of computing water surface elevations.

The geographic input data for the HEC-RAS model was extracted using HEC-GeoRAS. HEC-GeoRAS is a tool that processes the geospatial data within the County's Geographic Information System, specifically as it pertains to physical features such as stream geometry and flow path so that these features can be represented in the model.

Using available County or Virginia Department of Transportation (VDOT) engineering data, bridge and culvert crossings were coded into the model to simulate the effect these facilities have on the water surface elevations or profile. Where data were not available, field reconnaissance was performed to obtain the crossing elevation data. This crossing data was determined relative to a point where the elevation could be estimated accurately from the County's topographic data. Manning's 'n' values, which represent surface roughness, were assigned to the channel and overbank portions of the studied streams based on field visits and aerial photographs.

The hydrologic flow input data and the locations where the flows change were extracted from SWMM. The 2-yr, 10-yr and 100-yr storm flow outputs were determined at several locations in order to provide a detailed flow profile for input into the HEC-RAS hydraulic model.

As stated previously, the 2-year storm discharge is regarded as the channel-forming or dominant discharge that transports the majority of a stream's sediment load and therefore actively forms and maintains the channel. A comparison of stream dynamics and channel geometry for the 2-year discharge provides insight regarding the relative stability of the system and helps to identify areas in need of restoration.

The 10-year storm discharge was included to analyze the level of service of bridge and culvert stream crossings. Occurring less frequently than the 2-year storm, the flood stage associated with this storm can result in more significant safety hazards to residents. All stream crossings (bridges and culverts) were analyzed against this storm to see if they performed at safe levels.

The 100-year storm discharge is used by the Federal Emergency Management Agency (FEMA) to delineate floodplain inundation zones in order to establish a Flood Insurance Rate Map (FIRM) for a given area. The 100-yr HEC-RAS models were built in compliance with FEMA standards and were included to map the limits of these floodplain inundation zones. This mapping provided a means to assess which properties are at risk to flooding by the 100-yr storm event.

2.5 Public Involvement Plan

A consistent approach for public involvement was important to enable comparisons among planning processes and final watershed management plans. Conversely, as each watershed has unique characteristics, the strategies employed must also address the diverse needs, interests and conditions of the watershed and its community. The principal goals for public involvement were:

- Increase community awareness and understanding of stormwater management

- Provide meaningful participation options for a diversity of stakeholders
- Incorporate community ideas into the scope of the watershed plans
- Strive for community support for the final plans

Recognizing the need for public acceptance of the final plans, County staff created a public involvement process with multiple feedback loops to facilitate informed participation by the public and key stakeholder groups at all development stages. The first step of the public involvement process was to host an Introductory and Issues Scoping forum that was open to all residents. The primary purpose of this forum was to solicit informed input on the development of the watershed management plan. Other objectives were to explain the planning process to the community and develop an initial list of watershed issues and concerns.

After the forum, stakeholder groups were invited to be part of a Watershed Advisory Group (WAG) for each plan. These were comprised of local stakeholders who represented various interests (HOA representatives, environmental groups, etc) and advised County staff about community outreach opportunities and key issues affecting their watershed and potential projects. They also were invited to comment on draft and final versions of the watershed management plan. Each WAG met with County staff five to six times throughout the plan development in order to provide guidance and comments at critical junctures of the process.

The WAG also provided support at the second public forum, the Draft Plan Review Workshop. The workshop provided the extended community with an opportunity to review the first draft of the watershed plan and provide input. Comments were collected at the end of a 30-day period and addressed as appropriate. The final plan was then adopted by the Board of Supervisors.

More information on the public involvement process including WAG meeting minutes, public forum meeting minutes and public comments and responses can be found in Appendix C.

3 Summary of Watershed Conditions

Accotink Creek is approximately 52 square miles and is the second largest watershed in the County. It is a long, narrow watershed located in the center of the County and drains to Accotink Bay, and then into Gunston Cove and the Potomac River. Major roads within the watershed include Interstate 95, Interstate 66, Arlington Boulevard (US 50), Lee Highway (US 29-211), Richmond Highway (US 1) and Little River Turnpike (Route 236). A portion of the Capital Beltway (Interstate 495) runs through the northeastern part of the watershed and the Norfolk Southern Railroad and the CSX Railroad traverse the southern portion. The location of the watershed is shown on Map 3-1.

Approximately 11.7 square miles (23 percent) of the watershed are located in areas outside of the County jurisdiction in the City of Fairfax (11 percent) and Fort Belvoir Military Reservation (12 percent). The portions of Mainstem 1, Crook Branch and Long Branch South and the entire Daniels Run WMAs lie within the City of Fairfax and was not assessed in this planning effort. The Potomac and portions of Mainstem 6, 7 and 8 WMAs are within the boundaries of Fort Belvoir Military Reservation and were also not assessed during this study. It is important to note that future development and redevelopment of Fort Belvoir may impact the overall quality of watershed.

The Accotink Creek watershed is part of the Potomac River Basin and contains 111 miles of streams divided among the 16 WMAs listed in Table 3-1, below.

Table 3-1: Accotink Area and Stream Length by WMA

WMA	WMA Area (ac)	WMA Area (sq mi)	Stream Length (mi)
Bear Branch	1,392	2.2	5.9
Crook Branch	1,099	1.7	3.0
Daniels Run	1,209	1.9	2.6
Hunters Branch	1,202	1.9	3.2
Long Branch Central	2,429	3.8	8.0
Long Branch North	1,487	2.3	3.9
Long Branch South	3,121	4.9	7.6
Mainstem 1	3,653	5.7	11.3
Mainstem 2	2,069	3.2	9.1
Mainstem 3	3,128	5.1	13.3
Mainstem 4	1.812	2.6	6.7
Mainstem 5	2,445	3.8	8.4
Mainstem 6	1,532	2.4	8.4
Mainstem 7	2,391	3.7	9.2
Mainstem 8	3,233	5.1	12.0
Potomac	480	0.8	0.8
Total Watershed	**32,682**	**51.1**	**111.3**

The mainstem (or principal watercourse) of Accotink Creek flows for 23 miles in a southeasterly direction from the City of Fairfax to Accotink Bay near Fort Belvoir. The principal tributaries to Accotink Creek are Long Branch South, which drains into Accotink Creek in Fort Belvoir; Long Branch Central, which drains just downstream of Braddock Road; Long Branch North, which drains upstream of Prosperity Avenue; Crook Branch; Bear Branch; Hunters Branch; and Daniels Run which lies entirely within the City of Fairfax. These principal tributaries are the basis for the naming of each of the WMAs shown in Table 3-1. Lake Accotink is located in the center of the watershed. It has a surface area of 68 acres and exerts significant influence on the drainage characteristics of the watershed. See Map 3-2 and Map 3-3 for WMA boundaries.

Map 3-1: Accotink Creek Watershed Location

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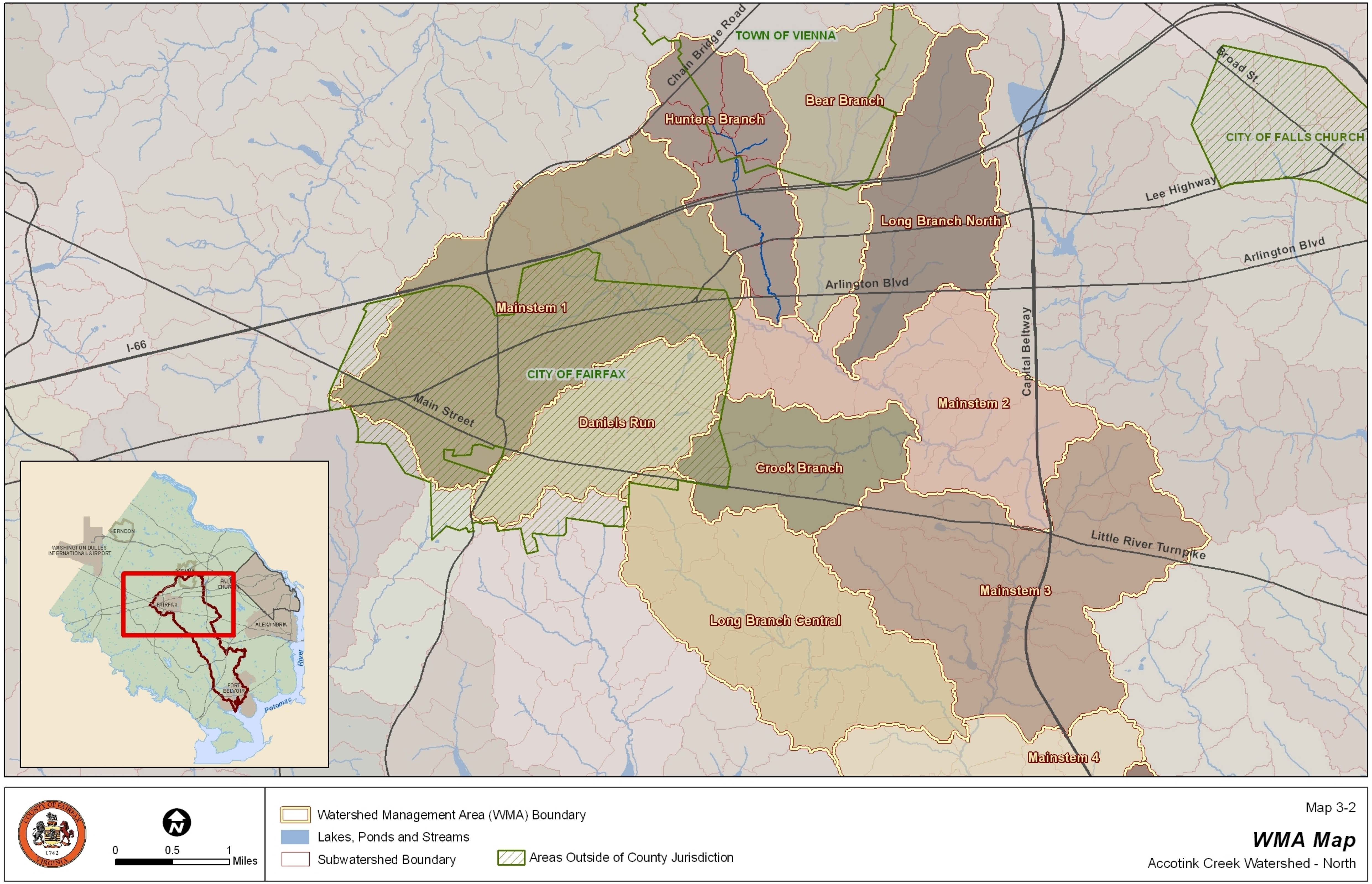
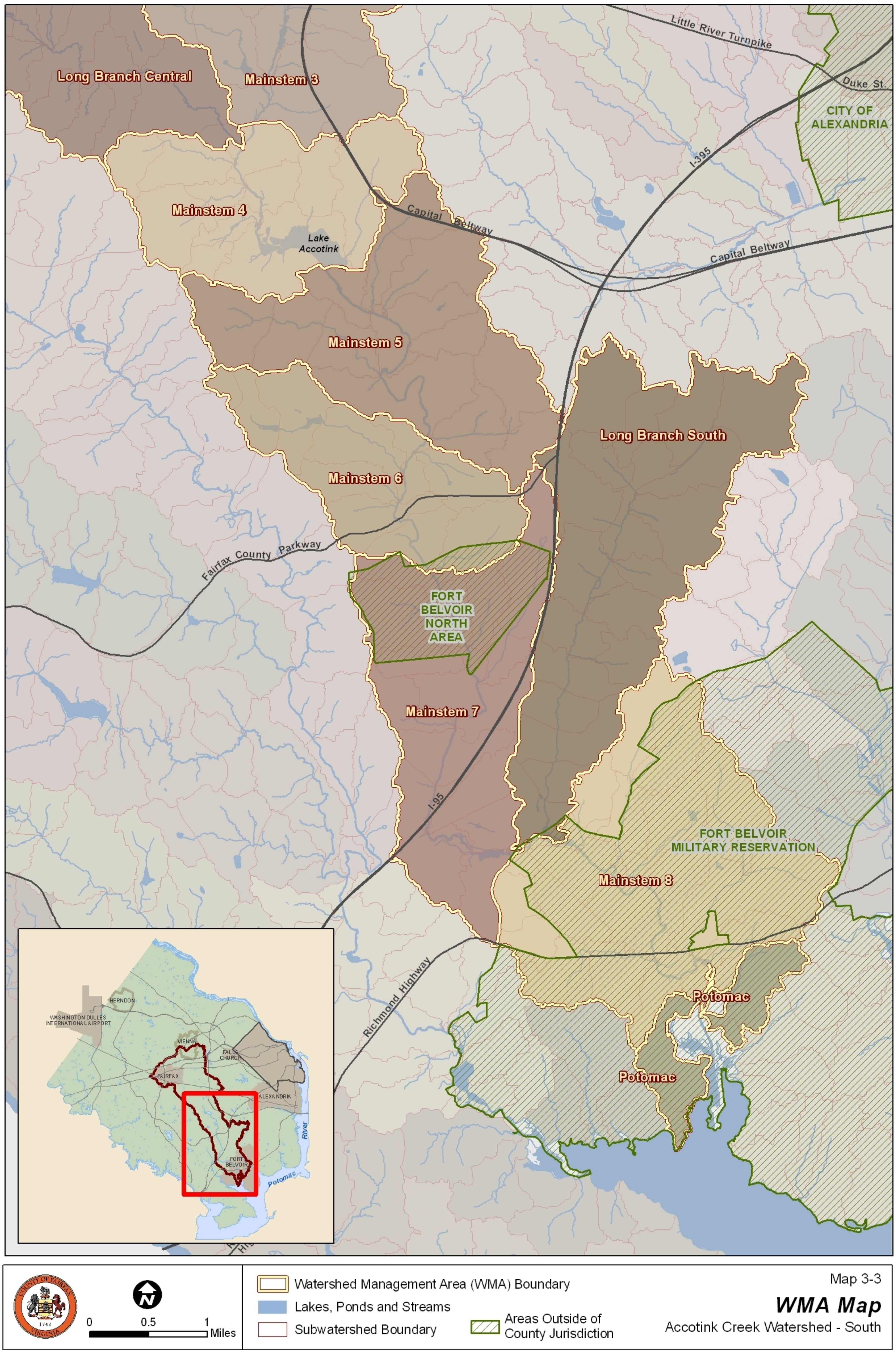
Map 3-2: Accotink Creek North WMA Map



Map 3-3: Accotink Creek South WMA Map



3.1 Watershed Land Use

Current land use mapping shows that the watershed is 87 percent developed, with 13 percent remaining as either open space or water. Map 3-4 and Map 3-5 show the land use distribution throughout the Accotink Creek watershed. Thirty-nine percent of the watershed is residential and 21 percent is in industrial, commercial or transportation land uses. Fourteen percent of the watershed is in institutional uses; the majority of this area consists of Fort Belvoir and the Fort Belvoir North Area (previously called the Engineer Proving Ground), with the remainder in public uses such as schools, churches, libraries and government office buildings. The City of Fairfax makes up another 11 percent of the watershed area; primarily in residential, commercial and industrial uses. Additionally, according to National Wetland Inventory (NWI) data, the watershed contains 1,043 acres of wetlands. Of this, approximately 880 acres are freshwater emergent and forested wetlands.

Undeveloped and forested areas in the watershed lie primarily in parkland along stream corridors or within the boundaries of Ft. Belvoir and the North Area. Roadways and development have effectively fragmented much of the remaining forest, compromising its ability to provide viable habitat. Stream corridors and the associated Chesapeake Bay Resource Protection Areas (RPAs), a 100-foot forested riparian buffer around all perennial streams in the County, provide some connection between forest cover and stream valleys, however upland forest cover does not have direct connectivity in most parts of the watershed.

The watershed is essentially built out with only 4 percent of the land use, or 1,247 acres, forecast to change through redevelopment and conversion of open space to high-intensity commercial land use.

3.2 Watershed Imperviousness

Overall, the watershed is 27 percent impervious. Imperviousness among the WMAs in the watershed ranges from three percent in the Potomac WMA to 41 percent impervious in the Long Branch North WMA. Imperviousness across the watershed is expected to increase by approximately 1.5 percent from future development.

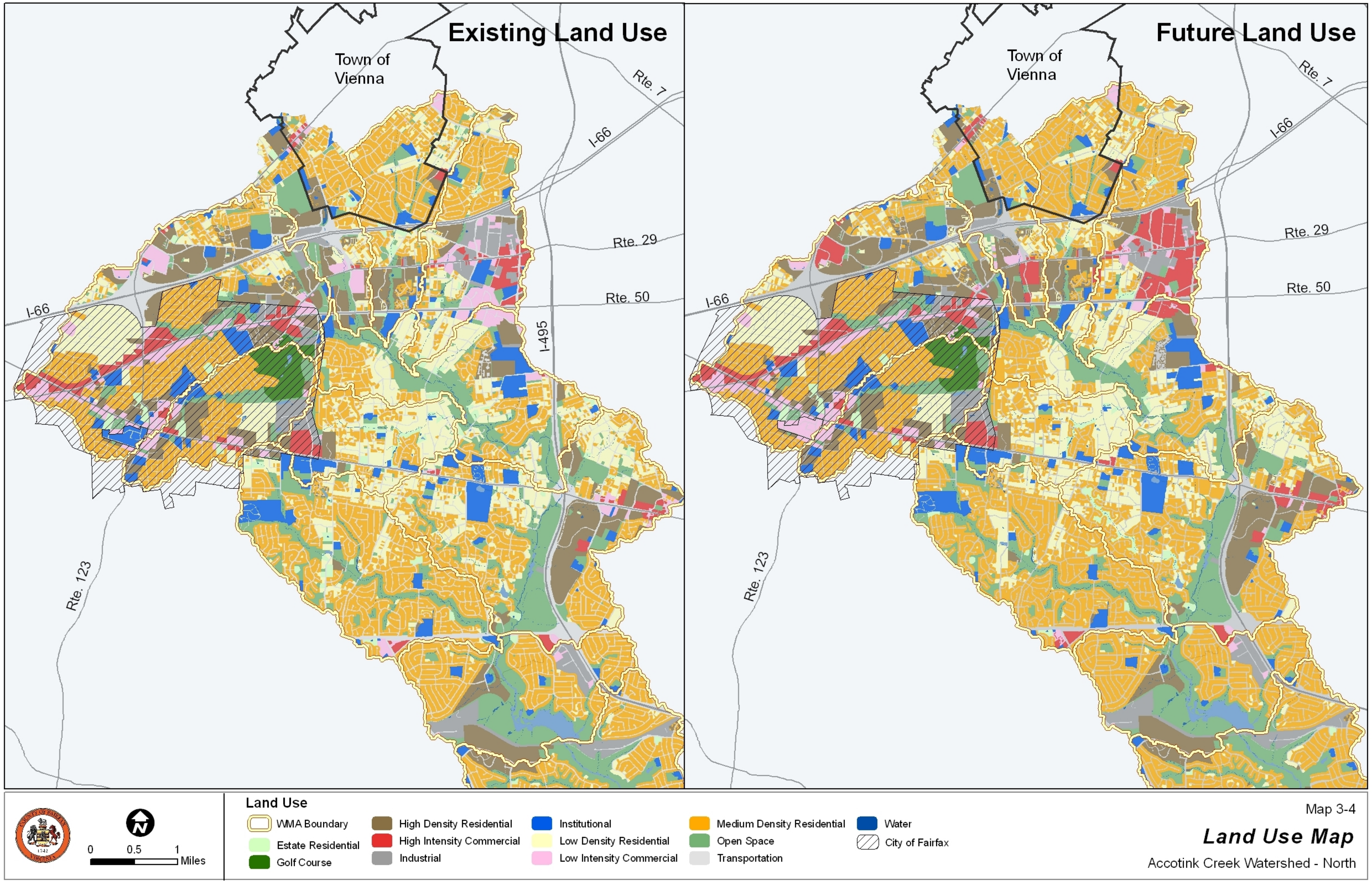
The acres of impervious surface in the watershed by WMA are shown in Table 3-2 and were calculated from geographic information system (GIS) planimetric layers provided by the County. Impervious surfaces include roads, parking lots, buildings, sidewalks and driveways.

Table 3-2: WMA Imperviousness

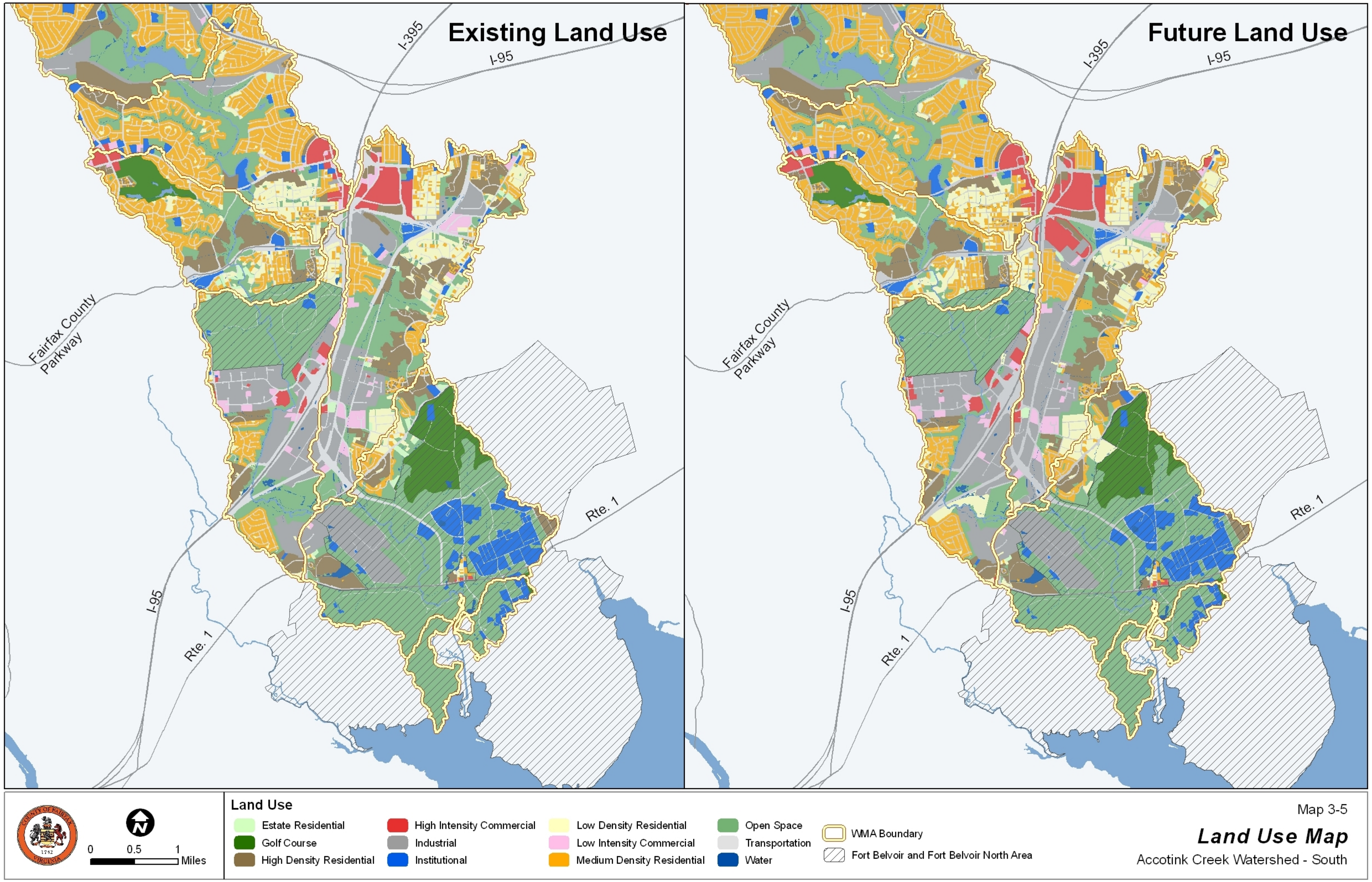
WMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious
Bear Branch	1,392	397	29
Crook Branch	1,099	274	25
Daniels Run	1,209	260	22
Hunters Branch	1,202	444	37
Long Branch Central	2,429	640	26
Long Branch North	1,487	610	41
Long Branch South	3,121	1,025	33
Mainstem 1	3,653	1,421	39
Mainstem 2	2,069	434	21
Mainstem 3	3,128	841	26

WMA	Total Area (ac)	Impervious Area (ac)	Percent Impervious
Mainstem 4	1.812	582	35
Mainstem 5	2,445	694	28
Mainstem 6	1,532	378	25
Mainstem 7	2,391	651	27
Mainstem 8	3,233	304	9
Potomac	480	16	3
Total Accotink Creek Watershed	**32,682**	**8,971**	**27**

Map 3-4: Accotink Creek North Land Use Map



Map 3-5: Accotink Creek South Land Use Map



3.3 Stream Monitoring

There were 12 sampling sites within the Accotink Creek in the Stream Protection Strategy 2001 Baseline Study. The sites are shown on Figure 3-1 and listed in Table 3-3, generally from upstream to downstream. There was a lack of fish diversity and only a few insects collected were intolerant to degraded conditions.

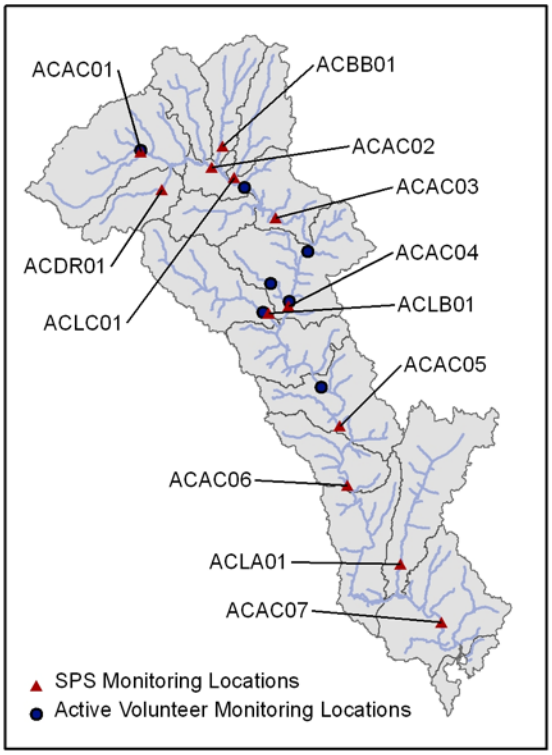


Figure 3-1: SPS and Volunteer Monitoring Locations

Geomorphological assessments indicated poor conditions throughout most of the watershed, with severely incised stream channels and active stream widening in most of the smaller tributaries. Unstable habitat and sediment bars, eroded banks, tree falls and log jams were widespread throughout. The poor and very poor overall rankings of the sites in Table 3-3 are consistent with the fact that many of the streams flow through heavily urbanized areas with greater than 25 percent imperviousness.

In addition to monitoring conducted by the County, the Northern Virginia Soil and Water Conservation District (NVSWCD) maintains a volunteer monitoring program throughout Fairfax County. All seven active volunteer monitoring sites in the Accotink Creek watershed received ratings of unacceptable in 2006. Five of these monitoring sites were located on the mainstem of Accotink Creek. Two additional sites were located on tributaries that flow into the mainstem; one tributary in southern Long Branch Central WMA and one tributary in southwestern Mainstem 3 WMA.

Table 3-3: Stream Protection Strategy Baseline Data Summary

Site Code and Stream Name	Composite	Environmental Variables		
	Site Condition Rating	Index of Biotic Integrity	Habitat Score	Fish Taxa Richness
ACAC01- Accotink Creek 1	Very Poor	Poor	Very Poor	Low
ACDR01- Daniels Run	Very Poor	Very Poor	Poor	Very Low
ACAC02- Accotink Creek 2	Very Poor	Fair	Very Poor	Moderate
ACBB01- Bear Branch	Very Poor	Very Poor	Poor	Low
ACLC01- Long Branch North	Very Poor	Very Poor	Poor	Low
ACAC03- Accotink Creek 3	Very Poor	Poor	Poor	Moderate
ACAC04- Accotink Creek 4	Poor	Poor	Poor	Moderate
ACLB01- Long Branch Central	Poor	Poor	Fair	Moderate
ACAC05- Accotink Creek 5	Poor	Very Poor	Good	Moderate
ACAC06- Accotink Creek 6	Poor	Poor	Good	Moderate
ACLA01- Long Branch South	Poor	Poor	Good	Low
ACAC07- Accotink Creek 7	Poor	Poor	Poor	Moderate

Source: SPS Baseline Study Report, 2001. Sites are generally ordered from upstream to downstream.

3.4 Stream Habitat and Geomorphology

To supplement the biological and habitat data collected by the Stream Protection Strategy Baseline Study, beginning in the fall of 2002, field crews conducted a detailed Stream Physical Assessment (SPA) on approximately 801 miles of streams throughout Fairfax County, including the Accotink Creek watershed. As part of the SPA, field crews completed a physical habitat assessment, a geomorphologic assessment and collected infrastructure information for all streams in the watershed with a drainage area greater than 50 acres. The results of the assessment were used in the watershed planning process to develop management strategies.

Habitat was assessed on 91 of the 111 miles of stream within the Accotink Creek watershed for the SPA study. In comparison with the rest of the County, the watershed is in the lower middle range of quality. Of the assessed reaches, four miles of stream was rated as excellent, 25 miles as good, 33 miles as fair, 26 miles as poor and three miles as very poor for habitat conditions. Geomorphological evaluations resulted in classifying 91 percent of the channels as unstable and experiencing severe bank erosion.

The SPA infrastructure inventory included all structures and conditions that may have potential impacts on the stream, such as sources of contamination or pipes, ditches, stream obstructions, dump sites, head cuts, utilities, erosion problem areas, stream crossings and areas of deficient buffer. Of the 1,211 inventory points, the most significant problems were deficient buffers, head cuts, exposed utility lines and erosion at pipe outfalls.

3.5 Water Quality

The streams of the Accotink Creek watershed are regulated by water quality standards set by the Virginia State Water Control Board (SWCB). Waters in the Accotink Creek watershed are designated as Class III waters (Nontidal Waters Coastal and Piedmont Zones), with regulated criteria for dissolved oxygen, pH and maximum temperature. Fecal coliform and *Escherichia coli,* a specific species of fecal coliform bacteria, are also regulated.

Fairfax County Sampling – Water quality data is collected through ongoing monitoring conducted by the County and various volunteer organizations. Available data for the Accotink Creek watershed, from June 1999 to March 2007 as part of the baseline SPS and continuing DPWES monitoring, indicate one site with a pH below the acceptable range of 6.0 and one site with dissolved oxygen below the acceptable range of 4 mg/L.

The Fairfax Department of Health's Division of Environmental Health conducted a water quality sampling program throughout Fairfax County from 1969 until 2002. For data collected between 2000 and 2002 at the 14 sampling sites in the Accotink Creek watershed, pH was outside of criteria limits for only one percent of over 700 samples. Criteria exceedance for dissolved oxygen and temperature were also low, with five percent of samples below the allowable dissolved oxygen limit and no sample above the allowable temperature. However, fecal coliform samples exceeded the maximum allowable limit of 200 colonies per 100 ml of water for 80 percent of the samples.

303(d) List and TMDLs - The Commonwealth of Virginia is required to monitor Waters of the State and submit a report to EPA and the public every two years. The Virginia Department of Environmental Quality (DEQ) prepares and submits the 305(b)/303(d) Water Quality Assessment Integrated Report, which combines general water quality information required under section 305(b) of the Clean Water Act (CWA) with a report on impaired waters that do not meet water quality standards required under Section 303(d).

The list of impaired waters in the Integrated Report (often referred to as the 303(d) List) describes the locations of the listed water body and the cause and source of pollutants causing the impairment. Once a water body is listed as impaired, a plan is developed to restore the water. This plan takes into account the total amount of pollution a water body can assimilate, or a total maximum daily load (TMDL). The restoration plan is often referred to as a TMDL and is accompanied by a target year for restoration (referred to as a schedule). Impaired waters for which a TMDL is required are listed under Category 5 in the Impaired Waters Report. For more information on Virginia's monitoring program, visit DEQ's page at www.deq.state.va.us/wqa/homepage.html. For more information on the TMDL program in Virginia, visit DEQ's page at www.deq.virginia.gov/tmdl/homepage.html.

DEQ listed portions of the streams in the Accotink Creek watershed as impaired waters, shown in Table 3-4.

Table 3-4: Impaired Water Bodies

Impairment Code	Location	Impairment	Year Listed	TMDL Schedule
A15L-01-HG	Lake Accotink	Mercury in fish tissue	2010	2022
A15L-01-PCB	Lake Accotink	PCBs in fish tissue	2010	2022
A15R-01-BAC	Begins at the confluence with Calamo Branch and continues downstream to the tidal waters of Accotink Bay.	Fecal Coliform, *Escherichia coli*	2004	2016
A15R-01-BEN	Begins at the outlet of Lake Accotink and continues downstream until the confluence of Calamo Branch	Benthic-Macroinvertebrate Bioassessments	2010	2022
A15R-01-BEN	Begins at the confluence with Calamo Branch and continues downstream to the tidal waters of Accotink Bay.	Benthic-Macroinvertebrate Bioassessments	1996	Draft benthic TMDL was prepared to control stormwater flow. Public comment period ended 8/20/2010.
A15R-01-PCB	Begins at the confluence with Calamo Branch and continues downstream to the tidal waters of Accotink Bay.	PCBs in fish tissue	2010	2022

Impairment Code	Location	Impairment	Year Listed	TMDL Schedule
A15R-02-BAC	Begins at the confluence with Crook Branch, upstream from Route 846, and continues downstream until the start of Lake Accotink.	*Escherichia coli*	1998	A fecal coliform TMDL for Accotink Creek above Lake Accotink was approved May 31, 2002.
A15R-03-BAC	Segment starts at confluence of Daniels Run to Accotink Creek in the City of Fairfax and extends downstream to the confluence of Bear Branch to Accotink Creek.	*Escherichia coli*	2002	A fecal coliform TMDL for Accotink Creek above Lake Accotink was approved May 31, 2002.
A15R-04-BEN	Segment begins at the confluence with an unnamed tributary to Accotink Creek, located in the upstream corridor of Ranger Park, and continues downstream to the confluence with Daniels Run.	Benthic-Macroinvertebrate Bioassessments	2008	2020
A15R-04-BEN	Begins at the headwaters of Accotink Creek and continues downstream until the start of Lake Accotink.	Benthic-Macroinvertebrate Bioassessments	2010	2022
A15R-05-BEN	Begins at the confluence with an unnamed tributary to Long Branch, at the Route 651 (Guinea Road) bridge, and continues downstream until the confluence with Accotink Creek, at rivermile 14.32 just below Braddock Road.	Benthic-Macroinvertebrate Bioassessments	2008	2020
A15R-06-BAC	Begins at the headwaters of Long Branch and continues downstream until the confluence with Accotink Creek, at rivermile 4.41.	*Escherichia coli*	2008	2020

USGS Bacteria Source Tracking – In 1998, a 4.5-mile segment of Accotink Creek from the confluence of Crook Branch and Accotink Creek to the start of Lake Accotink was placed on the Section 303(d) list of impaired waters due to elevated levels of fecal coliform bacteria (A15R-02-BAC in Table 3-4). In order to develop a TMDL for this stream segment, a study was conducted by the United States Geological Survey (USGS) in cooperation with Virginia Department of Conservation and Recreation (DCR). This study was a bacteria source tracking (BST) study which would identify the sources of fecal coliform in the streams using genetic fingerprinting. This study showed that the most significant sources of fecal coliform bacteria were geese, humans, dogs, cats, sea gulls and raccoons.

The results of the BST study were used in combination with a watershed model to simulate stream flow and bacterial transport in the watershed. According to the results of this second study, in order for the watershed to meet state water quality standards and the associated TMDL, an 89 percent reduction in fecal coliform bacteria load would need to occur. The full report may be found at: http://pubs.usgs.gov/wri/wri034160/wrir03-4160.htm.

3.6 Field Reconnaissance and Investigations

Field reconnaissance was conducted to update and supplement existing Fairfax County geographic data so current field conditions were accurately represented. This information was used to update watershed GIS data for subsequent analysis. The reconnaissance effort included the identification of pollution sources, current stormwater management and potential restoration opportunities using the Center for Watershed Protection's Hotspot Site Investigation (HSI) and Neighborhood Source Assessment (NSA). These assessments are described in Manual No. 11 of the Center's Urban Subwatershed Restoration Manual Series and are available from the Center's website at www.cwp.org.

Hotspot Site Investigation- The Hotspot Site Investigation was conducted to evaluate the pollution-producing behaviors at commercial hotspots (such as gas stations, restaurants, industrial areas, etc.). The goal was to quickly identify areas where stormwater pollution is generated and identify ways to mitigate it. A subsample of potential hotspots within the watershed was assessed. At each site, field crews evaluated various site practices, including vehicle operations, outdoor material storage, waste management, condition of the building, parking and landscaped areas and stormwater infrastructure.

Neighborhood Source Assessment- The Neighborhood Source Assessment is used to evaluate the pollution-producing behaviors in residential areas. A subsample of neighborhoods within the watershed was assessed. Field crews used a windshield survey method to get a sense of general neighborhood characteristics, such as the location of downspouts, turf management, curb and gutter condition and the amount of forest canopy. Where needed, the neighborhood was split into multiple areas when one portion of the neighborhood had significantly different characteristics.

The Draft Watershed Workbook (Appendix A) presents detailed information from field assessments of streams and upland areas, water quality monitoring data and watershed preliminary modeling conducted for this plan. The information was used to rank problem areas and identify potential sites for improvements.

In 2009, field crews conducted 37 Hotspot Site Investigations and assessed 54 neighborhoods in the Accotink Creek watershed to determine potential runoff pollution sources and identify potential treatment practices. As a result of this investigation, there were nine confirmed hotspots and 22 potential hotspots identified. Some neighborhoods lacked stenciled storm drains and many would benefit from a lawn care education program. Table 3-5 provides a summary of the sites investigated for each WMA.

Table 3-5: Accotink Creek Watershed HSI/NSA Results

WMA	HSI	NSA	Confirmed Hotspots	Potential Hotspots	NSA Result
Bear Branch	n/a	1	n/a	n/a	Lacked stenciled storm drains
Crook Branch	n/a	2	n/a	n/a	Single family neighborhoods, lacked stenciled storm drains in some areas and lawn care education recommended.
Daniels Run	n/a	n/a	n/a	n/a	
Hunters Branch	1	n/a	0	0	
Long Branch Central	1	14	0	1	A few storm drains remain unstenciled. Lawn care education recommended.
Long Branch North	7	2	3	4	Neighborhoods generally in good condition.

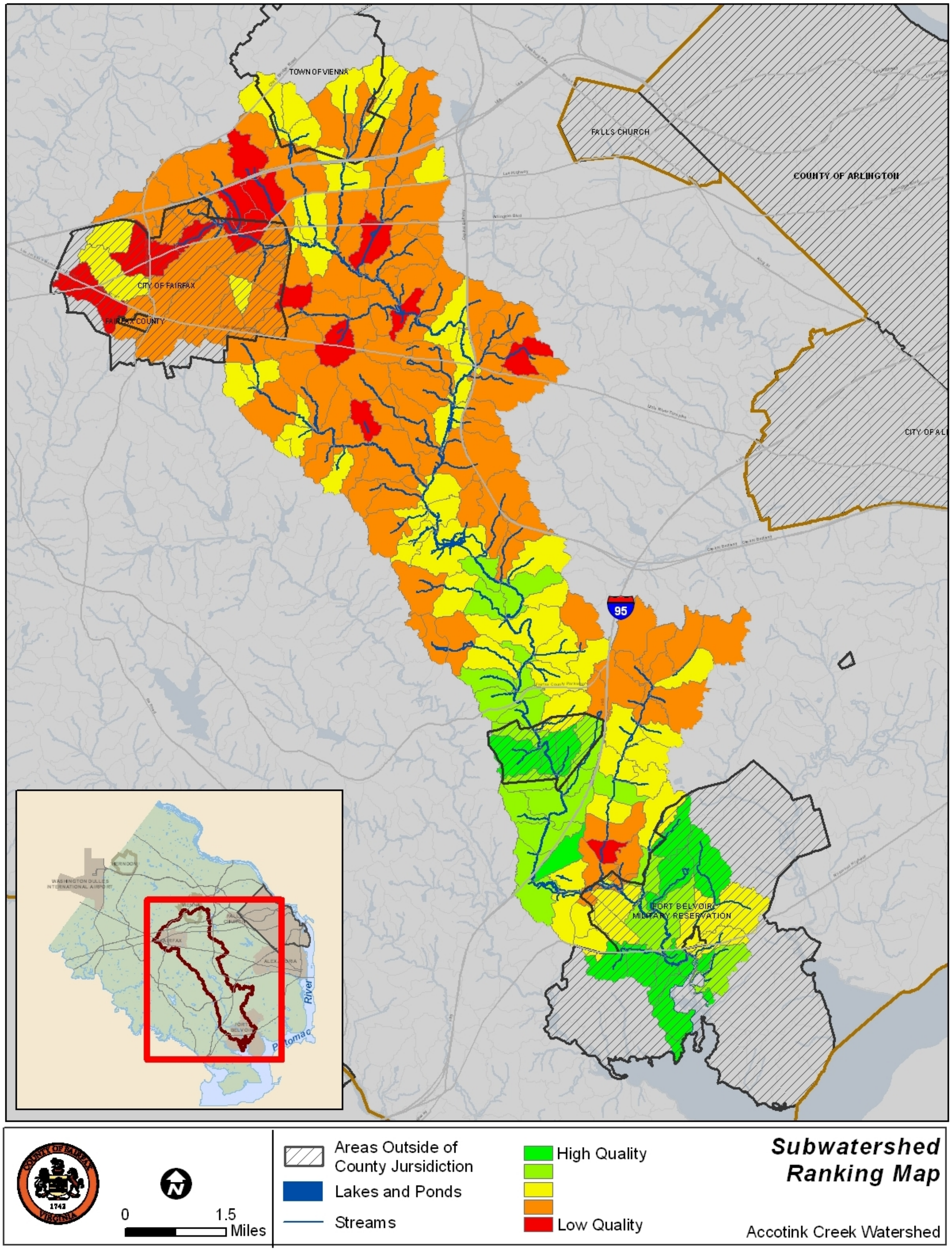
WMA	HSI	NSA	Confirmed Hotspots	Potential Hotspots	NSA Result
Long Branch South	8	3	3	2	Recommend rain gardens/barrels and lawn care education.
Mainstem 1	1	1	0	1	Neighborhood generally in good condition.
Mainstem 2	n/a	2	n/a	n/a	
Mainstem 3	n/a	11	n/a	n/a	
Mainstem 4	2	2	0	1	Recommend better maintenance of common space and stenciling in some areas.
Mainstem 5	3	7	1	2	Recommend tree planting in open spaces and rain barrels in some areas.
Mainstem 6	6	2	0	6	Rain barrels/rain gardens recommended.
Mainstem 7	2	1	0	1	Storm drain stenciling, lawn care education and rain gardens recommended.
Mainstem 8	6	6	2	4	Better management of common space, better lawn care practices recommended.
Potomac	n/a	n/a	n/a	n/a	
Total	**37**	**54**	**9**	**22**	

Modeling – The pollutant load model (STEPL) showed an increase of pollutant loads from existing conditions to future conditions without projects for the entire Accotink Creek watershed of 1.4 percent for Total Suspended Solids, 4.6 percent for Total Nitrogen and 3.8 percent for Total Phosphorus. Individually, the Mainstem 7, Long Branch South, Potomac, Hunters Branch and Long Branch North WMAs have the largest modeled increases for these three pollutants. All other WMAs in the watershed increase less than 6 percent for all pollutants. Table 6-2 in the last section of this WMP summarizes the pollutant load modeling results by WMA for existing conditions and future conditions, as well future conditions with the proposed 10-year and 25-year projects. The Technical Memorandum for Task 3.6 (Model Analysis) in Appendix B provides more background on the modeling procedures.

3.7 Subwatershed Ranking

The subwatershed ranking procedure described in Section 2.3 was performed on the Accotink Creek watershed. **Map 3-6** shows the results of the ranking. In general, areas in better condition (green or yellow) are those with a substantial amount of open space. The value of the stream valley parks can be seen, in particular. The northern half of the watershed which shows up in lower quality condition is more intensely developed. Streams in this half of the watershed were generally in worse condition, with active erosion, incision, and widening. This process identified areas in most need of projects to reduce the effects of uncontrolled stormwater or to restore the integrity of the stream system.

Map 3-6: Subwatershed Ranking Map



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4 Watershed Restoration Strategies

4.1 Subwatershed Strategies

The watershed restoration process follows the assessment of subwatershed conditions summarized in the preceding section. It involves two elements: first, to determine where in the watershed to prioritize restoration efforts, and second, to identify specific practices and locations where improvements can be made.

The purpose of prioritizing was to focus limited resources in the most effective way, as there were some geographic areas within the watershed where the same improvement can have a greater impact than in others. Once prioritization was complete, specific restoration sites were identified at a subwatershed scale. These results are described in Section 5. This section provides an overview of the approach and practices considered.

The overall strategy for restoring the Accotink Creek watershed was developed with the assistance and input of the Watershed Advisory Group (WAG). WAG members contributed the following approaches for subwatershed prioritization:

- Preserve pristine areas from development or degradation
- Restore areas with limited impairment to expand wildlife populations
- Restore areas that are highly impaired due to specific and treatable factors

These recommendations highlighted that targeting improvements only in the most impaired areas may not be the best watershed restoration method, and that other approaches to targeting improvements may work better. This strategy recognized that preventing impairments through preservation is more cost-effective than trying to restore an impaired system.

Impaired subwatersheds (identified by the two shades of grey in **Map 4-1**) were highlighted as priority subwatershed restoration areas using the indicator data discussed in Section 2.3. These are the areas in most need of projects to reduce the effects of uncontrolled stormwater or to restore the integrity of the stream system. The indicators were divided into four summary groups, and then each subwatershed was ranked based on the score from the four summary groups and the overall ranking. If the subwatershed scored among the worst 40 percent overall (light grey), or the worst 20 percent for one of the indicator groups (dark grey), it was presumed to be impaired. The four groups are as follows: areas in most need of projects to reduce the effects of uncontrolled stormwater or to restore the integrity of the stream system.

1. <u>Stormwater Runoff Impacts</u>: This group of indicators summarized the conditions of the streams within the subwatershed and has been used primarily to assist in locating potential stream restoration sites.

2. <u>Flooding Hazards:</u> The indicators for flooding hazards have been derived from planning-level hydraulic modeling for the project. They include residential or commercial buildings that are shown within the modeled 100-year flood limit and crossings which are modeled as overtopped by the 10-year event.

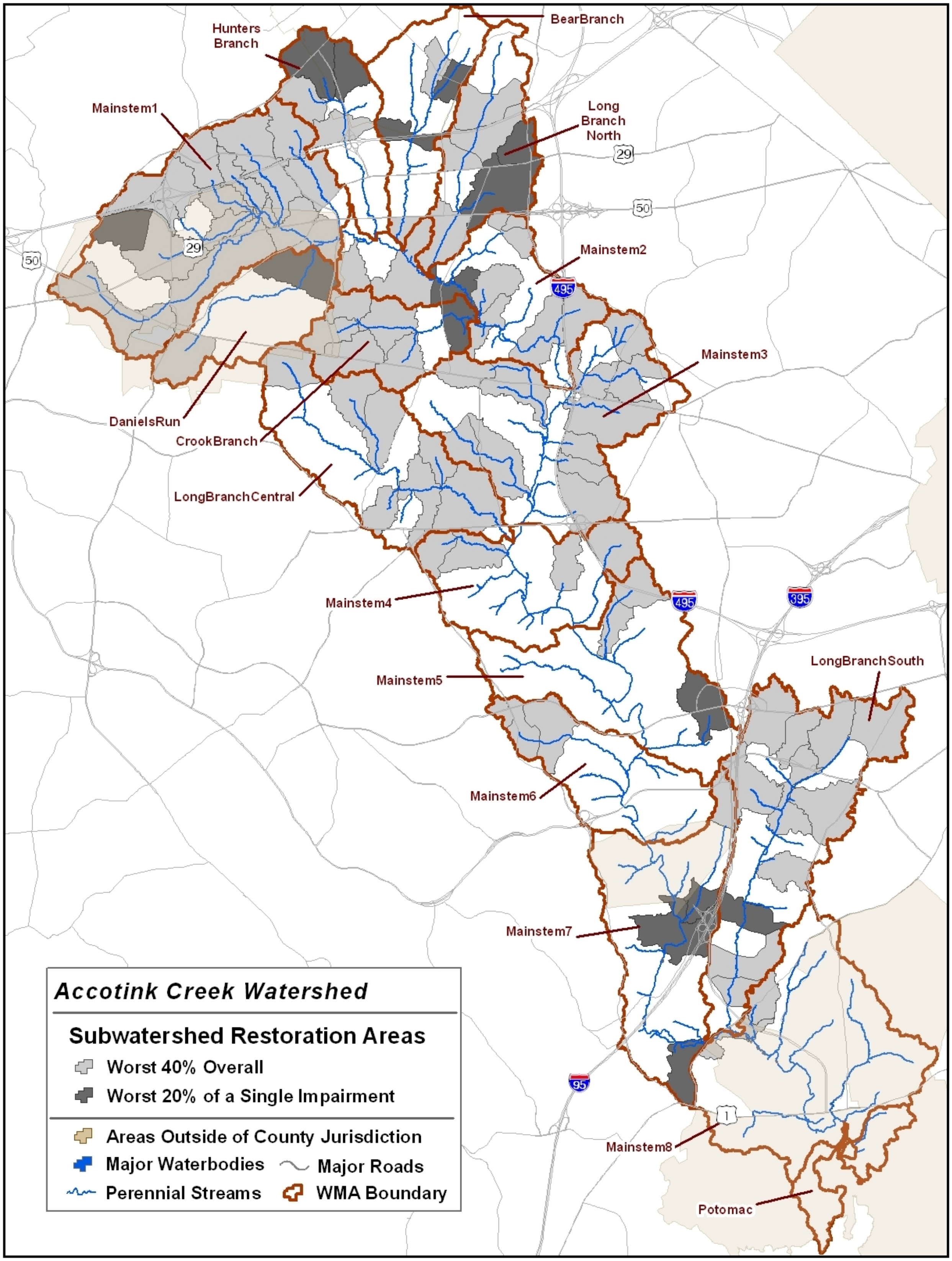
3. <u>Habitat Health:</u> These indicators describe conditions of the natural resources that contribute to habitat quality such as forest cover, wetlands and riparian buffers.

4. <u>Water Quality:</u> Four indicators were used in this group. Three are derived from watershed modeling, which is specific to each subwatershed and integrates GIS data on

imperviousness, land use and stormwater treatment. The fourth is based on monitoring data for *E. coli* collected by Virginia Department of Environmental Quality (VDEQ).

Two major conclusions can be drawn from this exercise. First, even though Accotink Creek is a highly urbanized watershed, there is a considerable area that was in fair condition. Mainstem 6 and 8 reflect the conditions of Fort Belvoir and the North Area while Mainstem 4 and 5 benefit from Lake Accotink Park. Secondly, most of the impaired subwatersheds met the criteria for impairment of more than one indicator groups. There were few areas where only a single cause of impairment could be pinpointed. Going forward, this leads to a search for restoration approaches that can address multiple types of impairment.

Map 4-1: Priority Subwatershed Restoration Areas



4.2 Description of Watershed Restoration Practices

This section provides a short description of the three types of practices that are proposed to help restore and protect the watershed. The first type provides background information on structural practices, the second provides information for non-structural practices and the third discusses the project prioritization process.

Stormwater practices are generally described as being in one of two categories: structural or non-structural. Structural practices are physical structures which generally involve budgeting through the Capital Improvement Plan and engineering, design and construction. Non-structural practices are more programmatic in nature and usually focus on controlling stormwater runoff at the source through reducing the amount of runoff and/or reducing the opportunity for stormwater runoff to pick up and transport pollutants downstream.

4.2.1 Structural Practices

Structural projects can be designed to meet any of the goals and objectives for a particular watershed through restoring streams, providing mitigation from flooding, removing pollutants from stormwater runoff, or improving aquatic and terrestrial habitat. The Accotink Creek Watershed Management Plan includes the following structural practices:

- New Stormwater Management Ponds
- Stormwater Pond Retrofit
- Stream Restoration Projects
- Area-Wide Drainage Improvement
- Culvert Retrofit
- New BMP/LID or BMP/LID Retrofit
- Flood Protection / Mitigation
- Outfall Improvement

When stormwater management began to be implemented, the approach taken was to provide treatment facilities at the point of discharge. These were typically a type of pond or storage facility or outfall improvement and dealt mainly with the excess volume of stormwater runoff. As more knowledge was gained from experience, approaches that treated stormwater closer to its source were developed. These included BMP/LID facilities or area-wide improvements to the drainage system such as water quality filters at inlets. Structural projects can serve several different functions based on their design: reducing the amount of stormwater, improving water quality, or attenuating high flows.

The following sections provide a short description of each of the structural practices proposed for the plan.

New Stormwater Management Pond

Description

These projects are newly-constructed dry ponds, wet ponds or stormwater wetlands. They are designed to help reduce the impacts of stormwater runoff by either permanently or temporarily storing the water.

All three types of ponds can be designed for water quality improvements by retaining the water long enough for sediment and pollutants to settle out of the water.

Wet ponds and stormwater wetlands can also provide water quality and habitat benefits through landscaping with aquatic vegetation. Vegetation is added to the pond design to treat dissolved nutrients (nitrogen and phosphorus), which can be difficult to remove through settling and filtering. In the process of growing, aquatic vegetation takes the nutrients up out of the water through its roots and sequesters them.

Figure 4-2: Stormwater Management wet pond (Source: Fairfax County)

Figure 4-1: Engineered stormwater wetland (Source: Fairfax County)

Design Considerations

Ponds can be categorized into three main categories:

1. Dry ponds, which are quantity controls to capture rapidly flowing runoff and release it slowly over a longer time period;

2. Wet ponds, which have a permanent pool that allows for sedimentation along with an level of storage above the pool to provide extended detention like a dry pond; and

3. Stormwater wetlands, which function similarly to a wet pond but are landscaped to provide better treatment of dissolved nutrients and aquatic habitat for a wider variety of species.

All three types may designed to include extended detention. Extended detention basins provide additional temporary storage above the bottom of a dry pond or the permanent pool of a wet pond or wetland. The extra storage area holds stormwater for longer settling times, which allows it to be released more slowly, reducing stress on downstream channels, and gives more time for pollutants to settle out. This improves the pollutant removal efficiency for dry ponds, wet ponds and wetlands.

Stormwater Management Pond Retrofit

Description

A stormwater management pond retrofit consists of changes or improvements made to an existing stormwater pond to provide additional water quality treatment. If the assessment of the watershed indicates that stream protection is necessary, the retrofit may include changes in the outflow controls to provide for peak flow reductions that help to minimize stream degradation.

Design Considerations

The amount of water treated (water quantity) can be improved in two ways. First, by increasing the time the stormwater runoff stays in the pond through making the pond bigger and changing the outflow control to release the extra water more slowly. Second, there may be opportunities to add to the drainage area treated by the pond by redirecting untreated area to the pond.

Retrofits to improve water quality treatment involve adding features or controls that were not part of the original design. These approaches involve changing the way the pond functions, with methods such as the following:

Figure 4-3: Stormwater dry pond retrofit (Source: Fairfax County)

- Changing outflow controls or adding a BMP plate for extended detention
- Changing the flow path within the pond so water travels farther between the inlet and the outlet
- Creating multiple pond cells within a single pond. Reconfiguring the pond and the landscape to capture more stormwater

Other approaches involve adding new features to the pond:

- Creating a shallow subsurface wetland bench around the perimeter which provides an opportunity for aquatic vegetation to take up nutrients
- Creating wetland areas within the pond
- Creating a forebay to capture sediment before it enters the pond, which improves maintainability
- Creating a micropool at the outlet to add an additional location for sedimentation

Stream Restoration

Description

The goal of stream restoration is to return the stream to a stable state in which it neither significantly erodes or fills with sediment, is connected to its floodplain and has an improved habitat condition.

Besides being undertaken to restore stability, stream restoration projects may be proposed to restore natural physical, biological, or ecological function to a stream which has become degraded due to man-made changes in the channel or the watershed, such as channel straightening, armoring with concrete or gabions, or culvert installation.

Design Considerations

Several approaches to restoration are available based on the type of impairment and constraints such as availability of adjacent land. For all of these projects, structures based on natural stream bed forms are used. Wood and stone structures can be used to concentrate stream flow to the center of the channel to provide a good flow depth for aquatic life between storm events.

Figure 4-4: Stream restoration (Source: Fairfax County)

For incised urban channels, there are several options available depending on the severity of the degradation and availability of adjacent land. The most extensive restoration designs may move the stream itself, creating a new channel on a new alignment at the original floodplain elevation. Other alternatives could involve adjusting the cross-section, reducing bank slopes, or creating a new floodplain bench within an over-widened channel. For incised channels with no room to increase meander width, a restoration design could include using grade controls to flatten the slope of the stream and dissipate stream energy.

Less extensive restoration approaches could be undertaken where there is insufficient space or the existing flows make it infeasible to recreate a natural channel. These could involve armoring stream banks with rock or bioengineering materials to prevent further erosion, grading to lay back over-steepened banks and create a more stable cross-section.

Culvert Retrofit

Description

Figure 4-5: Culvert retrofit control structure, flow left to right (Source: KCI)

These projects reconfigure and improve existing culverts, which allow streams to flow under roads and trails in the County. They may consist of water quantity (e.g. peak flow reduction, increased storage etc.) and/or water quality (e.g. improved runoff quality through micropools, wetland plantings, etc.) improvements.

This retrofit option is installed upstream from existing road culverts by constructing a control structure and potentially excavating a micro-pool similar to that seen in Figures 4-5 and 4-6.

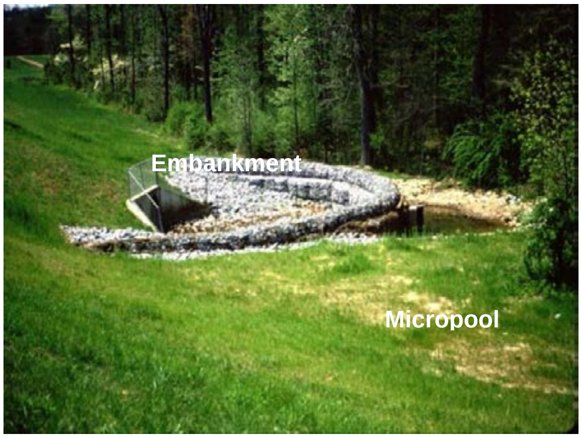


Figure 4-6: Culvert retrofit, flow right to left (Source: Center for Watershed Protection)

These projects are usually designed for headwater, intermittent streams. The control structure will detain and reduce stormwater flow; the micropool prevents resuspension of previously settled sediments and also prevents clogging of the low flow orifice and may be able to infiltrate the runoff from smaller storms, improving water quality. Additional water quality treatment can be obtained through sedimentation or vegetative uptake.

Design Considerations

If the upstream area is an open floodplain, it may be possible to construct an off-line wet pond or stormwater wetland to improve water quality treatment. Since roadway embankments are not usually designed to impound water, special design measures are necessary, particularly a new embankment built upstream of the culvert.

Secondary impacts need to be considered as well, including impacts to the 100-year floodplain, fish passage barriers, or impacts to wetlands and forest.

The best situations for culvert retrofits occur when:

- Upstream land is in public ownership.
- Channel has intermittent or ephemeral flow.
- Upstream channels have a shallow slope, are connected to the floodplain and have low streambanks.
- The retrofit is upstream of a proposed stream restoration project.

Best Management Practice / Low Impact Development

Description

These projects are intended to improve performance or efficiency of existing BMPs (which may or may not incorporate LID practices) or installation of new practices in areas where stormwater is uncontrolled.

BMP/LID systems are a suite of small practices which are installed as close as possible to where stormwater runoff is being generated. Depending on the exact type of project, they are designed to provide water quality treatment, some reduction in stormwater and detention to reduce peak flows. The main objective is to mimic the pre-development runoff characteristics of the site through treating precipitation (or runoff) before it becomes concentrated by designing many smaller systems that work together on the site instead of a larger stormwater management facility downstream.

Design Considerations

A combination of several BMP/LID types and techniques can be used to achieve the best overall treatment. All of them incorporate one or more of the following processes:

<u>Runoff reduction:</u>
- surface ponding
- infiltration
- evapotranspiration

<u>Pollutant removal:</u>
- sedimentation
- filtration
- vegetative uptake

Figure 4-7: Parking lot bioretention (Source: Fairfax County)

Figure 4-8: Vegetated swale (Source: Fairfax County)

Figure 4-9: Tree box filter (Source: Fairfax County)

Individual BMP/LID practices that incorporate these processes include the following:

- Bioretention Filters and Basins
- Vegetated Swale
- Manufactured BMPs (e.g. Tree Box Filter)
- Dry Swale
- Filter Strips
- Sand Filters
- Percolation/Infiltration Trench
- Vegetated Roof
- Rain Garden

Figure 4-10: Green roof on a parking building (Source: Fairfax County)

Rain gardens are essentially a non-engineered form of bioretention that treats rooftop runoff from individual roof leaders or overland runoff. They consist of small, landscaped depressions with a sand/soil mixture planted with native shrubs, grasses or flowering plants. Runoff is detained in the depression for no more than a day. Rain gardens can replenish groundwater, reduce stormwater volumes downstream and remove pollutants.

Figure 4-11: Sand filter along MD355(Source: KCI)

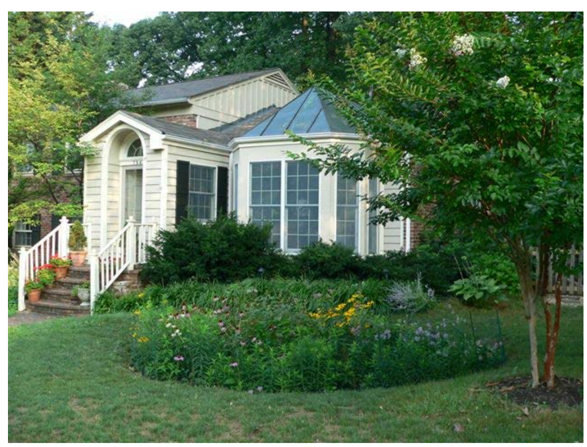


Figure 4-12: Residential rain garden (Source: Fairfax County)

Area-Wide Drainage Improvement

Description

Area-Wide Drainage Improvements are projects (or suites of projects) which improve multiple outfalls and/or other stormwater infrastructure throughout a neighborhood. Controls could be custom-designed swales or bioretention systems (Figure 4-13), proprietary devices such as inlet filters (Figure 4-14) or the tree boxes described earlier (Figure 4-9).

Figure 4-13: Vegetated swale for roadside drainage (Source: KCI)

Design Considerations

Area-wide improvements are similar to BMP/LID systems and may use the same practices. In some cases, an area-wide improvement may use more than one type of project type within the project limits.

Figure 4-14: Inlet filter (Source: Ultra-Tech Int'l)

The design focus on an area-wide improvement is to revise or upgrade the conveyance system area to provide treatment for a community rather than to treat a particular site, as with BMP/LID controls. Conversion of grass channels to vegetated swales, implementation of bioretention or tree boxes at inlets, or conversion of outfall ditches to storage or filtration systems would all be examples.

However, because of the proximity to roads and utilities, infiltration systems and vegetated swales may only be feasible in lower-density residential areas.

Flood Protection / Mitigation

Description

Flood protection projects (or suites of projects) are intended to alleviate potential flooding of roads, buildings, road crossings, or significant property.

Figure 4-15: Obsolete culvert (Source: KCI)

Figure 4-16: New replacement culvert (Source: KCI)

Road crossings (culverts or bridges) that may have been designed to safely pass high flows, such as the 100-year flood, occasionally become obsolete due to changes in upstream land use or other factors that increase storm flow volume or frequency. In such a case, a crossing that might have been designed with a one percent chance of flooding in any given year might now overtop more frequently.

In this case, for primary roads in particular, traffic standards may no longer be met. Flood protection or mitigation projects are intended to bring crossings back to current standards to allow higher stormwater flows to pass safely or adding storage upstream to reduce the peak flow to the under-sized structure.

Design Considerations

These improvements can include raising the roadbed above the flood level, rebuilding culverts so they can pass more water, replacing worn or damaged culverts with newer ones that allow water to flow more quickly. The example shown in Figures 4-15 and 4-16 include all of these techniques, with the roadway height increased and the larger double box culvert replacing the three smaller round metal ones.

In smaller streams, identifying and repairing constrictions in the drainage network may be sufficient. For larger rivers it may be necessary to rebuild bridges with a wider span to allow more space for floodwaters to pass.

For all of these types of projects, a key design consideration is to avoid potential flooding downstream. By removing constrictions, streamflows will increase, and conditions must be analyzed to make sure that flood mitigation at one site does not move the problem downstream to another.

Outfall Improvement

Description

Outfall projects improve existing stormwater outlet structures and address problems associated with inadequate outfalls (e.g. erosion, scour, head cuts etc.).

These projects are designed to protect the natural stream channels in the watershed from fast flowing stormwater runoff discharging from the storm drainage system. These high flows can cause erosion of the ditches and headwaters at the outfall; to the extent that stormwater infrastructure can be undermined and fail. They can also be a cause for further erosion or deposition downstream.

Design Considerations

There are several types of improvements that could be made depending on site constraints. If there is sufficient space, an off-line pond can be created to treat the first flush of stormwater, with higher flows bypassed into the existing stream channel.

Outfall improvements can be designed to provide water quality treatment along with energy dissipation. In an area with more constraints, a more common approach is to improve the conveyance immediately below the outfall structure to provide additional energy dissipation and reduce scour and erosion. Methods include the use of rip rap, plunge pools to break the flow of water and energy dissipation structures which adds turbulence to reduce the velocity of the outfall discharge.

Stream restoration design approaches can also be considered if the site is suitable, particularly step pool systems which can reduce the stormwater runoff velocity.

Figure 4-17: Outfall improvement (Source: Fairfax County)

4.2.2 Non-Structural Practices

Non-structural practices are a series of project types that do not require traditional construction measures to be implemented and may be programmatic in nature. They usually focus on controlling stormwater runoff at the source through reducing the amount of runoff and/or reducing the opportunity for stormwater runoff to pick up and transport pollutants downstream. These projects include but are not limited to the following practices:

- Stream buffer restorations
- Rain barrel and impervious disconnection programs
- Dumpsite and obstruction removals
- Community outreach and public education
- Land conservation coordination projects
- Inspection and enforcement projects
- Street sweeping programs
- Studies, surveys and assessments

These projects, in concert with the structural projects, represent a holistic approach to watershed management. Since much of the land area in Fairfax County is privately owned, there is a strong need to work with local communities to promote environmental awareness and recommend projects that can be implemented by residents and other groups.

The fundamental difference between structural and non-structural projects is the ability to predict the result of the project implementation through models. For example, the nitrogen removal of a wet pond may be calculated; however, there is no way to predict the reduction in nitrogen from an outreach campaign on proper fertilizer use. Additionally, these projects and programs should not be confined to any single watershed but could be implemented throughout the County as opportunities occur. Because of these differences, non-structural projects were evaluated and will be implemented using a different process than the structural projects.

There are many advantages of non-structural projects. Some of the key advantages to this projects type are:

- Less costly
- Less disruptive
- Promotes public and community awareness

In general, non-structural projects represent opportunities to proactively pursue stormwater issues that more traditional structural practices cannot address. The use of non-structural practices fulfills Fairfax County's MS4 permit requirements and environmental initiatives. The full potential of these projects will be realized through partnerships with County agencies, residents and other interested parties.

Stream Buffer Restoration

Description

The vegetated land area on either side of a stream is referred to as the riparian buffer. Buffers can be comprised of grasses, shrubs, trees, or a combination of the three. Forested buffers provide streambank stability, food for aquatic life and shading of the stream. Stream buffers also provide important wildlife habitat. In many urban areas, stream buffers have been impacted through development. Restoring vegetation to these areas can improve the quality of the stream. Buffer restoration projects can be incorporated into stream banks stabilization and stream restoration projects to encourage multiple water quality and habitat benefits.

Design Considerations

There are several design guidelines that can have an effect on the efficiency of a stream buffer. The first is the buffer width. Whenever possible, a minimum width of 100 feet on each side of the stream should be maintained to provide adequate stream protection.

The ideal buffer vegetation is a mature forest, for a number of reasons. Shade will help keep the stream cooler, roots will help stabilize the banks, and leaf litter will provide a food source for macroinvertebrates and other organisms in the stream.

Figure 4-18: Buffer restoration project in Fairfax County (Source: Fairfax County)

Buffers are effective as a stormwater filter in areas of low density development. Where there are frequent storm drain outfalls bypassing the buffer and discharging directly in the stream, the filtration benefit is lost.

Dumpsite/Obstruction Removal

Description

Stream valleys, particularly those in isolated areas, are occasionally sites where unwanted trash or materials are dumped. This can consist of yard waste in residential neighborhoods, bulk trash where the owner does not wish to pay a disposal fee, or hazardous materials where a permit may not have been obtained. Obstructions refer to items in the streambed that impede flow sufficiently to accelerate streambank erosion or increase the risk of flooding.

Design Considerations

Dumpsite cleanup is typically a maintenance-level activity, which may require trucks, loaders, or other light equipment for removal.

Obstructions are removed in a similar fashion. Review of the site conditions should be performed by a stream ecologist because in some cases woody debris and a buildup of sediment can improve stream habitat conditions.

Impervious Disconnection and Rain Barrel Programs

Description

Impervious disconnection refers to practices that reduce the effect of impervious cover by small-scale storage, infiltration, or redirection to pervious areas. It differs from BMP/LID systems primarily because these practices can be installed easily without the need for engineering and design.

Design Considerations

Rain barrels are used to capture, store and reuse residential rooftop runoff. They consist of a simple collection device to store rainwater from individual downspouts, after which it can be reused for non-potable purposes such as irrigation or car washing. Capacity is typically 50 to 100 gallons, which is sufficient to store the runoff from 0.1" to 0.2" of rainfall from the area drained by a single downspout.

Figure 4-19: Rain barrel (Source: Project Clean Water)

Figure 4-20: Disconnecting a downspout (Source: City of Toronto)

Figure 4-21: Permeable pavement blocks in a parking lot (Source: Fairfax County)

Downspout disconnection consists of adding piping or gutter systems on the ground to turn the flow from a downspout away from driveways or sidewalks to lawns or landscaped areas. Rooftop runoff redirected in this fashion is treated by surface filtration through the vegetated area and infiltration into the soil. Directing runoff onto vegetation allows the biological processes to reduce pollutants. This is also an effective method of preventing temperature increases in runoff.

The use of pervious pavement systems can provide a form of disconnection for parking lots, driveways, walkways and other hard surfaces. These systems may consist of a special asphaltic paving material (porous pavement), a special concrete material (porous concrete) or open jointed concrete blocks (permeable pavement blocks). They allow stormwater to infiltrate directly through the surface instead of flowing to a collection system. The most significant constraint is the requirement for an underdrain if the soils below the surface are not permeable and will not allow the runoff to infiltrate. Maintenance is also required to prevent sediment from clogging the surface and preventing the water from infiltrating through the surface.

Community Outreach/Public Education

Description

Outreach and education programs are intended to educate the public on how to reduce the potential for pollutants to reach our waterways. Pollutants can range from nitrogen and phosphorus in improperly applied fertilizer, to bacteria found in dog waste left on the ground. These programs are intended to change pollutant-causing behaviors by providing information on how behavior affects water quality and to recommend types of changes that can be made to reduce impacts.

Figure 4-22: High and medium maintenance lawns (Source: KCI)

Figure 4-23: Pet waste sign in common area (Source: KCI)

Design Considerations

Proper lawn and turf care practices can reduce excess nitrogen, phosphorus, insecticides and herbicides from getting into local streams. Education on soil testing, fertilizer application and pesticide use is intended to reduce the amount of these materials and educate on the appropriate application time. Encouraging conversion of lawn to native landscaping is another option for outreach programs.

Pet waste contributes harmful bacteria and excess nutrients to stormwater. Programs for control include adoption and enforcement of pooper scooper laws, education regarding its effects on streams and lakes, signs and publicly-available disposal containers.

Figure 4-24: Fairfax County storm drain label (Source: Fairfax County, label produced by Das Manufacturing, Inc.)

Storm drain stenciling or labeling is a relatively easy method of outreach that involves labeling storm drain inlets with painted or prefabricated signs that indicate that materials thrown into the storm drain are not treated and go directly to a water body, which is typically named on the sign.

Programs to promote tree planting in residential yards, commercial open space, and in the open grassy area between sidewalks and streets can increase the tree canopy, increasing evapotranspiration and interception, slowing runoff and allowing more infiltration as it is absorbed into the ground. Trees also reduce erosion by holding soil and by reducing the impact of rain to bare ground. The program is a good opportunity to involve park and neighborhood supporting groups.

Inspection/Enforcement Enhancement Project

Description

Inspection and enforcement activities include identifying staff to routinely inspect commercial sites for potential runoff polluting activities. Depending on local ordinances, citations can be written for improper disposal of materials. In other cases, a targeted education and outreach program to the landowner and the employees may be effective in reducing the activities.

Figure 4-25: Improperly stored outdoor materials (Source: Center for Watershed Protection)

Design Considerations

Vehicle maintenance and repair operations can exert a significant impact on water quality by generating toxins such as solvents, waste oil, antifreeze and other fluids. Often, vehicles that are wrecked or awaiting repair can be a stormwater hotspot if leaking fluids may be picked up by stormwater runoff.

Figure 4-26: Improper dumpster maintenance (Source: Center for Watershed Protection)

Protecting outdoor material storage areas is a simple and effective pollution prevention practice for many commercial, industrial, institutional, municipal and transport-related operations. The underlying concept is to prevent runoff contamination by avoiding contact between outdoor materials and rainfall (or runoff). Examples include salt storage areas for highways, manure storage on farms, or excavated soil from construction sites.

Dumpsters provide temporary storage of solid waste at many businesses and can be a significant pollution source if improperly maintained. Many dumpsters are open, which allows rainfall to mix with the wastes, generating a source of trash, oil and grease, metals, bacteria, organic material, excess nutrients and sediments. Good dumpster management is particularly important to reduce trash loadings to a stream.

Litter and trash enforcement is carried out through the enforcement of regulations for illegal dumping, litter laws or unsecure truck loads. Education can also be an element to positively change the behavior. Community outreach programs for beautifying neighborhoods, including health and safety information can be used effectively in the implementation of the programs.

Street Sweeping Program

Description

Street sweeping refers to sweeping of roads, gutters, and parking lots in order to remove street dust and dirt before it is washed into storm drains and streams. Street sweeping can be used as primary treatment or pre-treatment for pollutants that cannot be entirely removed from the environment through other source control methods.

Figure 4-27: Street sweeper (Source: Tymco, Inc.)

Figure 4-28: Catch basin (Source: Fairfax County)

Design Considerations

There is a wide range of variability and efficiency among street sweeping equipment. Mechanical sweepers are effective for larger particles and cleanup of winter deicing materials. Much of the pollutants picked up by stormwater runoff consist of smaller particles in the micrometer range. A regenerative air sweeper can be effective at removing this material. Frequency of sweeping activities is also a key factor in pollutant removal efficiency.

An alternative to street sweeping is catch basin cleaning, which consists of periodically opening storm drain inlets and removing the material that has accumulated at the bottom. However, resident outreach and education is needed to stop the practice of disposing of materials into storm drain inlets.

4.2.3 Structural Project Prioritization

Structural projects were prioritized in order to develop an implementation plan for their design and construction. This procedure is described in detail in Appendix B. The purpose was to identify the most effective project to restore and/or protect the watershed with a method that was quantifiable and based on a set of measurable indicators. The procedure was conducted using the indicator metrics from Section 2.3 to identify subwatersheds most in need of restoration or preservation. Five factors were considered, as follows:

1. <u>Impact Indicators:</u> Measure the extent that reversal or prevention of a particular watershed impact has been achieved ("What's there now, and how is it doing?").

2. <u>Source Indicators:</u> Quantify the presence of a potential stressor or pollutant source ("Is there a problem, and what's causing it?").

3. <u>Location within Priority Subwatersheds:</u> Projects were scored based on the priority ranking of the subwatershed in which they were located using the Composite Score for future conditions without projects.

4. Sequencing: Projects were scored based on their location in each WMA. Headwater subwatersheds were given highest priority.

5. Implementability: Implementability was defined by whether or not the projects were on County-owned or maintained property, and whether or not upstream quantity controls were required for them to be successfully implemented.

Final project prioritization was calculated based on a weighted average of the five factors:

• Effect on Impact Indicators	30%
• Effect on Source Indicators	30%
• Location within Priority Subwatersheds	10%
• Sequencing	20%
• Implementability	10%

After the scores were calculated, they were reviewed and adjustments were made using best professional judgment (BPJ) for some of the more qualitative factors, such as forecasts of changes in stream condition, flooding hazards and riparian buffer based on implementation of each project.

Once the initial prioritization was completed, a cost benefit analysis (CBA) was made for the highest priority 10-year projects in order to provide additional information on cost-effectiveness. This analysis was made by dividing the composite score (a measure of benefits) with the project cost, to allow a comparison among projects. This information was used to adjust final ranking of projects. The detailed prioritization methodology can be found in Appendix B and the final project list can be found in Table 4-3.

4.2.4 Non-Structural Project Prioritization

Non-structural projects were derived from two sources. First, during the upland reconnaissance of residential and commercial areas which assessed potential pollutant sources, a number of possible pollution prevention measures were identified. As part of the assessment, several programs were identified for specific areas which had the potential to reduce or control sources of pollution or stormwater runoff. The second approach included indentifying site specific areas for buffer restoration measures through the use and analysis of GIS mapping.

Over two hundred non-structural project sites were recommended for consideration through these assessments. Many of the pollution prevention measures could be carried out more efficiently if they were done on a watershed-wide or countywide basis. With this in mind, the proposed projects were grouped by project type. The resulting list of non-structural projects is shown in Table 4-1.

The non-structural projects were prioritized similarly to the structural projects and using best professional judgment with the goal of identifying high priority projects. Two factors were used in the prioritization:

Impact Indicators Projects were weighted based on the effectiveness at improvements in runoff impacts on streams, flood mitigation, habitat enhancement and water quality.

Implementability Projects were weighted by ease of implementation, based on cost and time commitment required by Fairfax County.

Scores were calculated based on a weighted average of these two factors:

- Effect on Impact Indicators 60%
- Implementability 40%

The highest priority watershed-wide project was Downspout Disconnection, followed by Dumpsite / Obstruction Removal and Storm Drain Marking. Inspection of outdoor material storage and lawn care outreach were also rated high priority. All of the remaining non-structural projects were in the low priority list. Table 4-1 summarizes the prioritization for the non-structural projects.

Table 4-1: Non-structural Project Prioritization

Project ID	Non-Structural Measure	Detailed Action	Priority
AC9909	Rain Barrel Programs	Downspout Disconnection	High
AC9913	Dumpsite / Obstruction Removal	Dumpsite / Obstruction Removal	High
AC9900	Outreach / Education	Storm Drain Marking	High
AC9903	Inspection / Enforcement	Outdoor Materials	High
AC9907	Outreach / Education	Lawn Care Outreach	High
AC9904	Rain Barrel Programs	Rain Barrels	Low
AC9906	Inspection / Enforcement	Litter/Trash Enforcement	Low
AC9936	Studies, Surveys, and Assessments	Floatables Control	Low
AC9935	Outreach / Education	Tree Planting	Low
AC9902	Inspection / Enforcement	Vehicle Maintenance	Low
AC9908	Inspection / Enforcement	Dumpster Maintenance	Low
AC9914	Outreach / Education	Turf Management	Low
AC9910	Street Sweeping	Street Sweeping	Low
AC9800	Buffer Restoration	Buffer Restoration	Low
AC9801	Buffer Restoration	Buffer Restoration	Low
AC9802	Buffer Restoration	Buffer Restoration	Low
AC9803	Buffer Restoration	Buffer Restoration	Low
AC9804	Buffer Restoration	Buffer Restoration	Low
AC9805	Buffer Restoration	Buffer Restoration	Low
AC9806	Buffer Restoration	Buffer Restoration	Low

4.3 Status of Regional Ponds

Fairfax County records show that there are six regional ponds proposed in the Accotink Creek watershed, three of which are in the Long Branch South WMA. Table 4-2 shows the status of these ponds according to the County records, followed by a short description of the results of the site investigation conducted as part of this watershed plan.

Table 4-2: Regional Ponds in Accotink Creek

Project Name	WMA	Status	Time frame	Facility ID Number	Drainage Area (ac)	WMP Status
Olley Lane Regional Pond	Long Branch Central	C	EX	1280DP	31.6	No action
Franconia Springfield Route H-1 (West Pond) (L-05)	Long Branch South	C	EX	DP0296	321.0	Alternative project AC9506 proposed

Project Name	WMA	Status	Time frame	Facility ID Number	Drainage Area (ac)	WMP Status
Franconia Springfield Route H-1 (South Pond) (L-10)	Long Branch South	C	EX	DP0569	11.5	Retrofit project AC9120 proposed
Kenwood Oaks, Sec. 1 Pond 1 (Rolling Valley)	Accotink Mainstem 6	C	EX	0091DP	44.4	Retrofit project AC9136 proposed
Hawthorne Property Regional SWM Pond (L-07)	Long Branch South	I	5+	1218DP	121.1	No action
Accotink Regional Pond B (WB-6B)	Accotink Mainstem 2	N/A	N/A	0374DP	88.0	No action

C=complete; I=Inactive, not funded;

EX=Existing; 5+=not planned for construction in the near future

Olley Lane Subdivision Regional Pond 1280DP was built near the proposed location for "Olley Lane". For the Accotink Creek plan, this site was investigated for a potential pond retrofit project. Field notes indicated that dry pond 1280DP had the potential for retrofit. Further investigation during the concept design phase showed that the existing facility is meeting current County water quality criteria. Opportunities to add untreated drainage area were investigated, but the impacts outweighed the potential benefits.

Pond L-05 Pond L-05 could not be built because Franconia Springfield Parkway was built through the proposed location; therefore Metros West pond (DP0296) was built rather than L-05. The drainage area was investigated during the retrofit assessment and found to be a mixture of commercial and residential land use. The commercial area is partially treated by two facilities, UG0400 and UG023, while the residential area is partially treated by 0748DP. Several candidate retrofit sites were investigated in the L-05 drainage area (subwatershed AC-LA-0070), as follows:

- Archstone apartments. No space was available for retrofits.
- Field assessment indicated it was feasible to create a small bioretention facility to treat the parking lot runoff at the commercial center on Frontier Drive. A concept design and project fact sheet was prepared for BMP/LID retrofit project AC9506.
- Retrofit opportunities were assessed at Forestdale Elementary School, including removal of invasive bamboo and reforesting with native trees and vegetation; disconnecting downspouts and implementing potential rain gardens. No structural projects were proposed.
- An outfall stabilization downstream of Franconia-Springfield Parkway was investigated based on size and drainage area; however, no project was proposed, as the site appears to be stabilized with rip rap.

Pond L-10 This regional pond could not be built because of the wetland impacts and reduction in storage capacity caused by the railroad embankment; therefore, the Metros South Pond was built rather than L-10. Dry pond DP0296 was constructed approximately 400 feet upstream of the proposed L-10 site. This existing pond was found to be a good candidate for retrofit opportunities. A concept design was developed and is shown in a project fact sheet as project number AC9120.

Rolling Valley Regional Pond This existing pond was found to be a good candidate for retrofit opportunities. A concept design was developed and is shown in a project fact sheet as project number AC9136.

Pond L-07 While the proposed regional pond is listed as inactive, an existing dry pond, 1218DP, was constructed in approximately the same location and assessed for retrofit potential. The pond appeared to be functioning as designed and no retrofits were proposed.

Pond WB-6B Also known as Accotink Regional Pond B, this site was investigated for retrofit feasibility. The pond appeared to be functioning as designed and no retrofits were proposed.

4.4 Summary of Proposed Projects

Map 4-2 shows all structural project locations throughout the watershed as they are distributed within the Braddock, Hunter Mill, Lee, Mason, Providence, Mount Vernon and Springfield supervisor districts. Non-structural projects, which are intended to be implemented watershed-wide, are listed in a table on the map.

Table 4-3 is the Master List of Projects, which shows all the projects proposed in the plan organized by implementation priority then by project number. The 10-year implementation projects have project fact sheets associated with them which are located at the end of Section 5. The lower-priority 25-year projects do not have fact sheets, but are described in the text for each WMA within Section 5.

Map 4-2: Proposed Projects in Supervisor Districts

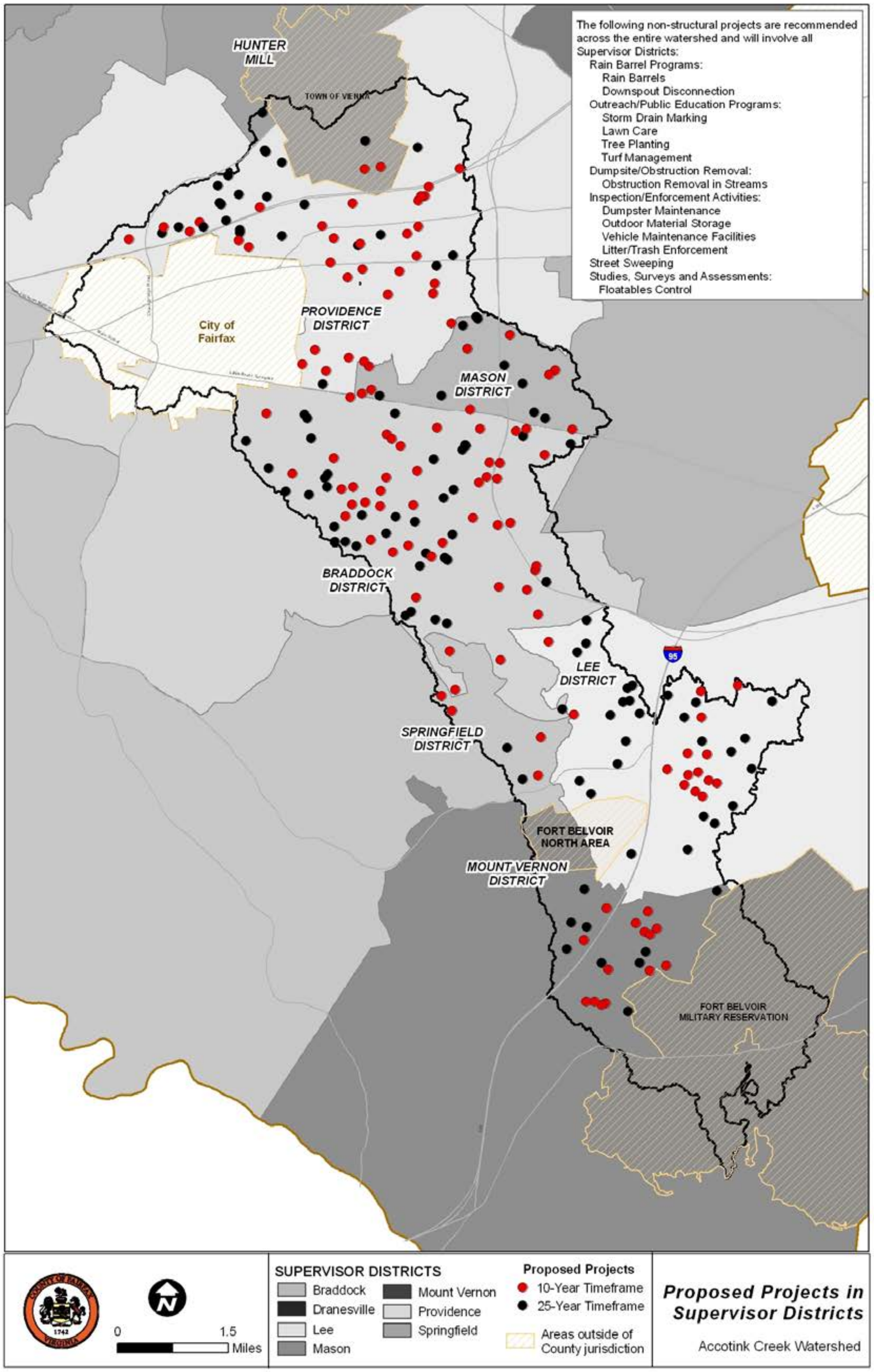


Table 4-3: Master Project List

Priority Structural Projects (Ten Year Implementation Plan)[1]						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
AC9101	Stormwater Pond Retrofit	Mainstem 8	Village of Mount Air neighborhood	Water Quality	Private - Residential	$90,000
AC9102	Stormwater Pond Retrofit	Long Branch South	Intersection of Telegraph Rd and Fairfax County Pkwy	Water Quality and Quantity	State - VDOT	$256,000
AC9105	Stormwater Pond Retrofit	Long Branch South	Pinewood Station neighborhood	Water Quality and Quantity	Private - Residential	$168,000
AC9106	Stormwater Pond Retrofit	Long Branch South	Backlick Rd and Cinder Bed Rd	Water Quality and Quantity	State - VDOT, Private - Commercial	$195,000
AC9110	Stormwater Pond Retrofit	Long Branch South	Amberleigh neighborhood	Water Quality and Quantity	Private - Residential	$227,000
AC9111	Stormwater Pond Retrofit	Long Branch South	Amberleigh neighborhood	Water Quality and Quantity	Private - Residential	$75,000
AC9112	Stormwater Pond Retrofit	Long Branch South	Springfield Industrial Park	Water Quality and Quantity	Private - Commercial	$305,000
AC9113	Stormwater Pond Retrofit	Long Branch South	Springfield Industrial Park	Water Quality	Private - Commercial	$161,000
AC9114	Stormwater Pond Retrofit	Long Branch South	Springfield Industrial Park	Water Quality and Quantity	State - VDOT	$732,000
AC9120	Stormwater Pond Retrofit	Long Branch South	Franconia/Springfield Metro	Water Quality and Quantity	Public - Metro	$1,753,000
AC9123	Stormwater Pond Retrofit	Mainstem 7	Gateway 95 Business Park	Water Quality	Private - Commercial	$62,000
AC9126	Stormwater Pond Retrofit	Mainstem 7	Alban Industrial Center	Water Quality and Quantity	Private - Commercial	$126,000
AC9133	Stormwater Pond Retrofit	Mainstem 6	Hunter Village neighborhood	Water Quality and Quantity	Private - Residential	$107,000
AC9136	Stormwater Pond Retrofit	Mainstem 6	Kenwood Oaks neighborhood	Water Quality and Quantity	Private - Residential	$111,000
AC9139	Stormwater Pond Retrofit	Mainstem 5	Westhaven neighborhood	Water Quality	Private - Residential	$63,000
AC9144	New Stormwater Pond	Long Branch Central	Lake Accotink Park	Water Quality and Quantity	County - FCPA	$879,000
AC9147	New Stormwater Pond	Long Branch Central	Kings Park Shopping Ctr	Water Quality and Quantity	Private - Commercial	$248,000
AC9148	New Stormwater Pond	Long Branch Central	Long Branch Stream Valley Park	Water Quality and Quantity	County - FCPA	$823,000
AC9161	Stormwater Pond Retrofit	Mainstem 3	Patriot Village neighborhood	Water Quality	Private - Residential	$86,000
AC9162	Stormwater Pond Retrofit	Mainstem 3	Patriot Village neighborhood	Water Quality and Quantity	Private - Residential	$79,000

Priority Structural Projects (Ten Year Implementation Plan)[1]						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
AC9172	New Stormwater Pond	Mainstem 2	End of Libeau Ln	Water Quality and Quantity	Private - Residential	$989,000
AC9175	Stormwater Pond Retrofit	Crook Branch	Hunters Glen and Ridgelea Hills neighborhoods and Bethlehem Lutheran Church	Water Quality	Private	$211,000
AC9178	Stormwater Pond Retrofit	Mainstem 2	Prosperity Heights neighborhood	Water Quality and Quantity	Private - Residential	$401,000
AC9181	Stormwater Pond Retrofit	Long Branch North	Prosperity Business Campus	Water Quality	Private - Commercial	$249,000
AC9182	Stormwater Pond Retrofit	Bear Branch	Mantua Park	Water Quality	County - FCPA	$54,000
AC9183	New Stormwater Pond	Bear Branch	Kena Shriners Temple	Water Quality and Quantity	Private	$274,000
AC9195	Stormwater Pond Retrofit	Mainstem 1	Oakton Village neighborhood	Water Quality and Quantity	Private - Residential	$67,000
AC9196	Stormwater Pond Retrofit	Mainstem 1	Four Winds at Oakton Condominium	Water Quality and Quantity	Private - Residential	$176,000
AC9199	Stormwater Pond Retrofit	Mainstem 1	Rosehaven Estates	Water Quality and Quantity	Private - Residential	$64,000
AC9200	Stream Restoration	Mainstem 6	Downstream from Greeley Blvd / Hunter Village Park	Water Quality	Private / County - FCPA	$643,000
AC9201	Stream Restoration	Mainstem 5	Accotink Stream Valley Park	Water Quality	County - FCPA	$707,000
AC9202	Stream Restoration	Mainstem 5	Charlestown neighborhood	Water Quality	Private - Residential	$822,000
AC9203	Stream Restoration	Mainstem 5	Lake Accotink Park	Water Quality	County - FCPA	$193,000
AC9204	Stream Restoration	Mainstem 5	Lake Accotink Park	Water Quality	County - FCPA	$1,317,000
AC9205	Stream Restoration	Mainstem 4	Lake Accotink Park	Water Quality	County - FCPA	$1,343,000
AC9206	Stream Restoration	Mainstem 4	Kings Park neighborhood	Water Quality	Private - Residential	$875,000
AC9207	Stream Restoration	Mainstem 4	Kings Park	Water Quality	County - FCPA	$527,000
AC9208	Stream Restoration	Long Branch Central	Long Branch Falls Park	Water Quality	County - FCPA	$600,000
AC9209	Stream Restoration	Long Branch Central	Long Branch Stream Valley Park	Water Quality	County - FCPA	$1,476,000
AC9210	Stream Restoration	Mainstem 3	Wakefield Park neighborhood	Water Quality	County - FCPA	$1,441,000
AC9211	Stream Restoration	Mainstem 3	Truro neighborhood	Water Quality	Private - Residential	$179,000
AC9212	Stream Restoration	Mainstem 3	Truro neighborhood	Water Quality	Private - Residential	$754,000

Priority Structural Projects (Ten Year Implementation Plan)[1]						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
AC9213	Stream Restoration	Mainstem 3	Truro neighborhood	Water Quality	Private - Residential	$1,011,000
AC9214	Stream Restoration	Mainstem 3	Wakefield Park	Water Quality	County - FCPA	$621,000
AC9215	Stream Restoration	Mainstem 3	Mill Creek neighborhood	Water Quality	Private / State - VDOT	$345,000
AC9216	Stream Restoration	Mainstem 3	Lafayette Forest neighborhood	Water Quality	Private - Residential	$811,000
AC9217	Stream Restoration	Mainstem 3	Lafayette Forest neighborhood	Water Quality	Private - Residential	$903,000
AC9218	Stream Restoration	Mainstem 3	Pleasant Ridge neighborhood	Water Quality	Private - Residential	$651,000
AC9219	Stream Restoration	Mainstem 2	Pine Ridge Park	Water Quality	County - FCPA	$1,664,000
AC9220	Stream Restoration	Crook Branch	Ridgelea Hills neighborhood	Water Quality	Private	$234,000
AC9221	Stream Restoration	Crook Branch	Mantua and Ridgelea Hills neighborhoods	Water Quality	Private	$1,801,000
AC9222	Stream Restoration	Crook Branch	Mantua Hills and Stockbridge neighborhoods	Water Quality	Private - Residential	$829,000
AC9223	Stream Restoration	Mainstem 2	Pine Ridge neighborhood	Water Quality	Private - Residential	$958,000
AC9224	Stream Restoration	Long Branch North	I-66 and Prosperity Ave	Water Quality	State - VDOT	$257,000
AC9225	Stream Restoration	Bear Branch	South Side Park	Water Quality	Private / Town of Vienna	$3,273,000
AC9226	Stream Restoration	Long Branch South	Windsor Estates	Water Quality	Private - Residential	$608,000
AC9227	Stream Restoration	Long Branch South	Windsor Estates	Water Quality	Private - Residential	$675,000
AC9229	Stream Restoration	Mainstem 4	Flag Run Park, Lake Accotink Park / I-495	Water Quality	County - FCPA / State - VDOT	$1,383,000
AC9230	Stream Restoration	Mainstem 3	Wakefield Park	Water Quality	County - FCPA	$748,000
AC9231	Stream Restoration	Mainstem 3	Wakefield Park	Water Quality	County - FCPA	$781,000
AC9232	Stream Restoration	Mainstem 3	Wakefield Park	Water Quality	County - FCPA	$697,000
AC9233	Stream Restoration	Mainstem 3	Wakefield Park	Water Quality	County - FCPA	$703,000
AC9234	Stream Restoration	Long Branch North	Sutton Place and Mantua Woods neighborhoods	Water Quality	Private - Residential	$1,026,000
AC9235	Stream Restoration	Long Branch North	Sutton Place and Copeland Pond neighborhoods	Water Quality	Private - Residential	$1,035,000
AC9236	Stream Restoration	Long Branch North	Merrifield View neighborhood	Water Quality	Private - Residential	$1,016,000

Priority Structural Projects (Ten Year Implementation Plan)[1]						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
AC9237	Stream Restoration	Long Branch North	Fairhill on the Boulevard neighborhood	Water Quality	Private - Residential	$624,000
AC9238	Stream Restoration	Long Branch North	Dunn Loring Woods neighborhood and Prosperity Business Campus	Water Quality	Private	$2,736,000
AC9239	Stream Restoration	Bear Branch	Covington / Villa Lee Park, Arrowhead Park	Water Quality	Private / County - FCPA	$3,225,000
AC9240	Stream Restoration	Bear Branch	South Side Park neighborhood	Water Quality	Town of Vienna	$2,241,000
AC9241	Stream Restoration	Hunters Branch	Stonehurst / Eakin Community Park	Water Quality	Private / County - FCPA	$2,176,000
AC9242	Stream Restoration	Hunters Branch	Lee Hwy and Hermosa Dr	Water Quality	Private	$389,000
AC9300	Area-Wide Drainage Improvements	Mainstem 7	Pohick Estates neighborhood	Water Quality	Private - Residential	$799,000
AC9301	Area-Wide Drainage Improvements	Long Branch South	Windsor Park	Water Quality	Private	$1,040,000
AC9302	Area-Wide Drainage Improvements	Mainstem 4	Ravensworth neighborhood	Water Quality	Private - Residential	$731,000
AC9303	Area-Wide Drainage Improvements	Mainstem 4	Kings Park neighborhood	Water Quality	Private	$1,475,000
AC9304	Area-Wide Drainage Improvements	Mainstem 3	Ravensworth Park and Bristow neighborhoods	Water Quality	Private	$1,681,000
AC9305	Area-Wide Drainage Improvements	Long Branch Central	Canterbury Woods neighborhood	Water Quality	Private - Residential	$1,647,000
AC9306	Area-Wide Drainage Improvements	Long Branch Central	Willow Woods neighborhood	Water Quality	Private - Residential	$757,000
AC9307	Area-Wide Drainage Improvements	Long Branch Central	Woodland Forest neighborhood	Water Quality	Private - Residential	$528,000
AC9308	Area-Wide Drainage Improvements	Long Branch Central	Canterbury Woods and Long Branch neighborhoods	Water Quality	Private - Residential	$358,000
AC9309	Area-Wide Drainage Improvements	Long Branch Central	Springbrook Forest, Willow Woods and Woods of Ilda neighborhoods	Water Quality	Private	$1,117,000
AC9310	Area-Wide Drainage Improvements	Long Branch Central	Springbrook Forest and Rutherford neighborhoods	Water Quality	Private	$1,885,000
AC9311	Area-Wide Drainage Improvements	Mainstem 3	Ramblewood neighborhood	Water Quality	Private	$422,000

Priority Structural Projects (Ten Year Implementation Plan)[1]						
Project #	Project Type	WMA	Location	Watershed Benefit	Land Owner	Cost
AC9312	Area-Wide Drainage Improvements	Crook Branch	Westchester and Briars of Westchester neighborhoods	Water Quality	Private - Residential	$1,191,000
AC9313	Area-Wide Drainage Improvements	Crook Branch	Langhorne Acres neighborhood	Water Quality	Private - Residential	$718,000
AC9314	Area-Wide Drainage Improvements	Long Branch North	Dunn Loring Village neighborhood	Water Quality	Private	$467,000
AC9315	Area-Wide Drainage Improvements	Bear Branch	Hideaway Park neighborhood	Water Quality	Private	$283,000
AC9316	Area-Wide Drainage Improvements	Mainstem 1	Hawthorne Village Apts, Five Oaks Place and Cedar Grove Park neighborhoods	Water Quality	Private	$1,039,000
AC9400	Culvert Retrofit	Mainstem 4	Queensberry Ave	Water Quality	State - VDOT	$74,000
AC9401	Culvert Retrofit	Mainstem 4	I-495	Water Quality	State - VDOT	$84,000
AC9405	Culvert Retrofit	Long Branch Central	Old Forge Park	Water Quality	State - VDOT	$29,000
AC9406	Culvert Retrofit	Long Branch Central	Long Branch Park	Water Quality	State - VDOT	$84,000
AC9409	Culvert Retrofit	Mainstem 1	Oakton High School	Water Quality	State - VDOT	$65,000
AC9501	BMP/LID	Long Branch South	Newington Industrial Park	Water Quality	Private - Industrial	$59,000
AC9502	BMP/LID	Long Branch South	Newington Rd	Water Quality	Private	$102,000
AC9503	BMP/LID	Long Branch South	Franconia/Springfield Metro	Water Quality	Public - Metro	$100,000
AC9505	BMP/LID	Long Branch South	Francis Scott Key Middle School	Water Quality	County - FCPS	$132,000
AC9506	BMP/LID	Long Branch South	Commercial Parking Lot	Water Quality	Private - Commercial	$114,000
AC9508	BMP/LID	Long Branch South	Robert E. Lee High School	Water Quality	County - FCPS	$176,000
AC9509	BMP/LID	Mainstem 7	Lockport Industrial Park	Water Quality	Private - Industrial	$213,000
AC9510	BMP/LID	Mainstem 7	Lockport Industrial Park	Water Quality	Private - Industrial	$723,000
AC9511	BMP/LID	Mainstem 7	Deer Park parking lot	Water Quality	Private - Industrial	$63,000
AC9512	BMP/LID	Mainstem 7	HRM Automotive	Water Quality	Private - Industrial	$106,000
AC9514	BMP/LID	Mainstem 6	Cardinal Forest Plaza	Water Quality	Private - Commercial	$142,000
AC9515	BMP/LID	Mainstem 6	Old Keene Mill Shopping Center	Water Quality	Private - Commercial	$204,000
AC9529	BMP/LID	Long Branch Central	Canterbury Woods Elementary School	Water Quality	County - FCPS	$44,000
AC9535	BMP/LID	Mainstem 3	Wakefield Chapel Estates	Water Quality	Private - Residential	$188,000

Priority Structural Projects (Ten Year Implementation Plan)[1]						
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**	**Cost**
AC9538	BMP/LID	Mainstem 3	Northern Virginia Community College parking lot	Water Quality	State	$388,000
AC9539	BMP/LID	Mainstem 3	Annandale Terrace Elementary School	Water Quality	County - FCPS	$118,000
AC9541	BMP/LID	Mainstem 3	Little River Shopping Center	Water Quality	Private - Commercial	$100,000
AC9545	BMP/LID	Mainstem 2	Eakin Park and Byzantine Church parking lot	Water Quality	County - FCPA / Private	$79,000
AC9546	BMP/LID	Crook Branch	Mantua Elementary School	Water Quality	County - FCPS	$109,000
AC9547	BMP/LID	Crook Branch	Providence Presbyterian Church and Pixie Ct	Water Quality	Private / State - VDOT	$95,000
AC9548	BMP/LID	Crook Branch	Ridgelea Hills neighborhood	Water Quality	Private	$398,000
AC9550	BMP/LID	Long Branch North	Industry Lane and Lee Hwy	Water Quality	Private - Industrial	$364,000
AC9551	BMP/LID	Long Branch North	Stenwood Elementary School	Water Quality	County - FCPS	$50,000
AC9553	BMP/LID	Hunters Branch	Pan Am Shopping Center	Water Quality	Private	$304,000
AC9558	BMP/LID	Mainstem 1	Mosby Woods Elementary School	Water Quality	County - FCPS	$100,000
AC9562	BMP/LID	Mainstem 1	AT&T office building	Water Quality	Private - Commercial	$328,000
AC9600	Flood Protection/Mitigation	Long Branch South	Culvert under railroad behind Industrial Park	Water Quantity	Federal	$450,000
TOTAL COST						**$75,072,000**

[1]Please note that only priority 10-yr structural projects will have associated project fact sheets at the end of section 5

Long Term Structural Projects (25 Year Implementation Plan)[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9100	Stormwater Pond Retrofit	Mainstem 8	Landsdowne neighborhood	Water Quality and Quantity	Private - Residential
AC9103	Stormwater Pond Retrofit	Long Branch South	Gateway 95 Business Park	Water Quality and Quantity	Private - Commercial
AC9104	Stormwater Pond Retrofit	Long Branch South	Shirley Industrial Complex	Water Quality	Private - Industrial
AC9107	Stormwater Pond Retrofit	Long Branch South	Landsdowne neighborhood	Water Quality and Quantity	Private - Residential

Long Term Structural Projects (25 Year Implementation Plan)[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9108	Stormwater Pond Retrofit	Long Branch South	Amberleigh Park	Water Quality and Quantity	County - FCPA
AC9109	Stormwater Pond Retrofit	Long Branch South	Island Creek Park	Water Quality and Quantity	County - FCPA
AC9115	Stormwater Pond Retrofit	Long Branch South	Next to Assembly of God Church	Water Quality and Quantity	State - VDOT
AC9116	Stormwater Pond Retrofit	Long Branch South	Devonshire Townhomes	Water Quality and Quantity	Private - Residential
AC9117	Stormwater Pond Retrofit	Long Branch South	Walker Lane Condo	Water Quality	Private - Residential
AC9118	Stormwater Pond Retrofit	Long Branch South	Fleet Industrial Park	Water Quality	Private - Industrial
AC9119	Stormwater Pond Retrofit	Long Branch South	Behind Gilders St	Water Quality and Quantity	Private - Residential
AC9121	Stormwater Pond Retrofit	Long Branch South	Sunrise Assisted Living	Water Quality and Quantity	Private - Residential
AC9122	New Stormwater Pond	Long Branch South	I-95 and Franconia Rd Interchange	Water Quality	Federal
AC9124	Stormwater Pond Retrofit	Mainstem 7	Newington Commerce Center	Water Quality	Private - Industrial
AC9125	Stormwater Pond Retrofit	Mainstem 7	Terra Grande neighborhood	Water Quality and Quantity	Private - Residential
AC9127	Stormwater Pond Retrofit	Mainstem 7	Alban Industrial Center	Water Quality and Quantity	Private - Commercial
AC9128	Stormwater Pond Retrofit	Mainstem 7	Terra Grande	Water Quality and Quantity	Private - Residential
AC9129	Stormwater Pond Retrofit	Mainstem 7	VA 95 Industrial Park	Water Quality	Private - Industrial
AC9130	New Stormwater Pond	Mainstem 7	Alban Road	Water Quality and Quantity	Private - Commercial
AC9131	Stormwater Pond Retrofit	Mainstem 6	Bonniemill Acres neighborhood	Water Quality	Private - Residential
AC9132	Stormwater Pond Retrofit	Mainstem 6	Shirley Springs neighborhood	Water Quality	Private - Residential
AC9134	Stormwater Pond Retrofit	Mainstem 6	Rolling Forest neighborhood	Water Quality and Quantity	Private - Residential
AC9135	Stormwater Pond Retrofit	Mainstem 6	Bethnal Pl and Caton Woods Ct	Water Quality and Quantity	Private - Residential
AC9137	Stormwater Pond Retrofit	Mainstem 5	Behind Villa Park Rd	Water Quality and Quantity	Private - Residential
AC9138	Stormwater Pond Retrofit	Mainstem 5	Toyota Dealership on Amherst Ave	Water Quality and Quantity	Private - Commercial

Long Term Structural Projects (25 Year Implementation Plan)[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9140	Stormwater Pond Retrofit	Mainstem 5	Brookfield Park	Water Quality and Quantity	County - FCPA
AC9141	Stormwater Pond Retrofit	Mainstem 5	Highland Business Park	Water Quality and Quantity	Private - Commercial
AC9142	New Stormwater Pond	Mainstem 4	Behind Morrissette Dr	Water Quality and Quantity	Private - Utility
AC9145	New Stormwater Pond	Long Branch Central	Canterbury Woods Swim Club	Water Quality	Private
AC9146	Stormwater Pond Retrofit	Long Branch Central	Woodland Forest neighborhood	Water Quality	Private - Residential
AC9149	Stormwater Pond Retrofit	Long Branch Central	Dunleigh neighborhood	Water Quality and Quantity	Private - Residential
AC9150	Stormwater Pond Retrofit	Long Branch Central	Burke Professional Center	Water Quality	Private - Commercial
AC9151	Stormwater Pond Retrofit	Long Branch Central	Long Branch Swim and Racquet Club	Water Quality	Private
AC9152	Stormwater Pond Retrofit	Long Branch Central	Chestnut Hills West neighborhood	Water Quality and Quantity	Private - Residential
AC9153	Stormwater Pond Retrofit	Long Branch Central	Behind Wrought Iron Ct	Water Quality and Quantity	Private - Residential
AC9154	Stormwater Pond Retrofit	Long Branch Central	Lee Meadows neighborhood	Water Quality and Quantity	Private - Residential
AC9155	New Stormwater Pond	Long Branch Central	Sweet Briar Forest neighborhood	Water Quality	Private - Residential
AC9156	Stormwater Pond Retrofit	Long Branch Central	Korean Presbyterian Church	Water Quality and Quantity	Private - Church
AC9157	Stormwater Pond Retrofit	Long Branch Central	George Mason Park	Water Quality and Quantity	County - FCPA
AC9158	Stormwater Pond Retrofit	Long Branch Central	Somerset South neighborhood	Water Quality and Quantity	Private - Residential
AC9159	New Stormwater Pond	Mainstem 3	Howery Field Park	Water Quality and Quantity	County - FCPA
AC9160	Stormwater Pond Retrofit	Mainstem 3	Chapel Lake	Water Quality and Quantity	Private - Residential
AC9165	Stormwater Pond Retrofit	Mainstem 3	Camelot Greens	Water Quality and Quantity	Private - Residential
AC9166	Stormwater Pond Retrofit	Mainstem 3	Lafayette Forest	Water Quality	Private - Residential
AC9167	Stormwater Pond Retrofit	Mainstem 3	Lafayette Park West	Water Quality and Quantity	Private - Residential
AC9168	Stormwater Pond Retrofit	Mainstem 3	Adams Walk	Water Quality	Private - Residential

Long Term Structural Projects (25 Year Implementation Plan)[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9169	Stormwater Pond Retrofit	Mainstem 3	Wachovia Building on Woodland Rd	Water Quality	Private - Commercial
AC9170	Stormwater Pond Retrofit	Mainstem 3	Lafayette Village	Water Quality	Private - Residential
AC9171	Stormwater Pond Retrofit	Mainstem 2	Holmes Run Village neighborhood	Water Quality and Quantity	Private - Residential
AC9173	Stormwater Pond Retrofit	Mainstem 2	Silk Vision and Surgery Center	Water Quality	Private - Commercial
AC9174	Stormwater Pond Retrofit	Crook Branch	Greater Washington Jewish Community Foundation	Water Quality and Quantity	Private - Church
AC9176	Stormwater Pond Retrofit	Crook Branch	Briars at Westchester neighborhood	Water Quality and Quantity	Private - Residential
AC9179	Stormwater Pond Retrofit	Long Branch North	Luther Jackson Middle School	Water Quality and Quantity	County - FCPS
AC9184	Stormwater Pond Retrofit	Bear Branch	Behind Barkley Gate Ln and Armistead Park neighborhood	Water Quality and Quantity	Private - Residential
AC9185	New Stormwater Pond	Bear Branch	Covington neighborhood	Water Quality and Quantity	Private - Residential
AC9186	New Stormwater Pond	Hunters Branch	Vienna Moose Lodge	Water Quality and Quantity	Private
AC9187	Stormwater Pond Retrofit	Mainstem 1	Behind Blake Park Ct	Water Quality	Private - Residential
AC9188	Stormwater Pond Retrofit	Mainstem 1	Country Creek neighborhood	Water Quality	Private - Residential
AC9189	New Stormwater Pond	Mainstem 1	East Blake Lane Park	Water Quality	County - FCPA
AC9190	Stormwater Pond Retrofit	Mainstem 1	Behind Oakton Pond Ct	Water Quality and Quantity	Private - Residential
AC9191	Stormwater Pond Retrofit	Mainstem 1	Behind Cyrandall Pl	Water Quality and Quantity	Private - Residential
AC9192	Stormwater Pond Retrofit	Mainstem 1	Edgemoore neighborhood	Water Quality and Quantity	Private - Residential
AC9193	Stormwater Pond Retrofit	Mainstem 1	Oakdale Woods Ct	Water Quality	Private - Residential
AC9194	Stormwater Pond Retrofit	Mainstem 1	Behind Miles Stone Ct	Water Quality	Private - Residential
AC9197	Stormwater Pond Retrofit	Mainstem 1	Borge St and Oakton Meadows	Water Quality	Private - Residential
AC9198	Stormwater Pond Retrofit	Mainstem 1	Silver Stone Ct and While Flint Ct	Water Quality and Quantity	Private - Residential
AC9402	Culvert Retrofit	Mainstem 4	Lake Accotink Park	Water Quality and Quantity	State - VDOT

Long Term Structural Projects (25 Year Implementation Plan)[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9403	Culvert Retrofit	Mainstem 4	Lake Accotink Park	Water Quality	State - VDOT
AC9404	Culvert Retrofit	Long Branch Central	Red Fox Dr	Water Quality and Quantity	State - VDOT
AC9407	Culvert Retrofit	Mainstem 3	Between Private Ln and Queen Elizabeth Blvd	Water Quality	State - VDOT
AC9408	Culvert Retrofit	Bear Branch	South Side Park	Water Quality	Town of Vienna
AC9500	BMP/LID	Mainstem 8	Pohick Industrial Park	Water Quality	Private
AC9504	BMP/LID	Long Branch South	Shopping area opposite Springfield Mall	Water Quality	Private - Commercial
AC9507	BMP/LID	Long Branch South	Springfield Mall	Water Quality	Private
AC9513	BMP/LID	Mainstem 6	West Springfield Elementary School	Water Quality	County - FCPS
AC9516	BMP/LID	Mainstem 5	Lee Valley Apts	Water Quality	Private
AC9517	BMP/LID	Mainstem 5	Garfield Elementary School	Water Quality	County - FCPS
AC9518	BMP/LID	Mainstem 5	Springfield United Methodist Church	Water Quality	Private - Church
AC9519	BMP/LID	Mainstem 5	Springfield Plaza	Water Quality	Private
AC9520	BMP/LID	Mainstem 5	Springfield Plaza	Water Quality	Private
AC9521	BMP/LID	Mainstem 5	Saint Bernadette Church and School	Water Quality	Private - Church
AC9522	BMP/LID	Mainstem 5	Grace Presbyterian Church	Water Quality	Private - Church
AC9523	BMP/LID	Mainstem 4	North Springfield Elementary School	Water Quality	County - FCPS
AC9524	BMP/LID	Mainstem 4	Church of Jesus Christ and behind Rexford Ct	Water Quality	Private
AC9525	BMP/LID	Mainstem 4	Tivoli Condominiums	Water Quality	Private
AC9526	BMP/LID	Mainstem 4	West Springfield Business Center	Water Quality	Private - Commercial
AC9527	BMP/LID	Mainstem 4	Kings Park Elementary School	Water Quality	County - FCPS
AC9528	BMP/LID	Long Branch Central	Holy Spirit Catholic Church and Canterbury Woods Swim Club	Water Quality	Private
AC9530	BMP/LID	Long Branch Central	Long Branch Swim and Racquet Club Parking Lot and St. Stephens United Methodist Church	Water Quality	Private

Long Term Structural Projects (25 Year Implementation Plan)[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9531	BMP/LID	Long Branch Central	Rutherford Area Swim Club	Water Quality	Private
AC9532	BMP/LID	Long Branch Central	Rutherford Park	Water Quality	County - FCPA
AC9533	BMP/LID	Long Branch Central	Rutherford Park	Water Quality	County - FCPA
AC9534	BMP/LID	Mainstem 3	Annandale District Govt Center	Water Quality	County
AC9536	BMP/LID	Mainstem 3	Wakefield Forest Elementary School	Water Quality	County - FCPS
AC9537	BMP/LID	Mainstem 3	Wakefield Chapel Park	Water Quality	County - FCPA
AC9543	BMP/LID	Mainstem 2	Camelot Elementary School / Pine Ridge Park	Water Quality	County - FCPS / County - FCPA
AC9544	BMP/LID	Mainstem 2	Silk Vision and Surgery Center	Water Quality	Private - Commercial
AC9549	BMP/LID	Mainstem 2	Arlington Blvd & Williams Dr	Water Quality	Private - Commercial
AC9552	BMP/LID	Long Branch North	Thoreau Middle School and Stenwood Elementary School	Water Quality	County - FCPS
AC9554	BMP/LID	Hunters Branch	Vienna Metro Station parking lot	Water Quality	Public - Metro
AC9555	BMP/LID	Hunters Branch	Nottoway Park	Water Quality	County - FCPA
AC9556	BMP/LID	Hunters Branch	Vienna Moose Lodge	Water Quality	Private
AC9557	BMP/LID	Hunters Branch	Madison High School	Water Quality	County - FCPS
AC9559	BMP/LID	Mainstem 1	End of Bickley Ct	Water Quality	Private
AC9560	BMP/LID	Mainstem 1	Behind Courthouse Wood Ct	Water Quality	Private
AC9561	BMP/LID	Mainstem 1	Vistas Condominiums	Water Quality	Private - Residential
AC9700	Outfall Improvement	Mainstem 3	Wakefield Park	Water Quality	County - FCPA
AC9701	Outfall Improvement	Mainstem 3	Wakefield Park	Water Quality	County - FCPA
AC9702	Outfall Improvement	Mainstem 4	Lake Accotink Park	Water Quality	County - FCPA

[1]Please note that only priority 10-yr structural projects will have associated project fact sheets at the end of section 5

Non-Structural Projects[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9800	Buffer Restoration	Long Branch South	Intersection of Telegraph Rd and Fairfax County Pkwy	Water Quality	Private
AC9801	Buffer Restoration	Long Branch South	Springfield Industrial Center	Water Quality	Private
AC9802	Buffer Restoration	Mainstem 2	Accotink Stream Valley Park	Water Quality	County - FCPA
AC9803	Buffer Restoration	Crook Branch	Upstream of Prosperity Ave / Lake Accotink Park	Water Quality	Private / County - FCPA
AC9804	Buffer Restoration	Crook Branch	Downstream of Prosperity Ave	Water Quality	Private
AC9805	Buffer Restoration	Mainstem 2	Eakin Community Park	Water Quality	County - FCPA
AC9806	Buffer Restoration	Long Branch North	Behind Amberley Ln	Water Quality	Private
AC9900	Community Outreach/Public Education - Storm Drain Marking	Multiple	Watershed-wide	Water Quality	Various
AC9902	Inspection/Enforcement Enhancement Project - Vehicle Maintenance	Multiple	Watershed-wide	Water Quality	Various
AC9903	Inspection/Enforcement Enhancement Project - Outdoor Materials Storage	Multiple	Watershed-wide	Water Quality	Various
AC9904	Rain Barrels	Multiple	Watershed-wide	Water Quality and Quantity	Various
AC9906	Inspection/Enforcement Enhancement Project	Multiple	Watershed-wide	Water Quality	Various
AC9907	Community Outreach/Public Education - Lawn Care Outreach	Multiple	Watershed-wide	Water Quality	Various
AC9908	Inspection/Enforcement Enhancement Project - Dumpster Maintenance	Multiple	Watershed-wide	Water Quality	Various
AC9909	Rain Barrels	Multiple	Watershed-wide	Water Quality and Quantity	Various
AC9910	Street Sweeping Program	Multiple	Watershed-wide	Water Quality	Various
AC9913	Dumpsite/Obstruction Removal	Multiple	Watershed-wide	Water Quality	Various
AC9914	Community Outreach/Public Education - Turf Management	Multiple	Watershed-wide	Water Quality	Various

Non-Structural Projects[1]					
Project #	**Project Type**	**WMA**	**Location**	**Watershed Benefit**	**Land Owner**
AC9935	Community Outreach/Public Education	Multiple	Watershed-wide	Water Quality and Quantity	Various
AC9936	Studies and Assessments – Floatables Control	Multiple	Watershed-wide	Water Quality	Various

[1]Please note that only priority 10-yr structural projects will have associated project fact sheets at the end of section 5

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5 WMA Restoration Strategies

In an area as built-out and diverse as Fairfax County, it is important to understand the specific issues in a watershed in order to determine the best strategy to restore and protect it. To facilitate data management and promote local awareness of the streams, the watershed was subdivided into 16 Watershed Management Areas (WMAs) each approximately four square miles in size. These include seven major tributaries: Bear Branch, Crook Branch, Daniels Run, Hunters Branch, Long Branch Central, Long Branch North and Long Branch South. Because of long, narrow shape of the watershed, the remaining areas that drain directly to Accotink Creek mainstem were subdivided into eight WMAs: Mainstem 1 through 8. Finally, the area of land draining to tidewater was designated as the Potomac WMA.

Approximately 11.7 square miles (23 percent) of the watershed are located in areas outside of the County jurisdiction and are not included in this plan. Because of this, the planning effort focused on only 14 of the 16 WMAs identified since the Potomac WMA is entirely within Fort Belvoir Military Reservation and the Daniels Run WMA is within the City of Fairfax.

The following section provides a discussion of the impairments affecting each WMA in the plan and the proposed solutions to those impairments. Impairments were identified through field assessment, modeling and the results of subwatershed ranking analysis. Additional information may be found in Appendix B, Technical Documents.

5.1 Bear Branch

Roughly half of the Bear Branch WMA is within the boundaries of the Town of Vienna, which still falls under the jurisdiction of Fairfax County. Two subwatersheds were identified among the highest priority areas in need for restoration in the entire Accotink Creek watershed.

5.1.1 Structural Projects

5.1.1.1 10-Year Projects

<u>AC9182 Stormwater Pond Retrofit</u>

A retrofit is proposed for the existing pond 0043DP in Mantua Park that treats the stormwater runoff from a high-density residential area in Chesterfield Meadows Section 1 neighborhood. Recommendations include a new control structure, extending the flow path and creating a new outfall, which would be reconnected to the wetland.

<u>AC9183 New Stormwater Pond</u>

This is a proposed new pond to treat runoff from the parking lot at Kena Shriners Temple. The facility would be located in the grassy area on the southwest portion of the site. The existing storm drain pipe will be cut so that it discharges into the pond for treatment and a riser structure will be designed to provide detention for water quality.

Bear Branch Stream Restoration Projects -- Three stream restoration projects and a series of culvert retrofits have been proposed to restore a substantial length of Bear Branch and its tributaries. Ideally, they would be implemented from upstream to downstream, in the following order: AC9225 and AC9240 first, with design of the confluence coordinated, followed by AC9239 downstream. If the 25-year culvert retrofit project, AC9408, is included, it should be designed simultaneously with AC9240.

AC9225 Stream Restoration

This project would retrofit the stream channel on the upstream side of I-66 at South Side Park in the Town of Vienna. The channel is over-widened with moderate to severe erosion along the stream banks. Restoration would include reducing the channel dimensions, raising the bed elevation and installing grade controls.

AC9239 Stream Restoration

This project would restore an eroded section of Bear Branch that originates north of Hunter Road and extends approximately 600 feet downstream of Route 50. Restoration would include stabilizing the stormwater outfall structures, regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, installing grade controls and removing the metal beams currently in the stream.

AC9240 Stream Restoration

This project is located at the downstream end of a road culvert under Yeonas Drive and extends through South Side Park approximately 2,500 feet downstream to a road culvert under Route 66. Restoration would include repairing broken stormwater outfall structures, regrading and stabilizing the eroded banks with armor-in-place and bioengineering techniques, installing grade controls and removing invasive plant species.

AC9315 Area-Wide Drainage Improvements

Some medium and low-density residential areas in the Hideaway Park subdivision between Elsmore Street and Glenvale Drive that lack stormwater management controls would be retrofitted to treat stormwater runoff by installing tree box filters at existing stormwater inlets and rain gardens at yard inlets.

5.1.1.2 25-Year Projects

AC9184 Stormwater Pond Retrofit

This project involves the retrofit of two existing ponds. The first (1204DP) is located along Barkley Gate Lane and Royal Doulton Lane. The second pond treats stormwater runoff from the Armistead Park neighborhood. Both projects would include some excavation of the existing ponds for additional storage. Tree removal along the embankment and riparian plantings downstream are also recommended with this project.

AC9185 New Stormwater Pond

This is a potential site for new pond behind Silent Valley Drive that would treat the stormwater runoff from high-density residential homes in the Covington neighborhood. A riser structure and embankment will be used to provide the water quality and water quantity treatment.

AC9408 Culvert Retrofit

This project is proposed at three different road crossings within the Town of Vienna's South Side Park: Kingsley Road, Yeonas Drive and Cottage Street. Recommendations include creating a micropool followed by a pool with wetland plantings upstream of each road crossing to provide water quality control.

5.1.2 Non Structural Projects

AC9900 Community Outreach/Public Education - Stenciling

This community-wide project involves marking the storm drain inlets within the Armistead Park neighborhood. The program can educate the public, reduce dumping and reduce the amount of litter and pollutants that enter the storm drain system.

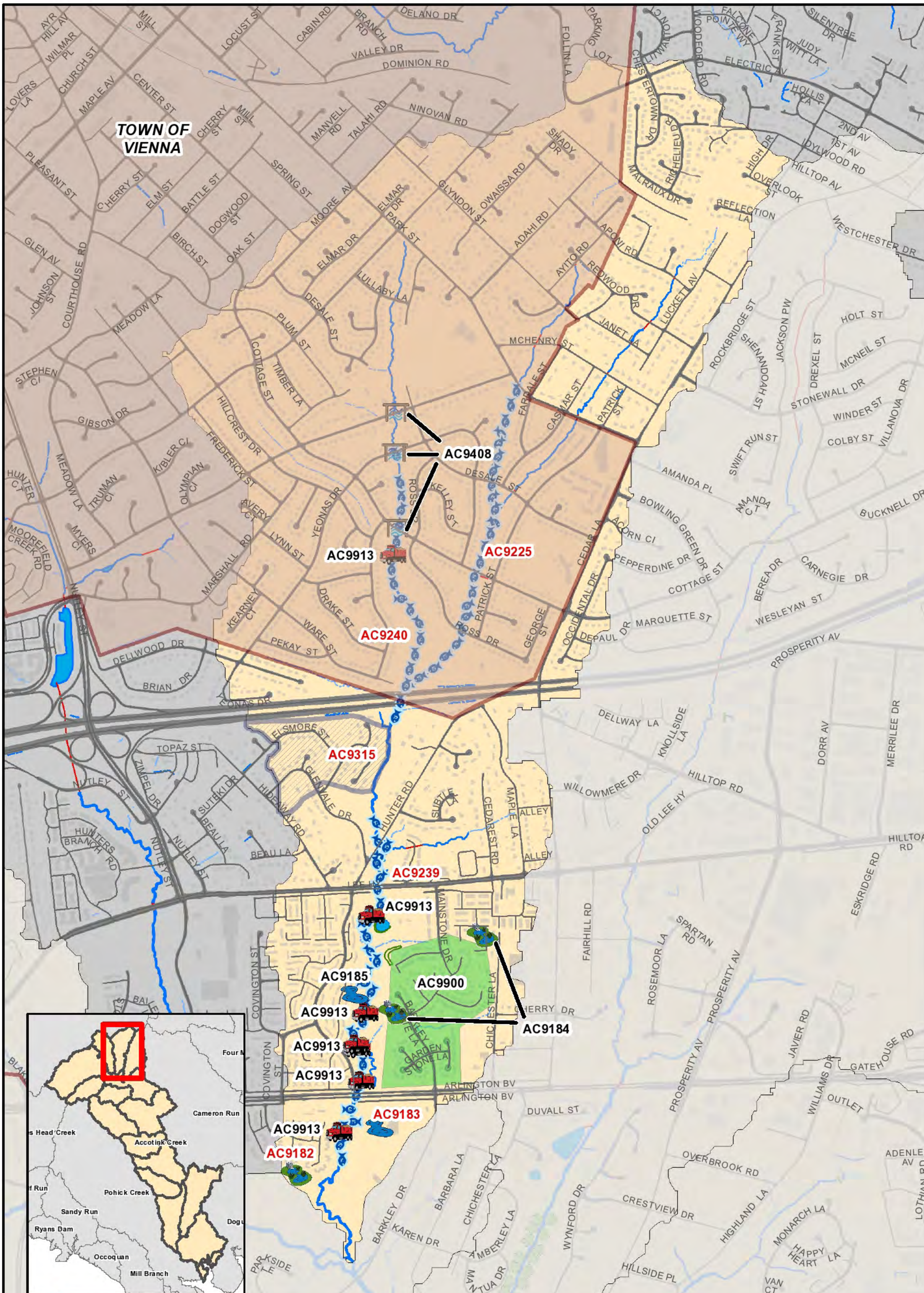
AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

Six sites were identified as areas of significant obstructions during the physical stream assessment. This project would be a community-wide program to remove trees and debris blocking fish passage, trees and yard waste within the stream.

Table 5-1: Bear Branch Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9182	Stormwater Pond Retrofit	AC-BB-0000	Mantua Park	Water Quality	County - FCPA	1 - 10
AC9183	New Stormwater Pond	AC-BB-0000	Kena Shriners Temple	Water Quality and Quantity	Private	1 - 10
AC9225	Stream Restoration	AC-BB-0030	South Side Park	Water Quality	Private / Town of Vienna	1 - 10
AC9239	Stream Restoration	AC-BB-0000, -0005, -0010	Covington / Villa Lee Park, Arrowhead Park	Water Quality	Private / County - FCPA	1 - 10
AC9240	Stream Restoration	AC-BB-0015, -0020	South Side Park Neighborhood	Water Quality	Town of Vienna	1 - 10
AC9315	Area-Wide Drainage Improvements	AC-BB-0010	Hideaway Park neighborhood	Water Quality	Private	1 - 10
AC9184	Stormwater Pond Retrofit	AC-BB-0005	Behind Barkley Gate Ln and Armistead Park neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9185	New Stormwater Pond	AC-BB-0005	Covington neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9408	Culvert Retrofit	AC-BB-0020	South Side Park	Water Quality	Town of Vienna	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9900	Community Outreach/Public Education	Multiple	Armistead Park	Water Quality	Multiple
AC9913	Dumpsite/Obstruction Removal	Multiple	Multiple	Water Quality	Multiple



Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Community Outreach/Public Education
Area-wide Drainage Improvement
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments

Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.

0 0.125 0.25
Miles

Map 5.1

WMA: Bear Branch Proposed Projects

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5.2 Crook Branch

The results of the subwatershed ranking analysis showed that all except one subwatershed in Crook Branch WMA appeared to be impaired in one form or another. One subwatershed located in the eastern portion of the WMA was in good condition primarily due to the influence of good forest and wetland coverage. In terms of overall ranking, the Crook Branch WMA had five of the highest priority subwatersheds in the entire Accotink Creek watershed.

5.2.1 Structural Projects

5.2.1.1 10-Year Projects

<u>AC9175 Stormwater Pond Retrofit</u>

Three local pond retrofits are proposed for this project. The first pond (0137DP) treats stormwater runoff from Hunters Glen neighborhood. The second pond (0045DP) treats stormwater runoff from the Ridgelea Hills neighborhood. The third pond (DP0133) treats the Bethlehem Lutheran Church. Proposed project recommendations include a new riser/control structure, excavating for additional storage and adding a plunge pool at each inflow point where stormwater enters the pond.

<u>AC9220 Stream Restoration</u>

There is severe erosion for approximately 100 feet in the stream channel behind Glade Hill Road. The project will include stabilizing the eroded stream through raising the bed elevation to meet the confluence elevation with Project AC9221, and installing grade controls or step pools to dissipate energy and prevent further bed incision.

<u>AC9221 Stream Restoration</u>

This project is a stream restoration of an incised and over-widened stream behind Colesbury Place in the Ridgelea Hills neighborhood. Restoration of this channel will focus on creating a nested channel, in which the floodplain and banks of the current channel will be regraded to allow for a new floodplain at an elevation lower than the original floodplain, and restoring the riparian buffer.

<u>AC9222 Stream Restoration</u>

There are areas of significant erosion along the length of the stream bank along Tovito Drive. This stream restoration project would involve regrading and stabilizing the eroded stream banks, grade controls to dissipate energy and installation of stone toe protection to ensure future bank stability.

<u>AC9312 Area-Wide Drainage Improvements</u>

Area-wide drainage improvements are recommended for the low and medium-density residential areas of the Westchester and Briars of Westchester neighborhoods to provide water quality control. Tree box filters will be installed at curb inlets, rain gardens will be installed at yard inlets and vegetated swales will be installed in place of paved ditches.

<u>AC9313 Area-Wide Drainage Improvements</u>

The Langhorne Acres neighborhood has no stormwater management facilities and would benefit by implementing area wide drainage improvements. Proposed treatment systems include tree box filters installed at various street inlets and rain gardens installed at yard inlets.

AC9546 New BMP/LID

There are four existing bioretention filters on the Mantua Elementary School property which are not functioning as optimally as they could due to a lack of vegetative cover. These sites are candidates for additional amendments to bring them to demonstration quality in this public location. As part of the overall project, one additional location for a bioretention filter was identified at an outfall on the southeast portion of the property.

AC9547 New BMP/LID

Two bioretention projects would treat the rooftop runoff from the Providence Presbyterian Church and the roadway runoff from Pixie Court. The downspouts at the rear of the church could be disconnected and routed to one of the bioretention facilities, while curb extensions on Pixie Court could route the roadway runoff into the other bioretention facility for treatment before it enters Crook Branch.

AC9548 New BMP/LID

Because of the large drainage area, this proposed project will use a flow splitter to direct the first flush of stormwater to a proposed bioretention filter, which is sited in open space adjacent to the intersection of Little River Turnpike and Ridgelea Drive in the Ridgelea Hills neighborhood. This will provide water quality treatment for a combination of residential, commercial and roadway runoff.

5.2.1.2 25-Year Projects

AC9174 Stormwater Pond Retrofit

This project is a retrofit of the existing dry pond (DP0378) at the Greater Washington Jewish Community Foundation. The retrofit would modify the riser structure, remove the concrete low-flow channels and replace them with meandering natural channels.

AC9176 Stormwater Pond Retrofit

This project is a proposed dry pond retrofit (0200DP) to treat stormwater runoff from the Briars at Westchester neighborhood. Recommendations include excavating to increase storage volume, removing the concrete channel and modifying the riser.

5.2.2 Non Structural Projects

AC9803 Buffer Restoration

This project, located downstream of Prosperity Avenue, involves the restoration of the impaired stream buffer.

AC9804 Buffer Restoration

This project, located upstream of Prosperity Avenue, involves the restoration of the impaired stream buffer.

AC9900 Community Outreach/Public Education - Stenciling

This community-wide project involves marking the storm drains within the Mantua Hills, Brian Acres, Skybrook, Sunnyhill Hill and Westchester communities. The stencil marking can educate the public, reduce dumping and reduce the amount of litter and pollutants that enter the storm drain system.

AC9907 Community Outreach/Public Education - Lawn Care

This project would provide community-wide education and guidance to homeowners on lawn care practices that would potentially reduce pollutants in stormwater runoff. The upland reconnaissance identified one neighborhood, Ridgelea Hills, which could be targeted with this effort.

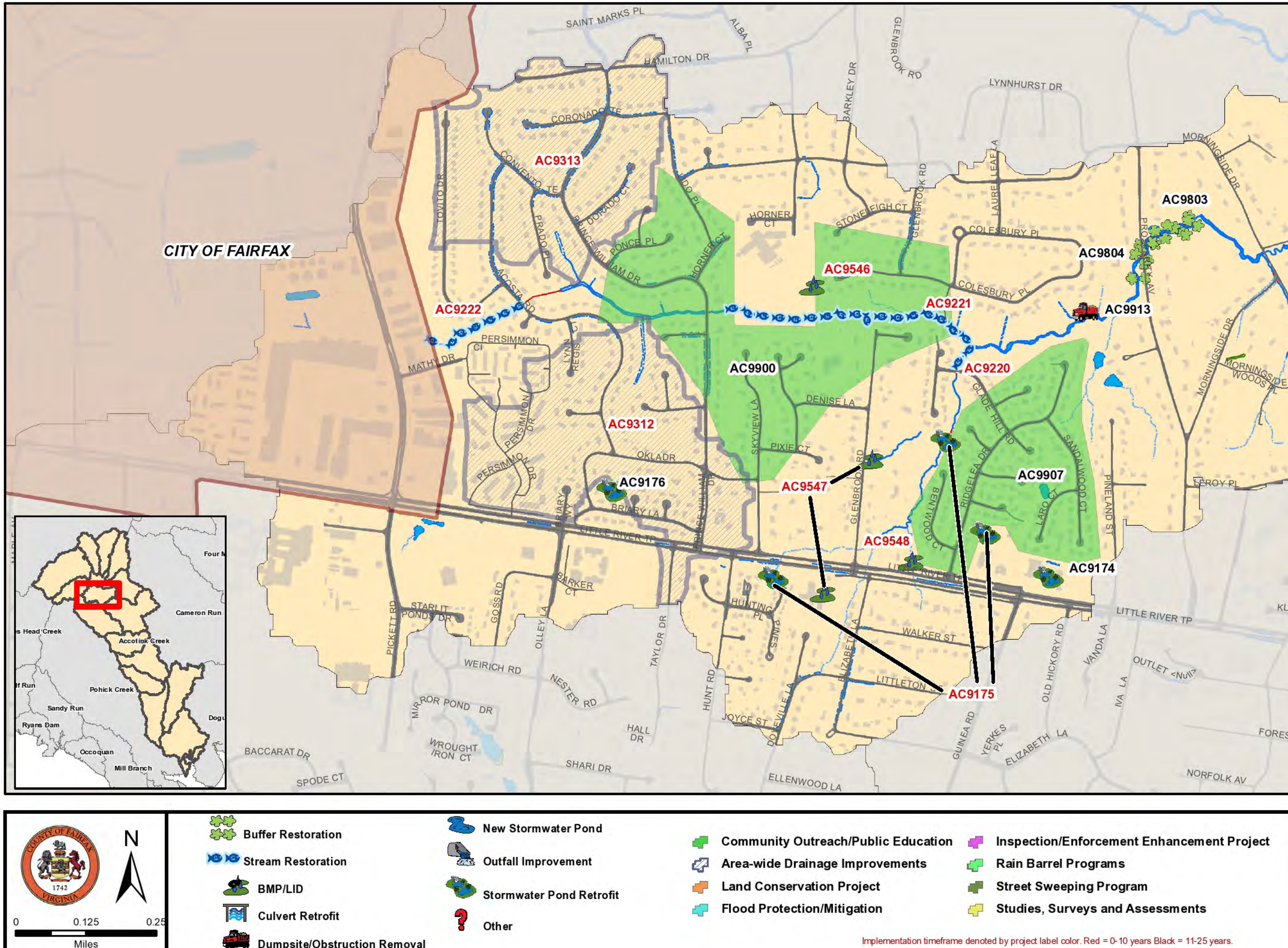
AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

Two sites were identified as areas of significant obstructions or dumpsites during the physical stream assessment. This project would be a community-wide program to remove debris blocking fish passage and trees within the stream.

Table 5-2: Crook Branch Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9175	Stormwater Pond Retrofit	AC-CR-0010	Hunters Glen and Ridgelea Hills neighborhoods and Bethlehem Lutheran Church	Water Quality	Private	1 - 10
AC9220	Stream Restoration	AC-CR-0010	Ridgelea Hills neighborhood	Water Quality	Private	1 - 10
AC9221	Stream Restoration	AC-CR-0015	Mantua and Ridgelea Hills neighborhoods	Water Quality	Private	1 - 10
AC9222	Stream Restoration	AC-CR-0025	Mantua Hills and Stockbridge neighborhoods	Water Quality	Private - Residential	1 - 10
AC9312	Area-Wide Drainage Improvements	AC-CR-0020	Westchester and Briars of Westchester neighborhoods	Water Quality	Private - Residential	1 - 10
AC9313	Area-Wide Drainage Improvements	AC-CR-0030	Langhorne Acres neighborhood	Water Quality	Private - Residential	1 - 10
AC9546	BMP/LID	AC-CR-0015	Mantua Elementary School	Water Quality	County - FCPS	1 - 10
AC9547	BMP/LID	AC-CR-0010	Providence Presbyterian Church and Pixie Ct	Water Quality	Private / State - VDOT	1 - 10
AC9548	BMP/LID	AC-CR-0010	Ridgelea Hills neighborhood	Water Quality	Private	1 - 10
AC9174	Stormwater Pond Retrofit	AC-CR-0005	Greater Washington Jewish Community Foundation	Water Quality and Quantity	Private - Church	11 - 25
AC9176	Stormwater Pond Retrofit	AC-CR-0020	Briars at Westchester neighborhood	Water Quality and Quantity	Private - Residential	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9803	Buffer Restoration	AC-CR-0000	Upstream of Prosperity Ave	Water Quality	Private, County
AC9804	Buffer Restoration	AC-CR-0005	Downstream of Prosperity Ave	Water Quality	Private
AC9900	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple
AC9907	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple
AC9913	Dumpsite/Obstruction Removal	Multiple	Multiple	Water Quality	Multiple



Map 5.2

WMA: Crook Branch Proposed Projects

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5.3 Hunters Branch

The results of subwatershed ranking analysis showed that most of the subwatersheds in the Hunters Branch WMA were in good condition primarily due to influence of forested or undeveloped parcels in Eakin, Towers and Nottoway Parks. Part of this WMA lies within the boundary of the Town of Vienna, which is still within the jurisdiction of Fairfax County. Only one subwatershed was among the highest priority in the watershed.

5.3.1 Structural Projects

5.3.1.1 10-Year Projects

<u>AC9241 Stream Restoration</u>

This project will restore a section of Hunters Branch approximately 3,700 feet upstream of the confluence of Hunters Branch and Accotink Creek mainstem. Restoration would include removing the riprap, creating stable stream crossings, repairing scour pools, regrading and stabilizing eroded stream banks, installing grade controls and removing invasive plant species.

<u>AC9242 Stream Restoration</u>

This project will restore an eroded section of Hunters Branch immediately upstream and downstream of a pedestrian bridge between Hermosa Drive and Lee Highway. Restoration will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques and repairing the pedestrian bridge.

<u>AC9553 BMP/LID Retrofit</u>

This project is a parking lot retrofit at the Pan Am Shopping Center off of Nutley Street. Tree box filters and bioretention basins will be installed adjacent to storm drain inlets at existing parking medians and along the vegetated area on the west side of the lot.

5.3.1.2 25-Year Projects

<u>AC9186 New Stormwater Pond</u>

This project is a new pond behind Vienna Moose Lodge on Court House Road. This pond will provide water quantity control and improve the water quality in the downstream channel.

<u>AC9554 New BMP/LID</u>

This proposed project is a parking lot retrofit at the Vienna Metro Station near Stansbury Way. Bioretention or dry swales along the green space between parking rows is proposed to treat the runoff from the parking lot.

<u>AC9555 New BMP/LID</u>

Two bioretention facilities are proposed at Nottoway Park; one in the parking lots and one near the tennis courts. This will improve the water quality of stormwater runoff as well as provide an educational opportunity.

AC9556 New BMP/LID

A parking lot retrofit is recommended at the Vienna Moose Lodge by adding tree box filters at storm drain inlets to provide water quality control.

AC9557 New BMP/LID

This is a proposed project at Madison High School. Tree box filters are proposed at storm drain inlets draining the parking lot to provide water quality treatment.

Table 5-3: Hunters Branch Projects

Structural Projects						
Project #	Project Type	Subshed	Location	Watershed Benefit	Land Owner	Phase
AC9241	Stream Restoration	AC-HB-0000, -0005	Stonehurst / Eakin Community Park	Water Quality	Private / County - FCPA	1 - 10
AC9242	Stream Restoration	AC-HB-0010	Lee Hwy and Hermosa Dr	Water Quality	Private	1 - 10
AC9553	BMP/LID	AC-HB-0005	Pan Am Shopping Center	Water Quality	Private	1 - 10
AC9186	New Stormwater Pond	AC-HB-0025	Vienna Moose Lodge	Water Quality and Quantity	Private	11 - 25
AC9554	BMP/LID	AC-HB-0010	Vienna Metro Station parking lot	Water Quality	Public - Metro	11 - 25
AC9555	BMP/LID	AC-HB-0025	Nottoway Park	Water Quality	County - FCPA	11 - 25
AC9556	BMP/LID	AC-HB-0025	Vienna Moose Lodge	Water Quality	Private	11 - 25
AC9557	BMP/LID	AC-HB-0035	Madison High School	Water Quality	County - FCPS	11 - 25

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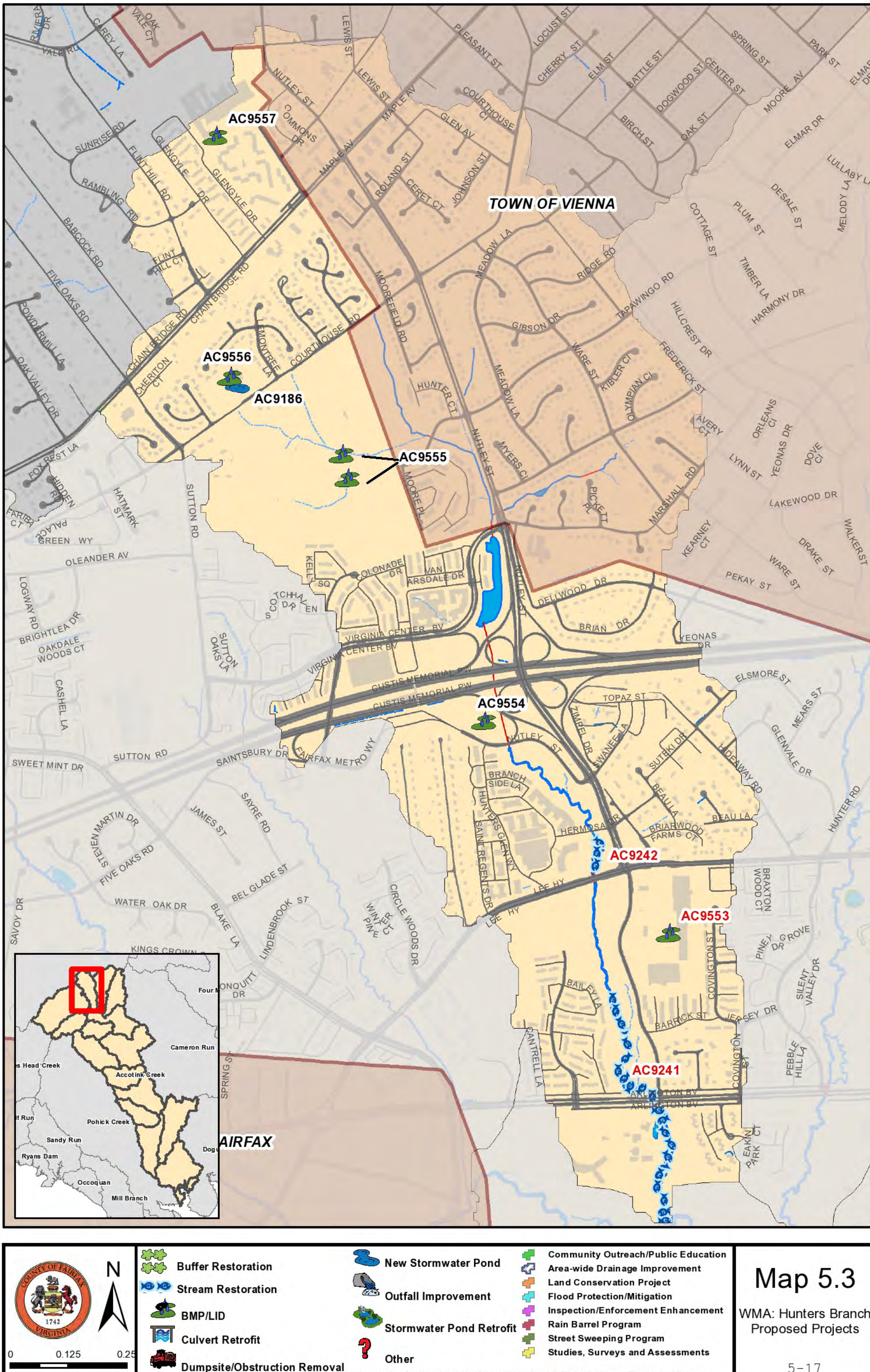

Map 5.3

WMA: Hunters Branch Proposed Projects

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5.4 Long Branch Central

Conditions in the Long Branch Central WMA were highly variable. A significant number of subwatersheds in the WMA were in good condition primarily due to the influence of undeveloped areas of Lake Accotink, Rutherford, Olde Forge and Long Branch Parks that have good forest and wetland coverage. However, in terms of overall ranking, Long Branch Central had seven of the highest priority subwatersheds in the watershed, generally influenced by the amount of residential land use runoff that is not controlled by stormwater management facilities.

5.4.1 Structural Projects

5.4.1.1 10-Year Projects

<u>AC9144 New Stormwater Pond</u>

This proposed facility between Danbury Forest Drive and Thames Street would be a new extended detention dry pond which would provide water quality and water quantity treatment at the outfall of the existing storm drainage system. The new riser structure would discharge to the existing culvert under Danbury Forest Drive.

<u>AC9147 New Stormwater Pond</u>

A new stormwater pond is proposed in the Kings Park Shopping Center to provide storage and capture runoff. The existing storm drains would be used for inflow and the new riser would connect to the existing storm drain under Braddock Road.

<u>AC9148 New Stormwater Pond</u>

An extended detention pond is proposed in the Long Branch Stream Valley Park adjacent to the stormwater outfall to provide water quality and water volume storage for the runoff from the Springbrook Forest neighborhood. The new pond would involve excavation, construction of an embankment, installation of a riser structure, and internal pond features including a plungepool, a micropool and a meandering low-flow channel.

<u>AC9208 Stream Restoration</u>

This stream restoration project is located behind King David Boulevard. Field crews noted isolated pockets of moderate to severe bank erosion on outside meanders, some of which are encroaching on private property. Restoration efforts would include reducing the channel dimensions, installing grade controls and stabilization techniques.

<u>AC9209 Stream Restoration</u>

This project in Long Branch Stream Valley Park involves the restoration of moderate to severe bank erosion within the stream channel and at a storm drain outfall. As part of this restoration, the storm drain outfall will be corrected, the stream banks will be stabilized with armor-in-place techniques and the stream bed elevation will be raised to encourage fish passage.

<u>AC9305 Area-Wide drainage improvements</u>

Area-wide drainage improvements are recommended for the Canterbury Woods neighborhood, a medium-density residential area, by implementing a hybrid project that includes installing tree box filters and rain gardens.

AC9306 Area-Wide Drainage Improvements

There are no existing stormwater management facilities in the subwatershed. An area-wide drainage improvement is recommended to treat the runoff from the medium-density residential area in the Willow Woods neighborhood. Rain gardens and tree box filters would be installed at storm drain inlets.

AC9307 Area-Wide Drainage Improvements

This project recommends treating the runoff for the Woodland Forest neighborhood, downstream of dry pond 1022DP, by implementing tree box filters and rain gardens to improve water quality.

AC9308 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the medium-density residential area in the Canterbury Woods and Long Branch neighborhoods by implementing a hybrid project that includes installing tree box filters and rain gardens.

AC9309 Area-Wide Drainage Improvements

There are no existing stormwater management facilities in the Springbrook Forest, Willow Woods and Woods of Ilda neighborhoods so area-wide drainage improvements are recommended to treat the runoff through installing tree box filters and rain gardens at stormwater inlets.

AC9310 Area-Wide Drainage Improvements

The medium density residential neighborhoods of Springbrook Forest and Rutherford were developed with no existing stormwater management facilities. The project is distributed throughout most of the subwatershed and involves treating runoff before it reaches the storm drain system by installing tree box filters at curb inlets and rain gardens adjacent to yard inlets.

AC9405 Culvert Retrofit

A retrofit is proposed for a road culvert under Twinbrook Road in Old Forge Park to add a weir wall control structure and stabilized micropool to regulate discharge of the smaller, high frequency storm events.

AC9406 Culvert Retrofit

This project is located in Long Branch Park on the upstream side of Laurel Street between Lenox Drive and Whitacre Road. This culvert retrofit would add a weir wall control structure on the upstream side of the culvert and creating a micropool followed by a pool with wetland plantings.

AC9529 New BMP/LID

A parking lot retrofit is recommended at the Canterbury Woods Elementary School by adding tree box filters at storm drain inlets to provide water quality control.

5.4.1.2 25-Year Projects

AC9145 New Stormwater Pond

A new pond is proposed to treat the runoff from the Canterbury Woods Swim Club on Blackpool Drive. This project would create a shallow wetland area to improve the water quality of the runoff.

AC9146 Stormwater Pond Retrofit

This site is an existing deep, dry pond (0943DP) with a small footprint behind Althea Drive in the Woodland Forest neighborhood. The proposed project is to retrofit the pond by adding a micropool, expanding the footprint and modifying the outlet to obtain channel erosion control through volume storage.

AC9149 Stormwater Pond Retrofit

This project proposes to retrofit an existing wet pond (WP0238) between Braddock Road and Dunleigh Drive that treats runoff from the Dunleigh neighborhood. Recommendations include retrofitting the existing pond by modifying the outlet structure, clearing out the inlet, adding an aquatic shelf and clearing trees from the embankment.

AC9150 Stormwater Pond Retrofit

This is a proposed retrofit of an existing dry pond (DP0362) behind Fern Park Drive in Burke Professional Center to treat the runoff from Dunleigh neighborhood. The retrofit would provide water quality improvements to the receiving waters.

AC9151 Stormwater Pond Retrofit

This project proposed the retrofit of two dry ponds (0207DP and 0055DP) located near the Long Branch Swim and Racquet Club to reduce downstream channel erosion. Recommendations include installing a forebay and micropool, adding new control structures and replacing the concrete channel with a wet swale. The downstream channels should also be stabilized through this project.

AC9152 Stormwater Pond Retrofit

This project proposes to retrofit an existing dry pond (0054DP) behind Tartan View Drive in the Chestnut Hills West neighborhood for water quality by creating forebays or micropools, lengthening the flow path and modifying the outlet structure.

AC9153 Stormwater Pond Retrofit

This project proposes to convert the existing downstream wet pond (WP0179) behind Wrought Iron Court that treats runoff from the Lee Meadows neighborhood to a large wetland facility. Proposed recommendations include excavating the pond to increase storage, adding pools and modifying the outlet.

AC9154 Stormwater Pond Retrofit

This is a retrofit of the existing wet pond (WP0178) that treats runoff from the Lee Meadows neighborhood. Field assessment indicated erosion in the low flow channel, sediment buildup in pond bottom and a clogged outlet. Proposed recommendations include modifying the outlet structure and adding forebays at the inlet.

AC9155 New Stormwater Pond

A large area of the Sweet Briar Forest residential neighborhood is draining to a concrete channel behind Olley Lane. The project proposes to convert this channel to a linear wetland to provide water quality benefits.

AC9156 Stormwater Pond Retrofit

This project is proposed to retrofit existing dry pond DP0123 which treats the runoff from the Korean Presbyterian Church by adding a forebay for additional water quality volume storage, modifying the outlet and lengthening the flow path.

AC9157 Stormwater Pond Retrofit

An existing dry pond (0197DP) behind Ceralene Court in George Mason Park that treats the runoff from a residential area is proposed to be converted to a wet pond by removing concrete channels, installing a sediment forebay and modifying the outlet to provide extended detention.

AC9158 Stormwater Pond Retrofit

The existing dry pond (0057DP) treating runoff from a section of the Somerset South neighborhood seems to be functioning as a shallow wetland at the lower end of pond. The proposed project recommendations include installing a plunge pool and micropool, installing a new riser and creating a meandering low flow channel.

AC9404 Culvert Retrofit

A road culvert retrofit is proposed under Red Fox Drive to provide storage upstream of the embankment and control the discharge of the small, high frequency events to provide water quality treatment and help reduce downstream channel erosion.

AC9528 New BMP/LID

This project consists of two separate sites to treat parking lot runoff through bioretention or rain gardens. The first site is Holy Spirit Catholic Church, which also presents the opportunity to disconnect rooftop drains. Bioretention is also proposed to treat the upper parking lot runoff at the second site, Canterbury Woods Swim Club, on Blackpool Drive.

AC9530 New BMP/LID

This project consists of two separate sites to treat stormwater runoff through bioretention or rain gardens. The first site is the downslope edge of the parking lot at Longbranch Swim and Racquet Club on Bradfield Drive. A bioretention filter is also proposed to capture rooftop and driveway runoff at Saint Stephen's United Methodist Church.

AC9531 New BMP/LID

This project recommends installation of a bioretention filter to capture and treat parking lot runoff from the Rutherford Area Swim Club parking lot.

AC9532 New BMP/LID

This is a proposed bioretention filter at the outlet behind Bayard Road in Rutherford Park to capture runoff from the Rutherford neighborhood.

AC9533 New BMP/LID

This is a potential site for water quality swales and detention storage behind Marley Road at Rutherford Park.

5.4.2 Non Structural Projects

AC9900 Community Outreach/Public Education – Stenciling

This community-wide project involves marking the storm drains within the Red Fox Forest, Stone Haven, Woodland Forest, Canterbury Woods, Olley Lane, Somerset and Oak Hill community. The stencil marking can educate the public, reduce dumping and reduce the amount of litter and pollutants that enter the storm drain system.

AC9904 Rain Barrel Programs – Rain Barrels

Rain barrels provide the first step for residents to disconnect their downspout from draining to an impervious surface. This project would be a community-wide outreach program to encourage their use. Several neighborhoods, Somerset South, Olley Lane, and Stone Haven, Red Fox Forest and Canterbury Woods, were identified during the upland reconnaissance with roof drainage that would be suitable for this approach.

AC9907 Community Outreach/Public Education – Lawn Care

This project would provide community-wide education and guidance to homeowners on lawn care practices that would potentially reduce pollutants in stormwater runoff. The upland reconnaissance identified several neighborhoods, Canterbury Woods, Long Branch, Ashford, Bradfield, Olde Forge, Surrey Square, Braddock Green and Somerset South, that could be targeted with this effort.

AC9908 Inspection/Enforcement Enhancement Project – Dumpster Maintenance

One source of litter and pollutants in stormwater runoff is poorly maintained dumpsters and other waste management practices. This project is a community-wide enforcement and outreach approach to properties where problems were identified during the upland reconnaissance. Dumpsters in this WMA were flagged as hotspots with evidence of having no cover.

AC9909 Rain Barrel Programs – Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows by turning downspouts away from driveways and impervious surfaces and letting the water flow onto lawns. In this WMA, they included the area around Chestnut Knolls, Somerset, Old Creek Estates, Rutherford, Sussex, Springbrook Forest, and Willow Woods.

AC9910 Street Sweeping Program

The Somerset, Old Creek Estates, Rutherford, Sussex and Springbrook Forest neighborhoods were found to have trash, litter or organic debris in the curb and gutter which could negatively impact the local waterways through introduction into the stream system via the storm drain inlets. This project consists of developing or extending a street sweeping program to remove potential pollutants from the street before they can wash into a storm drain or a stream.

AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

One site was identified with a significant obstruction or dumpsite during the stream assessment. This project would be a community-wide program to remove the debris blocking fish passage.

AC9935 Community Outreach/Public Education – Tree Planting

One community, Holly Park, was assessed during the upland reconnaissance and identified for a watershed-wide outreach program to encourage tree planting and urban reforestation.

Table 5-4: Long Branch Central Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9144	New Stormwater Pond	AC-LB-0000	Lake Accotink Park	Water Quality and Quantity	County - FCPA	1 - 10
AC9147	New Stormwater Pond	AC-LB-0015	Kings Park Shopping Ctr	Water Quality and Quantity	Private - Commercial	1 - 10
AC9148	New Stormwater Pond	AC-LB-0015	Long Branch Stream Valley Park	Water Quality and Quantity	County - FCPA	1 - 10
AC9208	Stream Restoration	AC-LB-0025	Longbranch Falls Park	Water Quality	County - FCPA	1 - 10
AC9209	Stream Restoration	AC-LB-0030	Long Branch Stream Valley Park	Water Quality	County - FCPA	1 - 10
AC9305	Area-Wide Drainage Improvements	AC-LB-0005	Canterbury Woods neighborhood	Water Quality	Private - Residential	1 - 10
AC9306	Area-Wide Drainage Improvements	AC-LB-0010	Willow Woods neighborhood	Water Quality	Private - Residential	1 - 10
AC9307	Area-Wide Drainage Improvements	AC-LB-0015	Woodland Forest neighborhood	Water Quality	Private - Residential	1 - 10
AC9308	Area-Wide Drainage Improvements	AC-LB-0025	Canterbury Woods and Long Branch neighborhoods	Water Quality	Private - Residential	1 - 10
AC9309	Area-Wide Drainage Improvements	AC-LB-0030	Springbrook Forest, Willow Woods and Woods of Ilda neighborhoods	Water Quality	Private	1 - 10
AC9310	Area-Wide Drainage Improvements	AC-LB-0035	Springbrook Forest and Rutherford neighborhoods	Water Quality	Private	1 - 10
AC9405	Culvert Retrofit	AC-LB-0060	Old Forge Park	Water Quality	State - VDOT	1 - 10
AC9406	Culvert Retrofit	AC-LB-0075	Long Branch Park	Water Quality	State - VDOT	1 - 10
AC9529	BMP/LID	AC-LB-0015	Canterbury Woods Elementary School	Water Quality	County - FCPS	1 - 10
AC9145	New Stormwater Pond	AC-LB-0005	Canterbury Woods Swim Club	Water Quality	Private	11 - 25
AC9146	Stormwater Pond Retrofit	AC-LB-0005	Woodland Forest neighborhood	Water Quality	Private - Residential	11 - 25
AC9149	Stormwater Pond Retrofit	AC-LB-0020	Dunleigh neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9150	Stormwater Pond Retrofit	AC-LB-0020	Burke Professional Center	Water Quality	Private - Commercial	11 - 25

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9151	Stormwater Pond Retrofit	AC-LB-0025	Long Branch Swim and Racquet Club	Water Quality	Private	11 - 25
AC9152	Stormwater Pond Retrofit	AC-LB-0040	Chestnut Hills West neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9153	Stormwater Pond Retrofit	AC-LB-0040	Behind Wrought Iron Ct	Water Quality and Quantity	Private - Residential	11 - 25
AC9154	Stormwater Pond Retrofit	AC-LB-0040	Lee Meadows neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9155	New Stormwater Pond	AC-LB-0045	Sweet Briar Forest neighborhood	Water Quality	Private - Residential	11 - 25
AC9156	Stormwater Pond Retrofit	AC-LB-0060	Korean Presbyterian Church	Water Quality and Quantity	Private - Church	11 - 25
AC9157	Stormwater Pond Retrofit	AC-LB-0060	George Mason Park	Water Quality and Quantity	County - FCPA	11 - 25
AC9158	Stormwater Pond Retrofit	AC-LB-0065	Somerset South neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9404	Culvert Retrofit	AC-LB-0020	Red Fox Dr	Water Quality and Quantity	State - VDOT	11 - 25
AC9528	BMP/LID	AC-LB-0005	Holy Spirit Catholic Church and Canterbury Woods Swim Club	Water Quality	Private	11 - 25
AC9530	BMP/LID	AC-LB-0025	Longbranch Swim and Racquet Club Parking Lot and St. Stephens United Methodist Church	Water Quality	Private	11 - 25
AC9531	BMP/LID	AC-LB-0035	Rutherford Area Swim Club	Water Quality	Private	11 - 25
AC9532	BMP/LID	AC-LB-0045	Rutherford Park	Water Quality	County - FCPA	11 - 25
AC9533	BMP/LID	AC-LB-0055	Rutherford Park	Water Quality	County - FCPA	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9900	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple
AC9904	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9907	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple
AC9908	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9910	Street Sweeping Program	Multiple	Multiple	Water Quality	Multiple
AC9913	Dumpsite/Obstruction Removal	Multiple	Multiple	Water Quality	Multiple
AC9935	Community Outreach/Public Education	Multiple	Multiple	Water Quality and Quantity	Multiple

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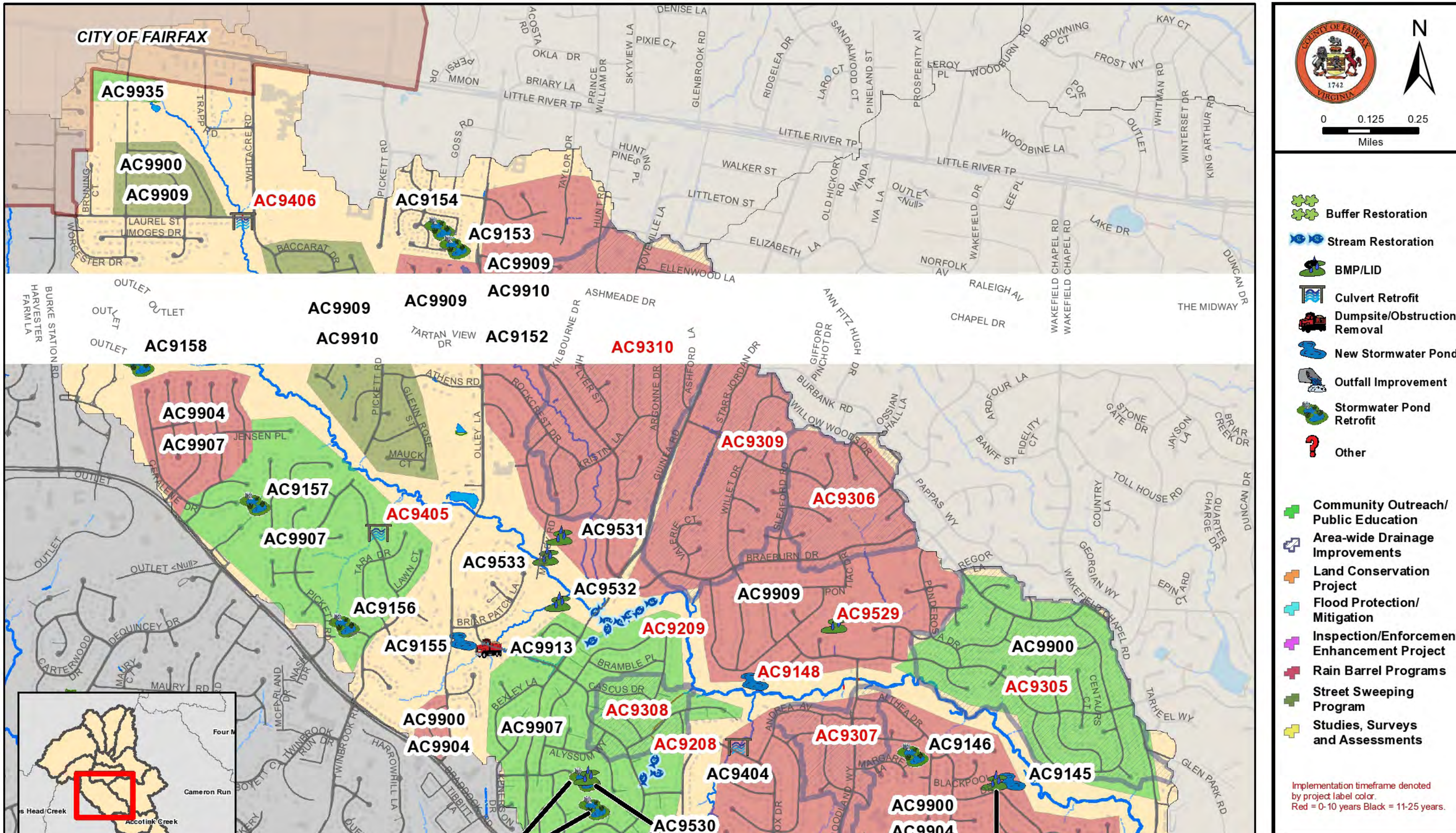

Map 5.4

WMA: Long Branch Central Proposed Projects

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5.5 Long Branch North

The results of the subwatershed ranking analysis showed that all except two subwatersheds in Long Branch North are impaired in some form. A subwatershed in the southwestern corner of the WMA was among the lowest ranked in the Accotink Creek watershed for composite score of impacts and sources because it is completely built out with low forest cover.

5.5.1 Structural Projects

5.5.1.1 10-Year Projects

<u>AC9181 Stormwater Pond Retrofit</u>

A retrofit is proposed for dry pond DP0146 that drains Prosperity Business Campus. Project recommendations include removing the existing concrete channels, excavating to create a permanent wet storage element and replacing the existing riser to convert the pond to a shallow wetland.

Long Branch North Stream Restoration Projects -- A series of stream restoration projects have been proposed to restore a substantial length of Long Branch North and its tributaries. Ideally, they would be implemented from upstream to downstream, in the following order: AC9238, AC9224 (a short tributary) and AC9237 on the main channel. AC9236 could be completed simultaneously, followed by AC9235 and AC9234.

<u>AC9224 Stream Restoration</u>

This is a short stream restoration project between I-66 and Prosperity Avenue in the I-66 right of way. Severe stream bank erosion was observed throughout the stream length. Proposed project recommendations are to raise the bed elevation using step pools and stabilize the stream bank.

<u>AC9234 Stream Restoration</u>

This project would restore an eroded section of stream in the Sutton Place and Mantua Woods neighborhoods near the confluence with the Accotink Creek mainstem. Restoration would include installing bank protection, reshaping the channel and removing invasive plant species.

<u>AC9235 Stream Restoration</u>

This project proposes to restore an eroded and previously stabilized section of Long Branch North in the Sutton Place and Copeland Pond neighborhoods. The proposed restoration starts downstream of the culvert under Arlington Boulevard to approximately the end of Copeland Pond Court. Restoration would include reshaping the channel, protecting the banks and replacing existing old engineering techniques with natural channel design structures.

<u>AC9236 Stream Restoration</u>

This stream restoration project is located downstream of Prosperity Avenue in the Merrifield View neighborhood. Restoration will include removing the existing concrete channel and restoring it to a more natural channel, retrofitting storm drain structures, installing grade control structures, regrading and stabilizing stream banks and buffer restoration.

<u>AC9237 Stream Restoration</u>

This stream restoration would extend north from Cherry Drive to south of Dogwood Lane and would include regrading and stabilizing eroded stream banks, adjusting the channel to protect the sanitary sewer manhole and removing riprap around the pedestrian bridge and replacing with bioengineering techniques.

AC9238 Stream Restoration

This project is intended to restore an eroded section of Long Branch North that originates north of Cottage Street and extends downstream to Lee Highway. Restoration efforts would include raising the stream bed elevation, installing grade control structures and stabilizing eroded stream banks. Additionally, buffer restoration is recommended to promote additional stability and to restore ecological function where extensive amounts of invasive vegetation are present.

AC9314 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the medium-density residential area in the Dunn Loring Village neighborhood by implementing a hybrid project that includes installing tree box filters and rain gardens.

AC9550 New BMP/LID

Multiple practices are proposed for industrial properties on Industrial Lane adjacent to Lee Highway. Installation of two tree box filters and a sand filter is proposed while a vegetated swale would replace an existing concrete swale.

AC9551 New BMP/LID

Two bioretention filters are proposed to treat the runoff from rooftops and parking areas in the southern section of Stenwood Elementary School. Disconnection and routing to the bioretention facilities would allow for water quality treatment before the runoff enters the stream system.

5.5.1.2 25-Year Projects

AC9179 Stormwater Pond Retrofit

This project would retrofit dry pond DP0138, which drains a part of Luther Jackson Middle School and the Gatehouse shopping complex, to an extended detention pond by excavating the bottom to add water quality treatment.

AC9552 New BMP/LID

This project consists of two separate school sites, Thoreau Middle School and the northern section of Stenwood Elementary School, to install bioretention facilities to treat stormwater runoff from the parking lot and rooftop for water quality. Curb cuts are recommended to divert the parking lot runoff to proposed bioretention areas.

5.5.2 Non Structural Projects

AC9806 Buffer Restoration

This project, located between Amberley Lane and Wynford Drive, involves the restoration of the degraded stream buffer.

AC9900 Community Outreach/Public Education - Stenciling

This community-wide project involves marking the storm drains within the North Pine, North Pine Ridge, Stonewall Manor, Dunn Loring Woods, Oak Forrest, Pine Ridge, Sutton Place and

Amanda Place communities. The stencil marking can educate the public, reduce dumping and reduce the amount of litter and pollutants that enter the storm drain system.

AC9902 Inspection/Enforcement Enhancement Project - Vehicle Maintenance

This project would provide community-wide targeted enforcement of spill prevention and pollution prevention regulations for sites where vehicles are maintained. The upland reconnaissance identified an uncovered fueling area that should be targeted.

AC9903 Inspection/Enforcement Enhancement Project - Outdoor Materials

Materials that are stored outdoors are subjected to precipitation, making them a possible source of stormwater runoff pollution. Three sites in this WMA had improper storage of mulch, uncovered fueling islands, oil-stained drum storage or uncovered storage of topsoil and sand. This project would be a community-wide enforcement and outreach approach to check for stormwater pollution prevention plans and to educate property owners.

AC9908 Inspection/Enforcement Enhancement Project - Dumpster Maintenance

One source of litter and pollutants in stormwater runoff is poorly maintained dumpsters and other waste management practices. This project is a community-wide enforcement and outreach approach to properties where problems were identified during the upland reconnaissance. Dumpsters in this WMA were flagged as hotspots with evidence of garbage and grease flowing from overfull grease traps and dumpsters to a storm drain.

AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

Seven sites were identified with significant obstructions or dumpsites during the stream assessment. This project would be a community-wide program to remove carpet and padding in the stream, trees blocking fish passage and debris within the stream.

Table 5-5: Long Branch North Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9181	Stormwater Pond Retrofit	AC-LC-0025	Prosperity Business Campus	Water Quality	Private - Commercial	1 - 10
AC9224	Stream Restoration	AC-LC-0025	I-66 and Prosperity Ave	Water Quality	State - VDOT	1 - 10
AC9234	Stream Restoration	AC-LC-0000	Sutton Place and Mantua Woods neighborhoods	Water Quality	Private - Residential	1 - 10
AC9235	Stream Restoration	AC-LC-0000	Sutton Place and Copeland Pond neighborhoods	Water Quality	Private - Residential	1 - 10
AC9236	Stream Restoration	AC-LC-0005	Merrifield View neighborhood	Water Quality	Private - Residential	1 - 10
AC9237	Stream Restoration	AC-LC-0015	Fairhill on the Boulevard neighborhood	Water Quality	Private - Residential	1 - 10
AC9238	Stream Restoration	AC-LC-0020, -0025, -0030	Dunn Loring Woods neighborhood and Prosperity Business Campus	Water Quality	Private	1 - 10
AC9314	Area-Wide Drainage Improvements	AC-LC-0025	Dunn Loring Village neighborhood	Water Quality	Private	1 - 10
AC9550	BMP/LID	AC-LC-0015	Industry Lane and Lee Hwy	Water Quality	Private - Industrial	1 - 10
AC9551	BMP/LID	AC-LC-0025	Stenwood Elementary School	Water Quality	County - FCPS	1 - 10
AC9179	Stormwater Pond Retrofit	AC-LC-0005	Luther Jackson Middle School	Water Quality and Quantity	County - FCPS	11 - 25
AC9552	BMP/LID	AC-LC-0030	Thoreau Middle School and Stenwood Elementary School	Water Quality	County - FCPS	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9806	Buffer Restoration	AC-LC-0000	Behind Amberley Ln	Water Quality	Private
AC9900	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9902	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9903	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9908	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9913	Dumpsite/Obstruction Removal	Multiple	Multiple	Water Quality	Multiple

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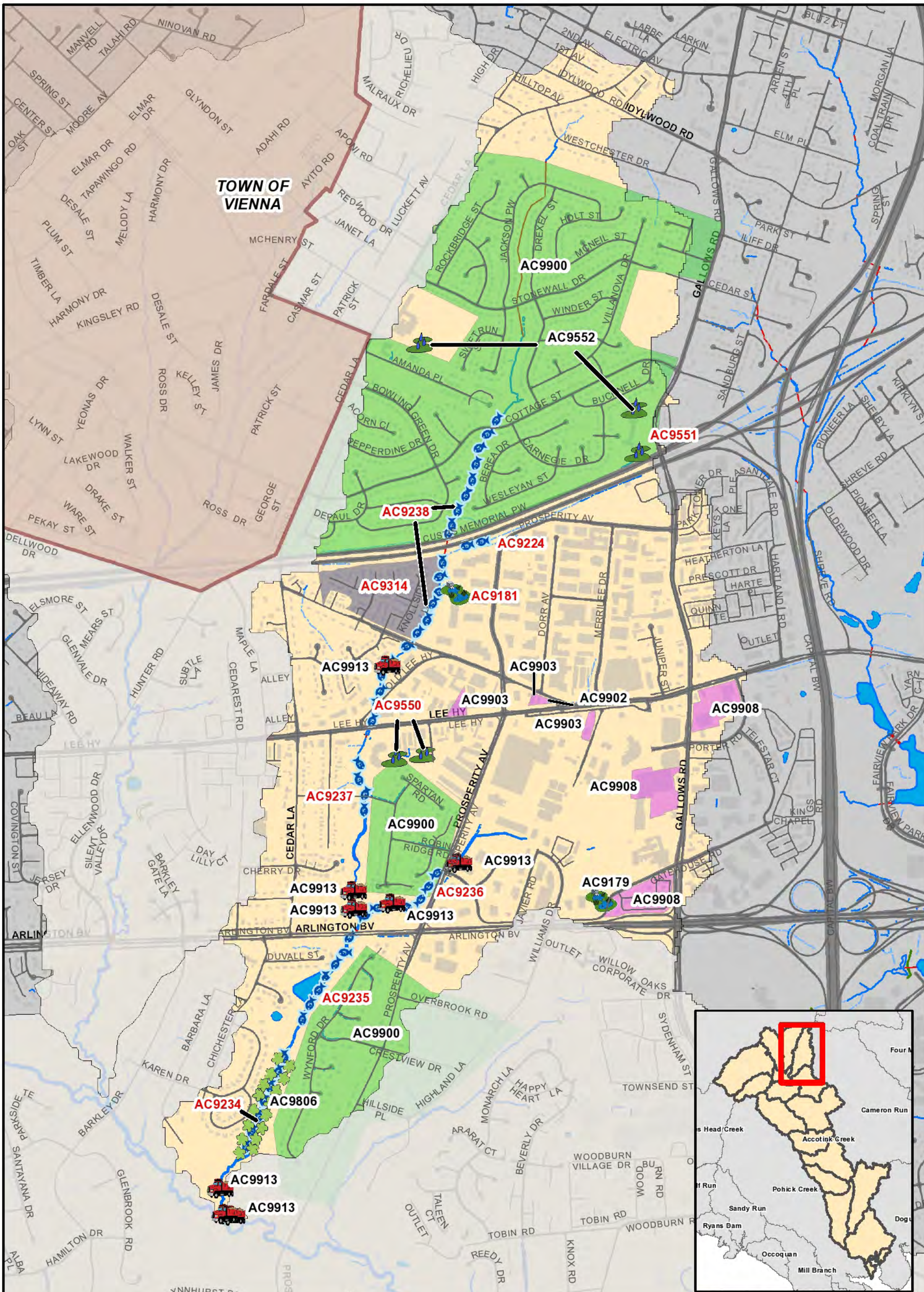

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Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Community Outreach/Public Education
Area-wide Drainage Improvement
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments

Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.

Map 5.5

WMA: Long Branch North
Proposed Projects

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5.6 Long Branch South

The results of the subwatershed ranking analysis showed a significant number of subwatersheds in Long Branch South impaired in some form. Six subwatersheds were in good conditions, three of which include large undeveloped and forested areas and the remaining three are undeveloped parcels in Fort Belvoir, Loisdale Estates and Amberleigh Park.

5.6.1 Structural Projects

5.6.1.1 10-Year Projects

<u>AC9102 Stormwater Pond Retrofit</u>

This project is at an existing VDOT dry pond that treats runoff from the Fairfax County Parkway and a part of an industrial area. The proposed project is to convert this existing dry pond to a shallow wetland facility by excavating for additional storage, adding plunge pools at the inflows along with wetland and dry plantings.

<u>AC9105 Stormwater Pond Retrofit</u>

This project is a retrofit of an existing dry pond (0095DP) that provides water quantity control for the multifamily residential homes in Pinewood Station. The dry pond could be converted to an extended detention facility through removing the existing headwalls and the concrete low-flow channels and adding and a riser structure and plunge pool at each inflow for energy dissipation into the facility.

<u>AC9106 Stormwater Pond Retrofit</u>

This project is a retrofit of two neighboring dry ponds that treat runoff from Newington Industrial along Backlick Road and Cinder Bed Road. The proposed project recommends excavating the bottom of dry pond DP0474 for water quality volume storage and removing the concrete channel and converting the existing pond behind Terminal Drive to a wet pond by installing a new riser and excavating for a forebay and micropool.

<u>AC9110 Stormwater Pond Retrofit</u>

This project is a proposed retrofit of dry pond 0700DP at the end of Briarleigh Way in the Amberleigh neighborhood. The dry pond would be retrofitted to an extended detention pond by adding a riser, excavating and creating berms to lengthen the flow path.

<u>AC9111 Stormwater Pond Retrofit</u>

This proposed project is to retrofit dry pond 0180DP behind Birchleigh Way in the Amberleigh neighborhood. Project recommendations include adding a riser structure, removing the headwall, tree removal and riprap stabilization.

<u>AC9112 Stormwater Pond Retrofit</u>

A retrofit of dry pond DP0366 in the Springfield Industrial Center is recommended. The pond could be converted to a shallow wetland facility through excavating and redesigning the outlet to reduce clogging. This would allow this pond to achieve water quality and water quantity goals for habitat improvement and reduce downstream channel erosion.

AC9113 Stormwater Pond Retrofit

This project retrofit will convert the dry pond DP0367 at the Springfield Industrial Center to a shallow wetland to improve water quality and habitat. The existing pond could be retrofitted by modifying the outlet structure along with adding wetland plantings and plunge pools. Field observations indicated that a part of the riser has failed.

AC9114 Stormwater Pond Retrofit

This is an existing pond (VDOT29028) in the Springfield Industrial Park with a large drainage area to be converted to a shallow wetland to improve water quality by reforesting and adjusting the outlet for storage.

AC9120 Stormwater Pond Retrofit

This project is a retrofit of an existing pond (DP0296) treating multifamily residential area near Springfield Metro Center along Metropolitan Center Drive. This project is a quantity control pond that will be converted to a shallow wetland by modifying the spillway characteristics of the existing riser, installing a new dewatering system and excavating to create permanent wet storage for water quality treatment. Trash removal is also recommended.

AC9226 Stream Restoration

This project on Long Branch South is located near Barry Road in the Windsor Estates neighborhood and would restore the channel near an instream sanitary sewer manhole and remove the debris jam. Additionally, the channel would be regraded and eroded stream banks would be stabilized with armor-in-place and/or bioengineering techniques.

AC9227 Stream Restoration

This stream restoration project would remove a concrete-lined channel south of Route 644 along Barry Road in the Windsor Estates neighborhood. The restoration would include removing the concrete channel, regrading and stabilizing the stream channel. Creating a riparian buffer is also proposed.

AC9301 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the Windsor Park neighborhood by installing tree box filters at curb inlets and rain gardens adjacent to yard inlets.

AC9501 New BMP/LID

This project proposes to build a vegetated swale alongside an existing pond to provide water quality treatment for the runoff from a section of Newington Industrial Park along Terminal Drive.

AC9502 New BMP/LID

This project proposes to build a vegetated swale at the downstream outfall from a commercial area on Newington Road to provide water quality treatment.

AC9503 New BMP/LID

This project proposes adding a bioretention facility to treat parking lot runoff at the Franconia-Springfield Metro Station.

AC9505 New BMP/LID

This project proposes to install tree box filters at storm drain inlets to treat the runoff from the parking lot at Francis Scott Key Middle School. There is no existing stormwater management on site.

AC9506 BMP/LID Retrofit

The installation of multiple bioretention filters and basins is proposed to treat the runoff from a large commercial parking lot located along Frontier Drive. There is an existing underground facilities that provides quantity control for large storm events, but field assessment indicates small bioretention systems within the parking lot medians could treat the runoff for water quality.

AC9508 New BMP/LID

This project includes retrofitting existing storm drain inlets with tree box filters to treat runoff for water quality from the western portion of the parking lot at Robert E. Lee High School.

AC9600 Flood Protection/Mitigation

This project, located at the culvert under the railroad tracks near Cinder Bed Road, would reduce flooding during the 10-year and 100-year storms.

5.6.1.2 25-Year Projects

AC9103 Stormwater Pond Retrofit

This is a potential pond retrofit which currently treats the stormwater runoff from part of the Gateway 95 Business Park. Recommendations include adding a riser at the outlet to provide channel erosion control downstream and a plunge pool at the inlet.

AC9104 Stormwater Pond Retrofit

This project consists of two existing neighboring small dry ponds (DP0300 and DP0301) that provide detention for stormwater runoff at the Shirley Industrial Complex. The proposed project would add water quality treatment by converting the ponds to bioretention facilities.

AC9107 Stormwater Pond Retrofit

The existing dry pond (0179DP) that treats the stormwater runoff from the Landsdowne neighborhood is proposed to be converted to an extended detention facility by removing concrete channels and excavating the area. Quantity control would be expanded by regrading embankments. A micropool and forebay would be created to promote water quality control.

AC9108 Stormwater Pond Retrofit

This project recommends converting two existing neighboring small dry ponds (0129DP and 0179DP) in Amberleigh Park by excavating for water quality volume storage, installing a restrictor on the riser and lengthening the flow path.

AC9109 Stormwater Pond Retrofit

The existing dry pond (1267DP) treats stormwater runoff from residential homes between Brockett Crossing and Venture Drive is proposed to be converted to an extended detention pond. This retrofit would add a new riser structure, remove the concrete low-flow channels and replace them with a meandering low flow channel, excavate for additional storage and add plantings.

AC9115 Stormwater Pond Retrofit

This project would retrofit an existing VDOT dry pond (VDOT29029) next to Assembly of God Church. Recommendations include a new riser structure, restricting the outlet for storage and installing a low berm to lengthen the flow path.

AC9116 Stormwater Pond Retrofit

This project would retrofit dry pond 0780DP, which treats stormwater runoff Devonshire Townhomes, to an extended detention facility. Concrete channels would be removed and a meandering low flow channel created.

AC9117 Stormwater Pond Retrofit

This project proposes converting the existing dry pond (DP0400), which treats stormwater runoff from the Walker Lane Condominiums, to a wet pond by raising the restrictor to create a permanent pool to improve water quality treatment.

AC9118 Stormwater Pond Retrofit

This project proposes to convert the dry pond (DP0308) behind Gravel Road at Fleet Industrial Park to a wet pond by raising the restrictor to increase the wet area and thus improve water quality in the receiving waters. Reforestation is also recommended.

AC9119 Stormwater Pond Retrofit

This project would retrofit the existing dry pond (0886DP) behind Gildar Street, which treats stormwater runoff from Springfield North Condominiums, to a wet pond by excavating and removing concrete channels or raising the restrictor and overflow.

AC9121 Stormwater Pond Retrofit

There is an existing dry pond (DP0450) at Sunrise Assisted Living that provides detention for runoff from the site. The proposed project would retrofit the dry pond by removing the concrete channel and raising the overflow. A micropool and forebay would be added for water quality management.

AC9122 New Stormwater Ponds

There are three potential areas for improvement in the ramp connecting I-95 and Franconia Road. Two are at existing inlets in low spots where a riser could be designed to create storage without the need for an embankment. One eroding ditch could be converted to a vegetated swale for water quality treatment.

AC9504 New BMP/LID

This project is located at a series of strip malls opposite Springfield Mall on Frontier Drive. The parking island and the area between the stores and the street could be retrofitted with bioretention facilities to treat the runoff from the parking lots.

AC9507 BMP/LID Retrofit

This project recommends the installation of bioretention and tree box filters in parking medians and around the perimeter to treat parking lot runoff for water quality at Springfield Mall, currently approved for redevelopment.

5.6.2 Non Structural Projects

AC9800 Buffer Restoration

This project, located off of Telegraph Road, involves the restoration of the degraded stream buffer.

AC9801 Buffer Restoration

This project, located near Cinder Bed Road, involves the restoration of the degraded stream buffer.

AC9902 Inspection/Enforcement Enhancement Project - Vehicle Maintenance

This project would provide community-wide targeted enforcement of spill prevention and pollution prevention regulations for sites where vehicles are maintained. The upland reconnaissance identified an outdoor vehicle repair/maintenance/storage facility and a van wash discharging directly to a storm drain.

AC9903 Inspection/Enforcement Enhancement Project - Outdoor Materials

Materials that are stored outdoors are subjected to precipitation, making them a possible source of stormwater runoff pollution. Four sites in this WMA had construction equipment stored outdoors, outdoor equipment fueling or outdoor drum storage without cover. This project would be a community-wide enforcement and outreach approach to check for stormwater pollution prevention plans and to educate property owners.

AC9904 Rain Barrel Programs - Rain Barrels

Rain barrels provide the first step for residents to disconnect their downspout. This project would be a community-wide outreach program to encourage their use. Three neighborhoods, Windsor Estates, Loisdale Estates and Springfield Forest, were identified during the upland reconnaissance with roof drainage that would be suitable for this approach.

AC9906 Inspection/Enforcement Enhancement Project - Litter/Trash Enforcement

Litter and trash enforcement is done through the enforcement of regulations for illegal dumping, litter laws, or unsecure truck loads. Community outreach programs for beautifying neighborhoods, including health and safety information, can be used effectively in the implementation of the programs. The area flagged for enforcement includes a cul-de-sac at the north end of Terminal Road.

AC9907 Community Outreach/Public Education - Lawn Care

This project would provide community-wide education and guidance to homeowners on lawn care practices that would potentially reduce pollutants in stormwater runoff. The upland reconnaissance identified several neighborhoods: Loisdale Estates, Springfield Forest and Windsor Estates, that could be targeted with this effort.

AC9908 Inspection/Enforcement Enhancement Project - Dumpster Maintenance

One source of litter and pollutants in stormwater runoff is poorly maintained dumpsters and other waste management practices. This project is a community-wide enforcement and outreach approach to properties where problems were identified during the upland reconnaissance. Dumpsters in this WMA were flagged as hotspots with evidence of unknown leakage.

AC9909 Rain Barrel Programs - Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, they included the area around Hunter Estates and Newberry Station.

AC9910 Street Sweeping Program - street sweeping

Loisdale Estates were found to have trash, litter or organic debris in the curb and gutter, flowing to storm drain inlets. This project consists of developing or extending a street sweeping program to remove potential pollutants from the street before they can wash into a storm drain or a stream.

AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

One site was identified with significant obstructions or dumpsites during the stream assessment. This project would be a community-wide program to remove appliances, trash and yard waste on the stream bank.

Table 5-6: Long Branch South Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9102	Stormwater Pond Retrofit	AC-LA-0003	Intersection of Telegraph Rd and Fairfax County Pkwy	Water Quality and Quantity	State - VDOT	1 - 10
AC9105	Stormwater Pond Retrofit	AC-LA-0010	Pinewood Station neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9106	Stormwater Pond Retrofit	AC-LA-0010	Backlick Rd and Cinder Bed Rd	Water Quality and Quantity	State - VDOT, Private - Commercial	1 - 10
AC9110	Stormwater Pond Retrofit	AC-LA-0050	Amberleigh neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9111	Stormwater Pond Retrofit	AC-LA-0050	Amberleigh neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9112	Stormwater Pond Retrofit	AC-LA-0060	Springfield Industrial Park	Water Quality and Quantity	Private - Commercial	1 - 10
AC9113	Stormwater Pond Retrofit	AC-LA-0060	Springfield Industrial Park	Water Quality	Private - Commercial	1 - 10
AC9114	Stormwater Pond Retrofit	AC-LA-0060	Springfield Industrial Park	Water Quality and Quantity	State - VDOT	1 - 10
AC9120	Stormwater Pond Retrofit	AC-LA-0065	Franconia/Springfield Metro	Water Quality and Quantity	Public - Metro	1 - 10
AC9226	Stream Restoration	AC-LA-0050	Windsor Estates	Water Quality	Private - Residential	1 - 10
AC9227	Stream Restoration	AC-LA-0055	Windsor Estates	Water Quality	Private - Residential	1 - 10
AC9301	Area-Wide Drainage Improvements	AC-LA-0055	Windsor Park	Water Quality	Private	1 - 10
AC9501	BMP/LID	AC-LA-0010	Newington Industrial Park	Water Quality	Private - Industrial	1 - 10
AC9502	BMP/LID	AC-LA-0015	Newington Rd	Water Quality	Private	1 - 10
AC9503	BMP/LID	AC-LA-0050	Franconia/Springfield Metro	Water Quality	Public - Metro	1 - 10
AC9505	BMP/LID	AC-LA-0080	Francis Scott Key Middle School	Water Quality	County - FCPS	1 - 10
AC9506	BMP/LID	AC-LA-0070	Commercial Parking Lot	Water Quality	Private - Commercial	1 - 10
AC9508	BMP/LID	AC-LA-0075	Robert E. Lee High School	Water Quality	County - FCPS	1 - 10
AC9600	Flood Protection/Mitigation	AC-LA-0010	Culvert under railroad behind Industrial Park	Water Quantity	Federal	1 - 10

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9103	Stormwater Pond Retrofit	AC-LA-0003	Gateway 95 Business Park	Water Quality and Quantity	Private - Commercial	11 - 25
AC9104	Stormwater Pond Retrofit	AC-LA-0005	Shirley Industrial Complex	Water Quality	Private - Industrial	11 - 25
AC9107	Stormwater Pond Retrofit	AC-LA-0030	Landsdowne neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9108	Stormwater Pond Retrofit	AC-LA-0045	Amberleigh Park	Water Quality and Quantity	County - FCPA	11 - 25
AC9109	Stormwater Pond Retrofit	AC-LA-0045	Island Creek Park	Water Quality and Quantity	County - FCPA	11 - 25
AC9115	Stormwater Pond Retrofit	AC-LA-0055	Next to Assembly of God Church	Water Quality and Quantity	State - VDOT	11 - 25
AC9116	Stormwater Pond Retrofit	AC-LA-0055	Devonshire Townhomes	Water Quality and Quantity	Private - Residential	11 - 25
AC9117	Stormwater Pond Retrofit	AC-LA-0085	Walker Lane Condo	Water Quality	Private - Residential	11 - 25
AC9118	Stormwater Pond Retrofit	AC-LA-0085	Fleet Industrial Park	Water Quality	Private - Industrial	11 - 25
AC9119	Stormwater Pond Retrofit	AC-LA-0090	Behind Gilders St	Water Quality and Quantity	Private - Residential	11 - 25
AC9121	Stormwater Pond Retrofit	AC-LA-0075	Sunrise Assisted Living	Water Quality and Quantity	Private - Residential	11 - 25
AC9122	New Stormwater Pond	AC-LA-0075	I-95 and Franconia Rd Interchange	Water Quality	Federal	11 - 25
AC9504	BMP/LID	AC-LA-0050	Shopping area opposite Springfield Mall	Water Quality	Private - Commercial	11 - 25
AC9507	BMP/LID	AC-LA-0075	Springfield Mall	Water Quality	Private	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9800	Buffer Restoration	AC-LA-0003	Intersection of Telegraph Rd and Fairfax County Pkwy	Water Quality	Private
AC9801	Buffer Restoration	AC-LA-0050	Springfield Industrial Center and Cinder Bed Rd	Water Quality	Private

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9902	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9903	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9904	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9906	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9907	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple
AC9908	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9910	Street Sweeping Program	Multiple	Multiple	Water Quality	Multiple
AC9913	Dumpsite/Obstruction Removal	AC-LA-0010	Multiple	Water Quality	Multiple

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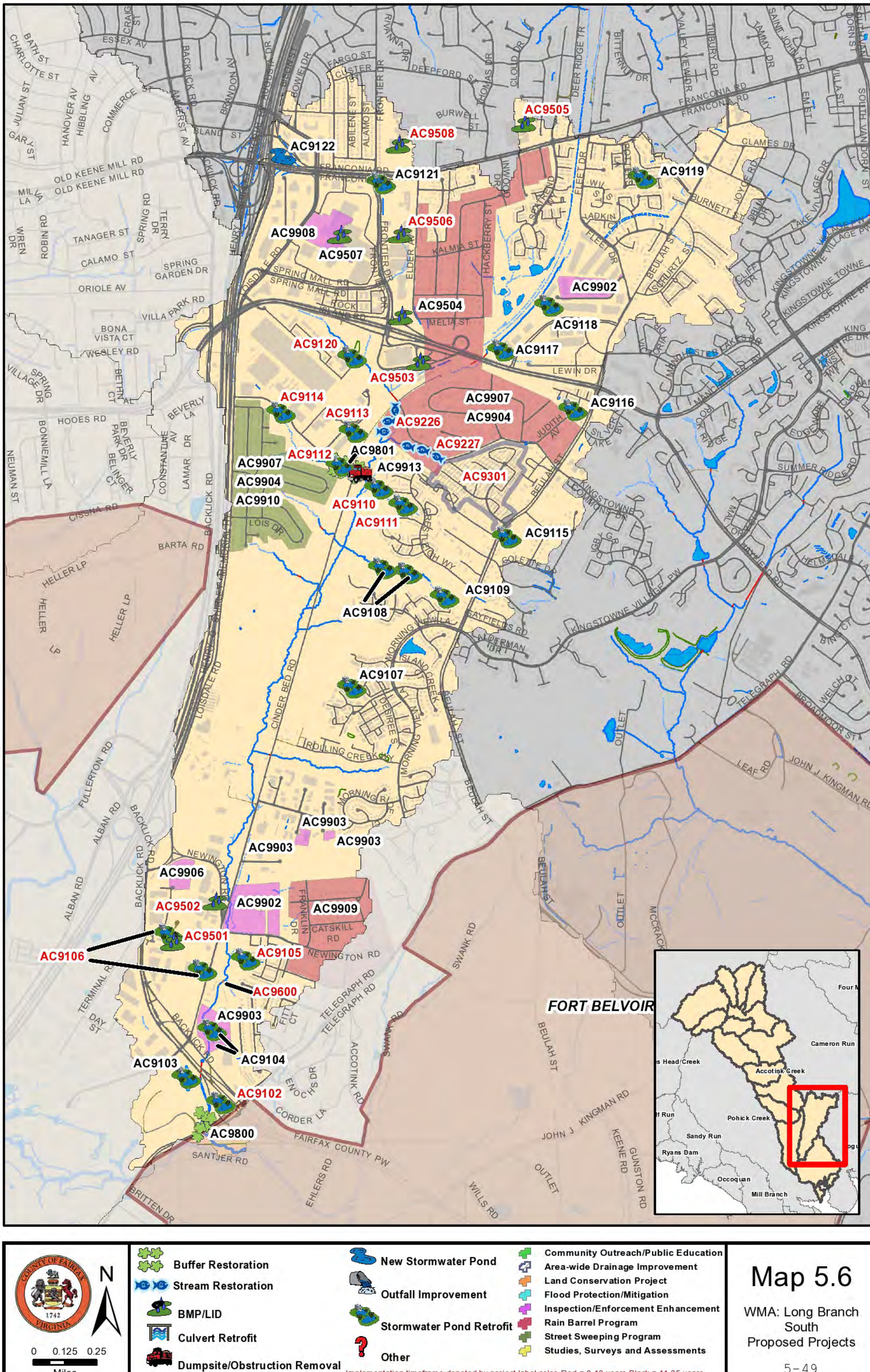

Map 5.6

WMA: Long Branch South Proposed Projects

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5.7 Accotink Mainstem 1

The results of the subwatershed ranking analysis showed a significant number of subwatersheds in Mainstem 1 that were impaired in some form. Three subwatersheds were in good condition, primarily due to good forest cover and the undeveloped parcels of Towers Park and Ranger Road Park. Thirteen of the 23 subwatersheds in the Mainstem 1 WMA are within the boundaries of Fairfax City and were not assessed for retrofits or improvements.

5.7.1 Structural Projects

5.7.1.1 10-Year Projects

AC9195 Stormwater Pond Retrofit

This project proposes to convert an existing dry pond (0100DP), which treats stormwater runoff from Oakton Village neighborhood, to an extended detention facility. A new riser structure, removal of the concrete channels and the addition of a plunge pool will improve the water quality treatment of this facility.

AC9196 Stormwater Pond Retrofit

This project proposes to retrofit existing wet pond WP0271 into a wetland facility at Four Winds at Oakton Condominium. Recommendations include stabilizing the outfall, adding a new riser structure, excavating for additional storage, tree removal and adding a micropool and plunge pool at the riser and inflow.

AC9199 Stormwater Pond Retrofit

An existing dry pond (1235DP) along Buckley Street in Rosehaven Estates is proposed to be retrofitted to provide greater water quality volume and peak flow reduction. Recommendations include modifying the existing riser structure, installing a plunge pool and a micropool and plantings.

AC9316 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the Hawthorne Village Apartments, Five Oaks Place and Cedar Grove Park neighborhoods by installing tree box filters at curb and street inlets and rain gardens adjacent to yard inlets.

AC9409 Culvert Retrofit

Runoff from Oakton High School is proposed to be treated by retrofitting the road culvert under Sutton Road. This would involve adding a control structure upstream of the culvert to regulate the discharge from small, frequent storms.

AC9558 New BMP/LID

Parking lot runoff at Mosby Woods Elementary School is proposed to be treated by implementation of two bioretention facilities. These facilities would be located in the parking and bus loop medians.

AC9562 New BMP/LID

A series of bioretention filters and basins is proposed to treat runoff from the AT&T building and parking lot on Chain Bridge Road. Currently, the parking area drains through three outfalls to a dry pond with a concrete channel located in an open grass field at the south end of the parking lot. There is sufficient space at the inflows to the pond to create bioretention facilities to pre-treat runoff for water quality and maintain the existing detention characteristics of the pond.

5.7.1.2 25-Year Projects

AC9187 Stormwater Pond Retrofit

Field assessment indicated the existing dry pond (0714DP) behind Blake Park Court is not functioning well due to a shortened flow path through the facility. The proposed project is to retrofit the existing dry pond with bioretention facilities to improve water quality and quantity control.

AC9188 Stormwater Pond Retrofit

Dry pond 0527DP treats the stormwater runoff from a multi-family residential area in the Country Creek neighborhood is proposed to be converted to bioretention to improve water quality before it enters the downstream channel.

AC9189 New Stormwater Pond

There is potential to create a wetland in a riparian area of East Blake Lane Park to treat high storm surges from the stream. This project would treat runoff from the Randall Valley and Five Oaks neighborhoods.

AC9190 Stormwater Pond Retrofit

The existing pond behind Oakton Pond Court could be retrofitted for increased water quality control by installing a forebay and a riser structure.

AC9191 Stormwater Pond Retrofit

Excavation of an existing dry pond behind Cyrandall Place is proposed to provide a permanent pool and aquatic bench for improved water quality treatment.

AC9192 Stormwater Pond Retrofit

Existing dry pond 0908DP behind Lochalsh Lane in the Edgemoore neighborhood is proposed to be retrofitted by removing the existing headwall and replacing it with a new riser, removing the concrete channels and replacing them with a meandering low flow channel and excavating for extended detention for to add water quality treatment to the existing quantity control.

AC9193 Stormwater Pond Retrofit

The project proposes to convert an existing dry pond that treats stormwater runoff from Oakdale Woods Court to a bioretention facility for increased water quality treatment by replacing the outlet structure, repairing inflow concrete flumes or replacing it with a natural channel within the facility.

AC9194 Stormwater Pond Retrofit

Two pond retrofits (1313DP and 0041DP) are proposed behind Miles Stone Court and along Courthouse Road. Recommendations include replacing the risers and adding storage volume for water quality treatment.

AC9197 Stormwater Pond Retrofit

This project recommends two neighboring ponds to be retrofitted to provide maximum water quality benefits. Pond 0147DP behind Borge Street treating neighborhood runoff is proposed to be retrofitted to include bioretention facilities. The pond retrofit behind Oakton Meadows Court (0173DP) would include excavating near the riser to create a small micropool, raising the embankment to reduce channel erosion and modifying the riser.

AC9198 Stormwater Pond Retrofit

The proposed project recommends retrofitting the existing pond behind Silver Stone Court (DP0505) and the existing dry pond behind White Flint Court (0073DP) by removing the concrete channel, adding forebays and increasing storage.

AC9559 New BMP/LID

Implementation of a bioretention facility at the outfall behind Bickley Court is recommended to improve the water quality of the roadway runoff before it enters the stream.

AC9560 New BMP/LID

Proposed recommendations are to retrofit dry pond 0015DP behind Courthouse Wood Court by converting it to a bioretention filter for water quality treatment.

AC9561 New BMP/LID

A bioretention facility is proposed to treat the Vistas Condominium parking lot runoff at Valentine Street. This would involve installing a curb cut and retrofitting a storm drain inlet to improve water quality control.

5.7.2 Non Structural Projects

AC9900 Community Outreach/Public Education - Stenciling

This community-wide project involves marking the storm drains within the Hawthorne Village, Beech Park, Fairfax Acres, Dudley Heights and Rosehaven Estates communities. The stencil marking can educate the public, reduce dumping and reduce the amount of litter and pollutants that enter the storm drain system.

AC9909 Rain Barrel Programs - Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, it includes the area around Hawthorne Village Apartments.

Table 5-7: Mainstem 1 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9195	Stormwater Pond Retrofit	AC-AC-0465	Oakton Village neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9196	Stormwater Pond Retrofit	AC-AC-0475	Four Winds at Oakton Condominium	Water Quality and Quantity	Private - Residential	1 - 10
AC9199	Stormwater Pond Retrofit	AC-AC-0510	Rosehaven Estates	Water Quality and Quantity	Private - Residential	1 - 10
AC9316	Area-Wide Drainage Improvements	AC-AC-0425	Hawthorne Village Apts, Five Oaks Place and Cedar Grove Park neighborhoods	Water Quality	Private	1 - 10
AC9409	Culvert Retrofit	AC-AC-0415	Oakton High School	Water Quality	State - VDOT	1 - 10
AC9558	BMP/LID	AC-AC-0425	Mosby Woods Elementary School	Water Quality	County - FCPS	1 - 10
AC9562	BMP/LID	AC-AC-0500	AT&T office building	Water Quality	Private - Commercial	1 - 10
AC9187	Stormwater Pond Retrofit	AC-AC-0410	Behind Blake Park Ct	Water Quality	Private - Residential	11 - 25
AC9188	Stormwater Pond Retrofit	AC-AC-0415	Country Creek neighborhood	Water Quality	Private - Residential	11 - 25
AC9189	New Stormwater Pond	AC-AC-0425	East Blake Lane Park	Water Quality	County - FCPA	11 - 25
AC9190	Stormwater Pond Retrofit	AC-AC-0425	Behind Oakton Pond Ct	Water Quality and Quantity	Private - Residential	11 - 25
AC9191	Stormwater Pond Retrofit	AC-AC-0430	Behind Cyrandall Pl	Water Quality and Quantity	Private - Residential	11 - 25
AC9192	Stormwater Pond Retrofit	AC-AC-0430	Edgemoore neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9193	Stormwater Pond Retrofit	AC-AC-0430	Oakdale Woods Ct	Water Quality	Private - Residential	11 - 25
AC9194	Stormwater Pond Retrofit	AC-AC-0430	Behind Miles Stone Ct	Water Quality	Private - Residential	11 - 25
AC9197	Stormwater Pond Retrofit	AC-AC-0475	Borge St and Oakton Meadows	Water Quality	Private - Residential	11 - 25
AC9198	Stormwater Pond Retrofit	AC-AC-0500	Silver Stone Ct and While Flint Ct	Water Quality and Quantity	Private - Residential	11 - 25

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9559	BMP/LID	AC-AC-0430	End of Bickley Ct	Water Quality	Private	11 - 25
AC9560	BMP/LID	AC-AC-0430	Behind Courthouse Wood Ct	Water Quality	Private	11 - 25
AC9561	BMP/LID	AC-AC-0465	Vistas Condominiums	Water Quality	Private - Residential	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9900	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple

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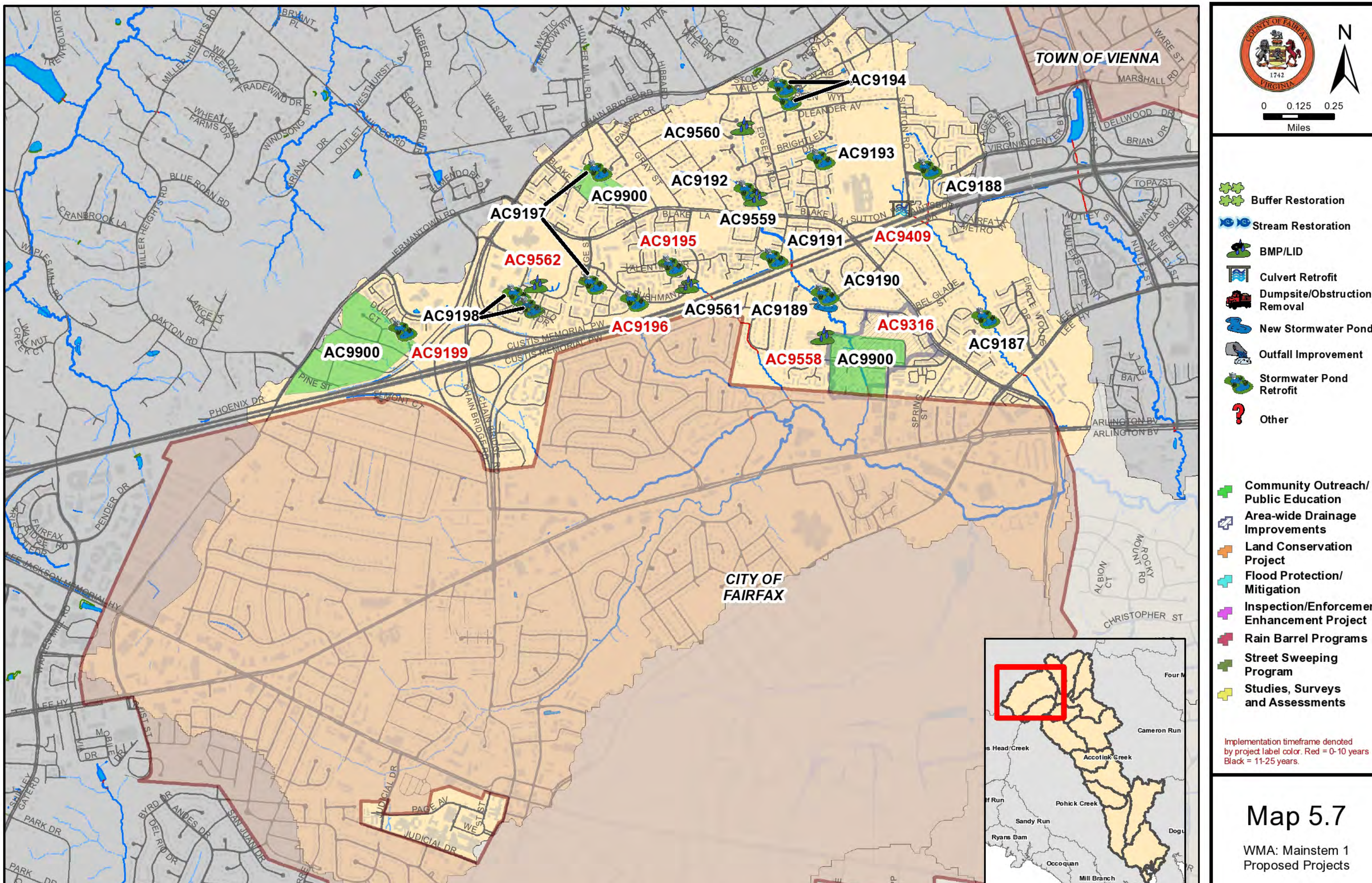
TOWN OF VIENNA
CITY OF FAIRFAX
AC9194
AC9560
AC9193
AC9192
AC9188
AC9900
AC9197
AC9559
AC9195
AC9191
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AC9558
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Miles
Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Community Outreach/ Public Education
Area-wide Drainage Improvements
Land Conservation Project
Flood Protection/ Mitigation
Inspection/Enforcement Enhancement Project
Rain Barrel Programs
Street Sweeping Program
Studies, Surveys and Assessments
Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.
Cameron Run
Accotink Creek
Pohick Creek
Sandy Run
Ryans Dam
Occoquan
Mill Branch
Map 5.7
WMA: Mainstem 1 Proposed Projects

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5.8 Accotink Mainstem 2

The results of the subwatershed ranking analysis showed four subwatersheds in the Mainstem 2 WMA to be in good condition due to the influence of undeveloped parcels in Mill Creek Park, Accotink Stream Valley Park and Eakin Park. The remaining 10 subwatersheds are impaired in some form. In terms of overall ranking, Mainstem 2 had 10 of the highest priority subwatersheds for the overall Accotink Creek watershed.

5.8.1 Structural Projects

5.8.1.1 10-Year Projects

AC9172 New Stormwater Pond

An extended detention facility is proposed to provide water quality and water quantity treatment for the runoff from the residential area along Wheatwheel Lane and Libeau Lane.

AC9178 Stormwater Pond Retrofit

An existing dry pond (0169DP), that treats the runoff from a residential area in the Prosperity Heights neighborhood, is proposed to be retrofitted into a wetland facility to provide additional water quality and quantity control by removing the headwall and putting in a riser and channel stabilization.

AC9219 Stream Restoration

This project would restore two existing stream channels and a ditch located within Pine Ridge Park as well as a third stream channel within Accotink Stream Valley Park. There is also a potential sewer utility being exposed at the Collins Street road culvert. Restoration efforts will include reducing channel dimensions and raising bed elevations to reconnect each channel to its original floodplain, as well as stabilization of severe erosion.

AC9223 Stream Restoration

A large restoration project is recommended for the stream between Monarch Lane and Highland Lane. Currently this channel is mostly straight, incised, over-widened and is lacking a riparian buffer in several areas along the right bank facing downstream. Restoration of this channel will include regrading and stabilizing eroded stream banks. Buffer restoration on the right bank facing downstream in various locations will be necessary to further improve restored areas and to restore ecological function.

AC9545 New BMP/LID

This project proposed two separate bioretention facilities to treat the parking lot runoff at Eakin Park and from the Byzantine Church parking lot located along Woodburn Road.

5.8.1.2 25-Year Projects

AC9171 Stormwater Pond Retrofit

Dry pond 0106DP treating runoff from the Holmes Run neighborhood is proposed to be converted to a wetland by adding a micropool, a forebay, raising the embankment for water quality volume storage and reduce downstream channel erosion and lengthening the flow path to a meandering channel.

AC9173 Stormwater Pond Retrofit

The existing dry pond (DP0204), which treats the stormwater runoff from the Silk Vision and Surgery Center, is proposed to be retrofitted by removing the concrete channel, adding forebays at inlets and modifying the outlet for water quality volume storage.

AC9543 New BMP/LID

This project proposes two separate facilities to control water quality from parking lots. Installation of bioretention or infiltration at parking islands is proposed to treat the parking lot runoff at Camelot Elementary School while installation of a bioretention basin to treat the runoff from a gravel parking lot is proposed in Pine Ridge Park.

AC9544 New BMP/LID

The parking lot runoff at the Silk Vision and Surgery Center is proposed to be treated by retrofitting the storm drain inlets with tree box filters for water quality control.

AC9549 New BMP/LID

Installation of two sand filters is proposed to improve the water quality of the parking lot runoff at commercial business along Arlington Boulevard and Williams Drive.

5.8.2 Non Structural Projects

AC9802 Buffer Restoration

This project, located along Launcelot Way in the Accotink Stream Valley Park, involves the restoration of the degraded stream riparian buffer.

AC9805 Buffer Restoration

This project, located near Prosperity Avenue and Highland Lane in Eakin Community Park, involves the restoration of the degraded stream riparian buffer.

AC9900 Community Outreach/Public Education - Stenciling

This community-wide project involves marking the storm drains within the Camelot, Winterset Section 4, Camelot Heights, Mill Creek Park, Woodburn Village, Mantua, Langhorne Acres, Pine Ridge, Sutton Place and Strathmeade Square communities. The stencil marking can educate the public, reduce dumping and reduce the amount of litter and pollutants that enter the storm drain system.

AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

Ten sites were identified with significant obstructions or dumpsites during the stream assessment. This project would be a community-wide program to remove trees and debris blocking fish passage and trees and yard waste within the stream.

AC9935 Community Outreach/Public Education - Tree Planting

Four communities assessed during the upland reconnaissance could be sites for a watershed-wide outreach program to encourage tree planting and urban reforestation. These include Holmes Run Heights, Shamrock Heights, Chaconas Estates and Gallows Estates.

Table 5-8: Mainstem 2 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9172	New Stormwater Pond	AC-AC-0335	End of Libeau Ln	Water Quality and Quantity	Private - Residential	1 - 10
AC9178	Stormwater Pond Retrofit	AC-AC-0370	Prosperity Heights neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9219	Stream Restoration	AC-AC-0350	Pine Ridge Park	Water Quality	County - FCPA	1 - 10
AC9223	Stream Restoration	AC-AC-0370	Pine Ridge neighborhood	Water Quality	Private - Residential	1 - 10
AC9545	BMP/LID	AC-AC-0360	Eakin Park and Byzantine Church parking lot	Water Quality	County - FCPA / Private	1 - 10
AC9171	Stormwater Pond Retrofit	AC-AC-0335	Holmes Run Village neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9173	Stormwater Pond Retrofit	AC-AC-0350	Silk Vision and Surgery Center	Water Quality	Private - Commercial	11 - 25
AC9543	BMP/LID	AC-AC-0350	Camelot Elementary School / Pine Ridge Park	Water Quality	County - FCPS / County - FCPA	11 - 25
AC9544	BMP/LID	AC-AC-0350	Silk Vision and Surgery Center	Water Quality	Private - Commercial	11 - 25
AC9549	BMP/LID	AC-AC-0375	Arlington Blvd & Williams Dr	Water Quality	Private - Commercial	11 - 25
Non-Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	
AC9802	Buffer Restoration	AC-AC-0350	Accotink Stream Valley Park	Water Quality	County - FCPA	
AC9805	Buffer Restoration	AC-AC-0370	Eakin Community Park	Water Quality	County - FCPA	
AC9900	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple	
AC9913	Dumpsite/Obstruction Removal	Multiple	Multiple	Water Quality	Multiple	
AC9935	Community Outreach/Public Education	Multiple	Multiple	Water Quality and Quantity	Multiple	

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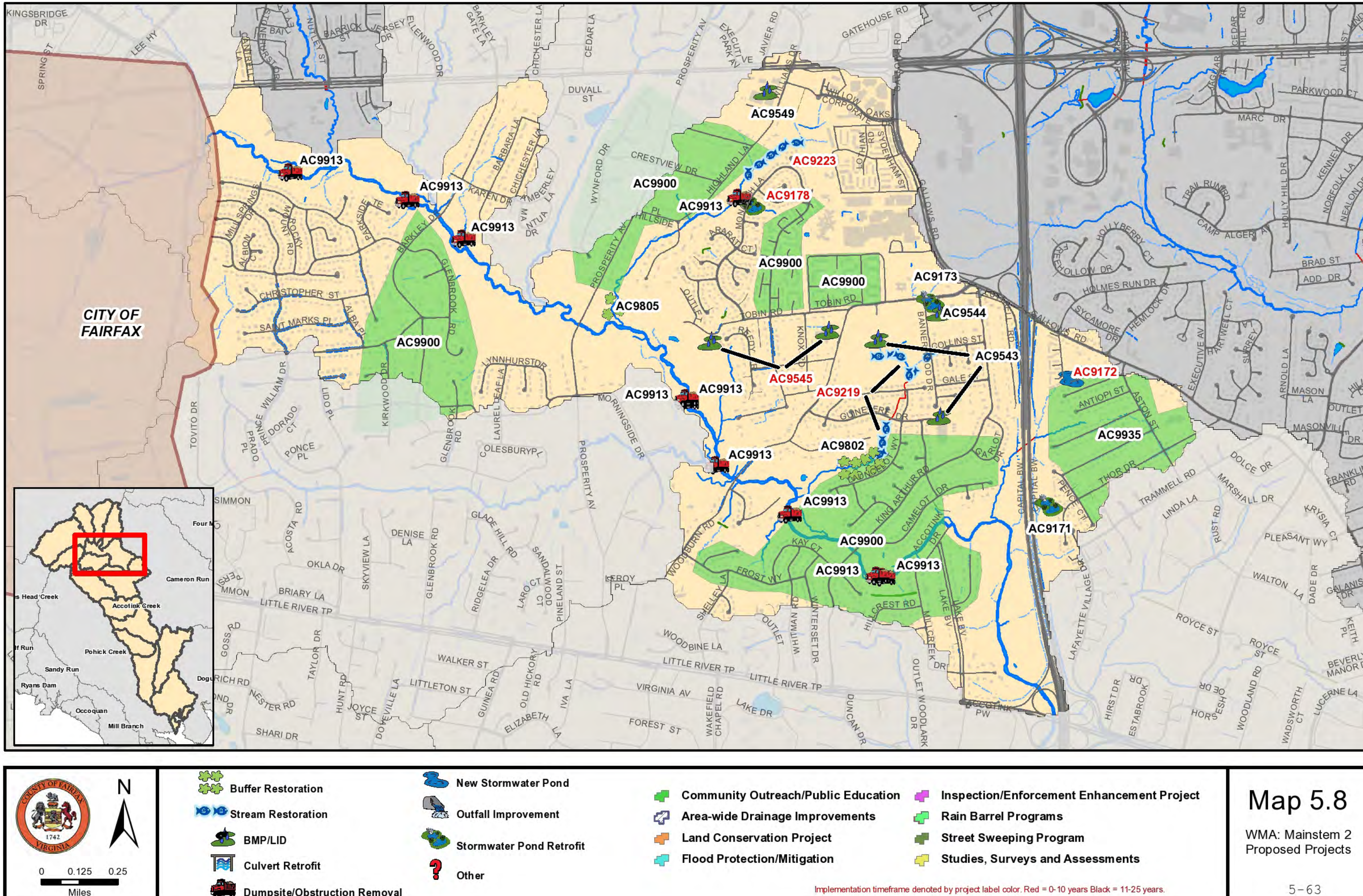

Map 5.8

WMA: Mainstem 2
Proposed Projects

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5.9 Accotink Mainstem 3

The results of the subwatershed ranking analysis showed seven subwatersheds in Mainstem 3 WMA to be in good condition; four of these were due to the influence of undeveloped parcels in Wakefield Park. Three additional subwatersheds have good forest and wetland cover. The remaining 11 subwatersheds were impaired in some form. In terms of overall ranking, Mainstem 3 had 11 of the highest priority subwatersheds for the overall project.

5.9.1 Structural Projects

5.9.1.1 10-Year Projects

<u>AC9161 Stormwater Pond Retrofit</u>

This existing dry pond (0294DP) near the intersection of Americana Drive and Commons Drive in the Patriot Village neighborhood is recommended to be retrofitted by modifying the outlet structure to provide storage, creating a micropool at the outlet, installing sediment forebays at inlets, excavating the pond outlet to provide better storage and stabilizing the existing stream channel.

<u>AC9162 Stormwater Pond Retrofit</u>

This project is a retrofit of an existing dry pond (0293DP) at Patriot Drive and American Drive in the Patriot Village neighborhood. Recommendations include adding forebays at all inlets, modifying the outlet to provide storage and excavating the pond to provide additional storage. The receiving stream on the downstream side of the culvert will also be stabilized to prevent further erosion.

<u>AC9210 Stream Restoration</u>

This project involves restoring three stream channels located within Wakefield Park draining commercial areas located along Braddock Road and the Capital Beltway. These channels are currently incised and over-widened with moderate to severe erosion occurring on meander bends and along straight sections. Restoration of these channels will focus on reducing the channel dimensions and raising the stream bed elevations to reconnect each channel to the floodplain.

Truro Neighborhood Stream Restoration Projects -- Three stream restoration projects through the Truro neighborhood have been proposed to restore a substantial length of Turkey Run, a tributary to Mainstem 3. Ideally, they would be implemented from upstream to downstream, in the following order: AC9213, AC9212 and AC9211.

<u>AC9211 Stream Restoration</u>

This project is located between Kenwyn Court and Wakefield Drive and involves the restoration of a short section of existing stream channel that starts at a large storm drain outfall and extends southwest to the mainstem of Turkey Run. Currently, this channel is incised with moderate erosion on both banks. Regrading and stabilizing are recommended. Stone toe protection may be needed near the storm drain outfall and under the foot bridge to prevent future erosion. Raising the bed elevation of this channel and installing grade controls will prevent further incision.

AC9212 Stream Restoration

This project involves a stream channel located between Elizabeth Lane, Aunt Lilly Lane, Kenwen Court and Ossian Hall Lane. This sinuous channel is currently incised, and over-widened. It has eroded primarily on outside meander bends and along some straight sections. The severity of erosion and incision increases downstream. Reconnecting the stream to the floodplain and grade controls are recommended.

AC9213 Stream Restoration

This project is located between Ann Fitzhugh Drive, Aunt Lilly Lane, Turkey Creek Court and Mary Lee Lane. Currently, there is an exposed sanitary sewer concrete casing acting as grade control for an active headcut in the stream channel near the end of Mary Lee Lane. on either side of the sewer utility the stream channel is beginning to over-widen. Reducing the existing channel dimensions, raising the bed elevation of the channel, and correcting the slope of the channel at the sewer casing will all help to reconnect flows to the floodplain.

AC9214 Stream Restoration

This is a stream restoration project for an eroded and incised channel behind Woodlark Drive in Wakefield Park. Recommendations include regrading and stabilizing eroded stream banks, raising the current bed elevation and installing stone toe protection and armoring techniques where sanitary sewer lines are exposed in the stream channel.

AC9215 Stream Restoration

This project is a stream restoration in Mill Creek Park just upstream of the road culvert under Little River Turnpike that receives stormwater runoff from the Turnpike and the Calvary Church of the Nazarene. The stream channel is incised and over-widened with moderate to severe erosion occurring on the outside of meanders. Recommendations include regrading and stabilizing eroded stream banks, altering the current stream alignment and installing stone toe protection.

AC9216 Stream Restoration

This is a stream restoration project for two channels behind Americana Drive in the Lafayette Forest neighborhood. Both channels are currently incised and over-widened and eroding on meander bends and straight sections. Recommendations include reducing the stream channel dimensions, raising the bed elevation to reconnect each channel to the floodplain and installing grade controls to prevent future incision and over-widening of the channel.

AC9217 Stream Restoration

This is a stream restoration project behind Donnybrook Court. Field assessment indicated an absence of riparian buffer and moderate erosion along the stream banks. Restoration will focus on reconnecting higher flows to the original floodplain to dissipate energy and encourage deposition of sediment on the floodplain. Other restoration components include reducing the existing channel dimensions, installing grade controls in the stream channel restoring areas of deficient riparian buffers.

AC9218 Stream Restoration

The stream channel between Hummer Road and Pleasant Ridge Road in the Pleasant Ridge neighborhood is incised with areas of active erosion and presents an opportunity for stream restoration. Recommendations include constructing nested benches throughout the reach and restore riparian buffer where applicable.

AC9230 Stream Restoration

This project entails restoring the existing stream channel located in Wakefield Park between I-495 and Queen Elizabeth Boulevard that is deeply incised and experiencing severe bank and bed erosion. Restoring the channel will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques and installing grade controls to dissipate energy.

AC9231 Stream Restoration

This project entails restoring overflow stream channels located within the eastern floodplain of Accotink Creek between I-495 and Toll House Road in Wakefield Park. Currently, these channels are deeply incised with bank and bed erosion. Restoration would include repairing bank erosion with armor-in-place and bioengineering techniques and installing grade controls.

AC9232 Stream Restoration

This project entails restoring the existing stream channel located within Wakefield Park that is located between I-495 and Toll House Road which extends from the culvert under I-495 downstream to the confluence with Accotink Creek. Currently, this channel is experiencing severe bank and bed erosion and is deeply incised. This restoration would regrade and stabilize the eroded banks and install grade controls to dissipate energy.

AC9233 Stream Restoration

This project entails restoring an existing stream channel that is experiencing severe bank and bed erosion and is deeply incised located within Wakefield Park between I-495 and Briar Creek Drive. The channel extends from the downstream side of the culvert under I-495 downstream to the confluence with Accotink Creek. Restoration would include regrading and stabilizing eroded stream banks and installing grade controls.

AC9304 Area-Wide Drainage Improvements

There are no existing stormwater management facilities in the subwatershed. Area-wide drainage improvements are recommended to treat the runoff from the medium-density Ravensworth Park and Bristow residential areas through the installation of tree box filters, swales and bioretention filters.

AC9311 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the untreated medium-density areas of the Ramblewood subdivision are recommended here. Projects include installing tree box filters, disconnecting downspouts and installing rain gardens.

AC9535 New BMP/LID

This site, in Wakefield Chapel Estates, experiences concentrated flows across a yard to an outlet. Recommendations include adding a vegetated swale and check dams. Outreach and education is proposed for this neighborhood as part of project AC9935.

AC9538 New BMP/LID

Project recommendations include converting three existing dry ponds in the parking lot at Northern Virginia Community College dry ponds to bioretention cells or extended detention through modifying outlets and excavating the ponds to increase storage. The bottom of the existing ponds would be excavated and the outlets modified to provide additional water quality treatment.

AC9539 New BMP/LID

This project is a potential parking lot retrofit at Annandale Terrace Elementary School. Currently, there are no stormwater management facilities on this site. Recommendations include adding bioretention facilities in the parking lot medians to provide water quality control and installing tree box filters at the existing storm drain inlets.

AC9541 New BMP/LID

This is a potential parking lot retrofit at Little River Shopping Center on Little River Turnpike. Recommendations include the addition of bioretention cells in parking lot islands along Little River Turnpike to provide water quality control.

5.9.1.2 25-Year Projects

AC9159 New Stormwater Pond

There is an existing grass swale receiving runoff from the Townes of Wakefield development along Braddock Road at the south end of Howery Field Park. The project proposes converting the swale to a stormwater pond by using a berm and creating wetlands to provide water quality treatment.

AC9160 Stormwater Pond Retrofit

This project is a retrofit of wet pond WP0195 which treats stormwater runoff from the medium-density residential area of Chapel Lake, along Chapel Lake Court. Recommendations include removing trees from the embankment, modifying the riser to provide storage, excavating the pond bottom for storage and create an aquatic bench around the pond perimeter. There are wetland elements around pond edge but the existing pond banks are beginning to erode. There are no modifications necessary for the existing inlets.

AC9165 Stormwater Pond Retrofit

This is a potential retrofit of dry pond 0102DP behind Whitman Road in Camelot Greens to be converted to a shallow wetland facility. This project will install a new riser structure in place of the existing headwall, remove trees impacting the facility and excavating for additional storage.

AC9166 Stormwater Pond Retrofit

A retrofit is proposed for the dry pond (0627DP) behind Donnybrook Court in the Lafayette Forest neighborhood. Proposed project recommendations include adding a forebay, lengthening the channel flow path, excavating for additional volume and modifying the riser to maximize the volume available for wet storage.

AC9167 Stormwater Pond Retrofit

This is a potential retrofit of dry pond 0128DP that treats multifamily residential homes in the Lafayette Park West neighborhood. The project recommendations include excavating the pond bottom for additional volume storage, replanting vegetation on side slopes and bottom, adding a forebay and lengthening the flow path.

AC9168 Stormwater Pond Retrofit

This project is a retrofit of dry pond 0178DP that treats stormwater runoff from high and medium-density residential areas in the Adams Walk neighborhood. Recommendations include modifying the riser, excavation and installing micropools or plunge pools at inlets for increased settlement of sediment and energy dissipation.

AC9169 Stormwater Pond Retrofit

This project is a retrofit of a long narrow dry pond (DP0373) located in the parking lot at the Wachovia building between Hummer Road and Woodland Road. The project includes converting the pond to a bioretention facility to provide water quality treatment.

AC9170 Stormwater Pond Retrofit

This proposed project is to retrofit existing dry pond 0314DP to an extended detention facility to treat a part of the Lafayette Village neighborhood. Field assessment indicated badly eroded inlet channels and an eroded downstream channel. Recommendations include modifying the riser, adding a forebay at the inlet and a micropool at the outlet.

AC9407 Culvert Retrofit

A retrofit is proposed at the upstream end of the road culvert under Private Lane. The area is flat and would provide some storage as well as water quality benefits through a micropool and plantings.

AC9534 New BMP/LID

This site is a former school converted into the Annandale District Government Center. A bioretention facility is proposed to treat the runoff from the parking lots.

AC9536 New BMP/LID

This project identifies potential areas for a downspout disconnection and installation of bioretention facilities at Wakefield Forest Elementary School. Rain gardens may also be possible here.

AC9537 New BMP/LID

This project proposes to convert an existing swale in Wakefield Chapel Park to a step-pool bioretention facility to provide additional water quality control. The swale now drains single-family residential homes in the Wakefield Chapel Estates neighborhood.

AC9700 Outfall Improvement

This project will reconstruct the storm drain outfall in Wakefield Park to a step pool wetland to provide additional water quality control through removal of an existing concrete channel and excavation of the area. The channel now drains single-family residential homes on Mockingbird Drive and a part of Duncan Drive.

AC9701 Outfall Improvement

This proposed project is located at the upstream edge of Wakefield Park where drainage from a single-family residential area in the Chestnut Hill neighborhood flows into the park. Project recommendations include removing the concrete channel below the outfall and constructing a step pool wetland system to provide additional water quality control.

5.9.2 Non Structural Projects

AC9900 Community Outreach/Public Education - Stenciling

This community-wide project involves marking the storm drains within the Ravensworth Grove, Ravensworth Park, Bristow, Cedar Crest, Heritage Hill, Wakefield Chapel Estates, Chestnut Hill, Fairfax Hill, Tollhouse Woods and Monroe Knolls communities. The stencil marking can educate the public, reduce dumping and reduce the amount of litter and pollutants that enter the storm drain system.

AC9903 Inspection/Enforcement Enhancement Project - Outdoor Materials

Materials that are stored outdoors are subjected to precipitation, making them a possible source of stormwater runoff pollution. One site in this WMA had improper storage of materials. This project would be a community-wide enforcement and outreach approach to check for stormwater pollution prevention plans and to educate property owners.

AC9904 Rain Barrel Programs - Rain Barrels

Rain barrels provide the first step for residents to disconnect their downspout. This project would be a community-wide outreach program to encourage their use. Several neighborhoods were identified during the upland reconnaissance with roof drainage that would be suitable for this approach. These included Ravensworth Grove, Ravensworth Park, Bristow, Cedar Crest, Heritage Hill, Wakefield Chapel Estates, Chestnut Hill, Fairfax Hill, Tollhouse Woods and Monroe Knolls Truro, Wakefield Chapel Woods, and Wakefield Forest, Woods of Ilda, and Oak Hill.

AC9906 Inspection/Enforcement Enhancement Project - Litter/Trash Enforcement

Litter and trash enforcement is done through the enforcement of regulations for illegal dumping, litter laws, or unsecure truck loads. Community outreach programs for beautifying neighborhoods, including health and safety information, can be used effectively in the implementation of the programs. The areas flagged for enforcement include Parliament Apartments and Fairmont Garden Apartments.

AC9908 Inspection/Enforcement Enhancement Project - Dumpster Maintenance

One source of litter and pollutants in stormwater runoff is poorly maintained dumpsters and other waste management practices. This project is a community-wide enforcement and outreach approach to properties where problems were identified during the upland reconnaissance. Dumpsters in this WMA were flagged as hotspots with grease stains and little to no evidence of appropriate management.

AC9909 Rain Barrel Programs - Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, it includes the area around Willow Woods and Bristow Village.

AC9910 Street Sweeping Program - Street Sweeping

The Truro and Oak Hill neighborhoods were found to have trash, litter, or organic debris in the curb and gutter, flowing to storm drain inlets. This project consists of developing or extending a street sweeping program to remove potential pollutants from the street before they can wash into a storm drain or a stream.

AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

Eleven sites were identified with significant obstructions or dumpsites during the stream assessment. This project would be a community-wide program to remove trees and debris blocking fish passage, and trees and yard waste within the stream.

AC9935 Community Outreach/Public Education - Tree Planting

Four communities assessed during the upland reconnaissance could be sites for a watershed-wide outreach program to encourage tree planting and urban reforestation. These include Truro, Wakefield Chapel Woods, Park Glen Heights and Oak Hill.

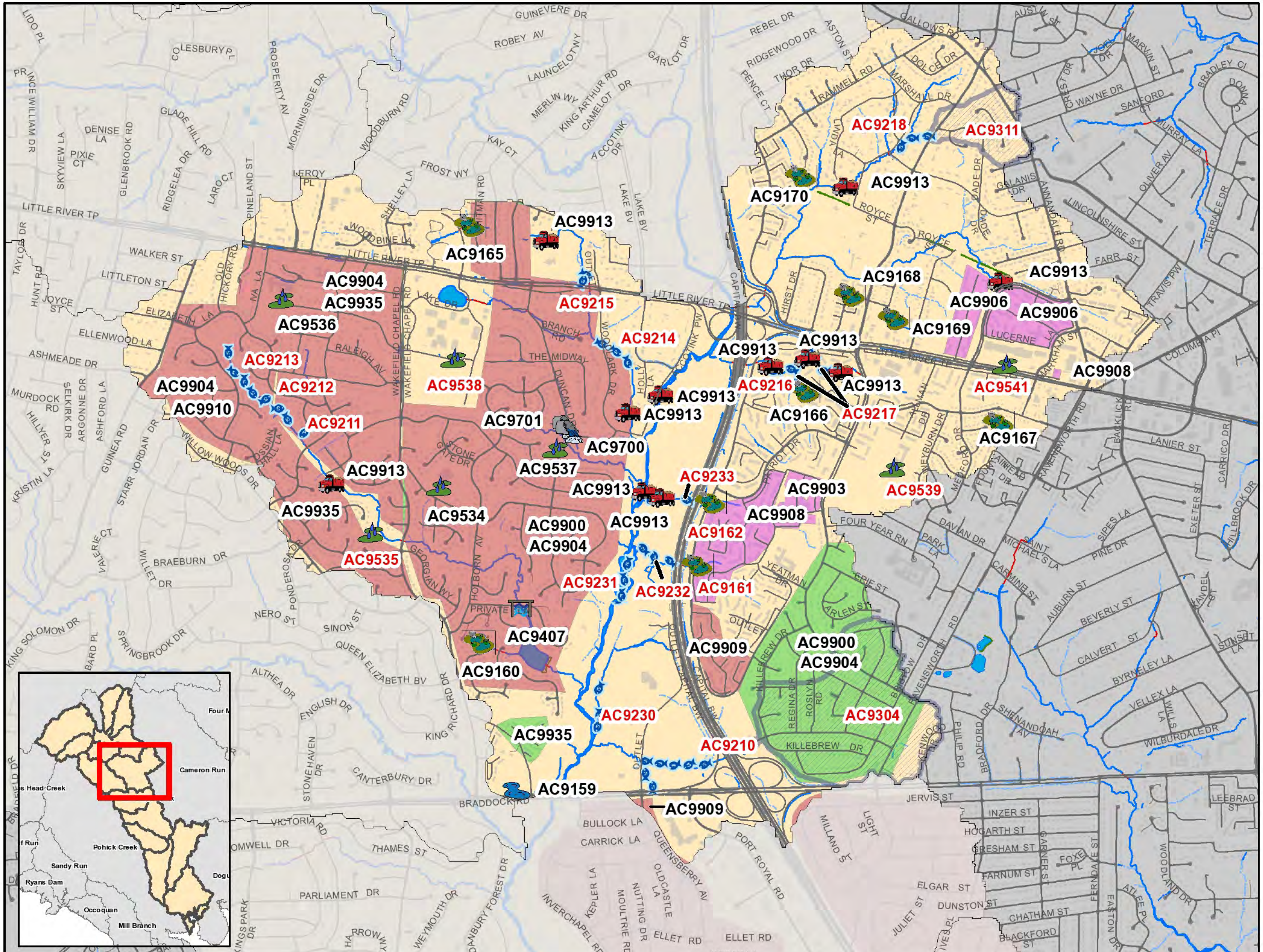
Table 5-9: Mainstem 3 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9161	Stormwater Pond Retrofit	AC-AC-0295	Patriot Village neighborhood	Water Quality	Private - Residential	1 - 10
AC9162	Stormwater Pond Retrofit	AC-AC-0300	Patriot Village neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9210	Stream Restoration	AC-AC-0280	Wakefield Park neighborhood	Water Quality	County - FCPA	1 - 10
AC9211	Stream Restoration	AC-TR-0010	Truro neighborhood	Water Quality	Private - Residential	1 - 10
AC9212	Stream Restoration	AC-TR-0010	Truro neighborhood	Water Quality	Private - Residential	1 - 10
AC9213	Stream Restoration	AC-TR-0010	Truro neighborhood	Water Quality	Private - Residential	1 - 10
AC9214	Stream Restoration	AC-AC-0320	Wakefield Park	Water Quality	County - FCPA	1 - 10
AC9215	Stream Restoration	AC-AC-0320	Mill Creek Park neighborhood	Water Quality	Private / State - VDOT	1 - 10
AC9216	Stream Restoration	AC-AC-0315	Lafayette Forest neighborhood	Water Quality	Private - Residential	1 - 10
AC9217	Stream Restoration	AC-AC-0315	Lafayette Forest neighborhood	Water Quality	Private - Residential	1 - 10
AC9218	Stream Restoration	AC-CO-0020	Pleasant Ridge neighborhood	Water Quality	Private - Residential	1 - 10
AC9230	Stream Restoration	AC-AC-0280	Wakefield Park	Water Quality	County - FCPA	1 - 10
AC9231	Stream Restoration	AC-AC-0285	Wakefield Park	Water Quality	County - FCPA	1 - 10
AC9232	Stream Restoration	AC-AC-0285	Wakefield Park	Water Quality	County - FCPA	1 - 10
AC9233	Stream Restoration	AC-AC-0285	Wakefield Park	Water Quality	County - FCPA	1 - 10
AC9304	Area-Wide Drainage Improvements	AC-AC-0290	Ravensworth Park and Bristow neighborhoods	Water Quality	Private	1 - 10
AC9311	Area-Wide Drainage Improvements	AC-CO-0020	Ramblewood neighborhood	Water Quality	Private	1 - 10
AC9535	BMP/LID	AC-TR-0005	Wakefield Chapel Estates	Water Quality	Private - Residential	1 - 10
AC9538	BMP/LID	AC-AC-0310	Northern Virginia Community College parking lot	Water Quality	State	1 - 10

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9539	BMP/LID	AC-AC-0315	Annandale Terrace Elementary School	Water Quality	County - FCPS	1 - 10
AC9541	BMP/LID	AC-AC-0315	Little River Shopping Center	Water Quality	Private - Commercial	1 - 10
AC9159	New Stormwater Pond	AC-AC-0280	Howery Field Park	Water Quality and Quantity	County - FCPA	11 - 25
AC9160	Stormwater Pond Retrofit	AC-TR-0000	Chapel Lake	Water Quality and Quantity	Private - Residential	11 - 25
AC9165	Stormwater Pond Retrofit	AC-AC-0320	Camelot Greens	Water Quality and Quantity	Private - Residential	11 - 25
AC9166	Stormwater Pond Retrofit	AC-AC-0315	Lafayette Forest	Water Quality	Private - Residential	11 - 25
AC9167	Stormwater Pond Retrofit	AC-AC-0315	Lafayette Park West	Water Quality and Quantity	Private - Residential	11 - 25
AC9168	Stormwater Pond Retrofit	AC-CO-0000	Adams Walk	Water Quality	Private - Residential	11 - 25
AC9169	Stormwater Pond Retrofit	AC-CO-0005	Wachovia Building on Woodland Rd	Water Quality	Private - Commercial	11 - 25
AC9170	Stormwater Pond Retrofit	AC-CO-0015	Lafayette Village	Water Quality	Private - Residential	11 - 25
AC9407	Culvert Retrofit	AC-TR-0000	Between Private Ln and Queen Elizabeth Blvd	Water Quality	State - VDOT	11 - 25
AC9534	BMP/LID	AC-TR-0000	Annandale District Govt Center	Water Quality	County	11 - 25
AC9536	BMP/LID	AC-TR-0010	Wakefield Forest Elementary School	Water Quality	County - FCPS	11 - 25
AC9537	BMP/LID	AC-AC-0310	Wakefield Park	Water Quality	County - FCPA	11 - 25
AC9700	Outfall Improvement	AC-AC-0310	Wakefield Park	Water Quality	County - FCPA	11 - 25
AC9701	Outfall Improvement	AC-AC-0310	Wakefield Park	Water Quality	County - FCPA	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9900	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9903	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9904	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9906	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9908	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9910	Street Sweeping Program	Multiple	Multiple	Water Quality	Multiple
AC9913	Dumpsite/Obstruction Removal	Multiple	Multiple	Water Quality	Multiple
AC9935	Community Outreach/Public Education	Multiple	Multiple	Water Quality and Quantity	Multiple



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- Buffer Restoration
- Stream Restoration
- BMP/LID
- Culvert Retrofit
- Dumpsite/Obstruction Removal
- New Stormwater Pond
- Outfall Improvement
- Stormwater Pond Retrofit
- Other

- Community Outreach/ Public Education
- Area-wide Drainage Improvements
- Land Conservation Project
- Flood Protection/ Mitigation
- Inspection/Enforcement Enhancement Project
- Rain Barrel Programs
- Street Sweeping Program
- Studies, Surveys and Assessments

Implementation timeframe denoted by project label color.
Red = 0-10 years Black = 11-25 years.

Map 5.9

WMA: Mainstem 3
Proposed Projects

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5.10 Accotink Mainstem 4

The results of the subwatershed ranking analysis showed a significant number of subwatersheds in Mainstem 4 WMA to be in good condition primarily due to the influence of undeveloped parcels of Lake Accotink Park. In terms of overall ranking, Mainstem 4 had four highest priority subwatersheds in the watershed.

5.10.1 Structural Projects

5.10.1.1 10-Year Projects

Accotink Mainstem 4 Stream Restoration Projects -- Three stream restoration projects and two culvert retrofits have been proposed on the tributary draining Kings Park and continuing into Lake Accotink Park. These projects should be constructed starting at the upstream end with AC9207 in Kings Park, followed by AC9206 downstream. Culvert retrofit AC9408 may provide some attenuation in flows which should be accounted for before designing stream restoration project AC9205. The final project in the series is culvert retrofit AC9402.

AC9205 Stream Restoration

This is a potential stream restoration site behind Thames Street in Lake Accotink Park in the Kings Park subdivision. Field investigation indicated moderate stream bank erosion and parts of the stream was widened to over 100 feet in many areas. The recommendation is to reconnect the channel to the floodplain by reducing channel dimensions and raising the bed elevation.

AC9206 Stream Restoration

This is a potential stream restoration site in the Kings Park subdivision between Thames Street, Victoria Street and Perth Court. Field investigations found the stream with moderate incision and stream bank erosion and over-widened stream conditions. An existing sanitary sewer crossing encased in concrete as well as an exposed sewer manhole standpipe are present in the stream channel. Recommendations include reconnecting this channel to the floodplain, possible channel relocation to redirect flows away from existing infrastructure, regrading and stabilization.

AC9207 Stream Restoration

This project is located entirely within Kings Park and extends from the end of Trafalgar Court to a culvert under Cromwell Drive. The current sinuous, incised, and over-widened stream channel is eroding on the outside of meander bends as well as along straight segments of the steam. Recommendations include creating a nested channel, reducing the existing channel dimensions and installing grade controls as well as armor-in-place stabilization techniques or stone toe protection.

AC9229 Stream Restoration

This project is intended to restore an eroded section of Flag Run located between the north side of the Capital beltway (I-495) and the south side of Queensberry Avenue. Currently, this channel is experiencing severe bank and bed erosion. The project would include regrading and stabilizing the eroded stream banks, protecting the outfall and potentially replacing the existing culvert with a bottomless arch culvert.

AC9302 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the large medium-density residential area in the Ravensworth neighborhood by installing tree box filters at various inlets throughout the neighborhood.

AC9303 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the untreated medium-density residential area in the Kings Park subdivision by installing tree box filters at inlets, disconnecting downspouts and installing rain gardens.

AC9400 Culvert Retrofit

This project, located at the road culvert under Queensbury Avenue in Lake Accotink Park, would modify the control structure to manage the high frequency storm events, reduce stream channel erosion and improve water quality. The project is located downstream of stream restoration project AC9229 and culvert retrofit AC9401. Design of all three projects should be performed concurrently.

AC9401 Culvert Retrofit

A culvert retrofit is proposed under the Capital Beltway in North Springfield. This project would add a control structure on the upstream side of the road culvert to control small, high frequency storms, primarily for water quality control. The project is located in the middle of two segments of stream restoration project AC9229 and upstream of culvert retrofit AC9400. Design of all three projects should be performed concurrently.

5.10.1.2 25-Year Projects

AC9142 New Stormwater Pond

This site is located at an industrial area on Morrissette Drive. Proposed recommendations include adding a new wetland to provide storage and a forebay at the outfall to provide water quantity and quality control. The project may be constrained by an electric line overhead.

AC9402 Culvert Retrofit

This project proposes to retrofit the upstream side of the road culvert under Danbury Forest Drive in Lake Accotink Park. This would add a control structure on the upstream side of the culvert to regulate discharge of the small, high frequency storms.

AC9403 Culvert Retrofit

This is a potential retrofit of a road culvert under Southampton Drive in the Kings Park neighborhood. Recommendations include adding a control structure on the upstream side of the road culvert to control the storm surge from rain events.

AC9523 New BMP/LID

Several bioretention facility options are proposed at the North Springfield Elementary School. Recommendations include adding a bioretention facility at the end of the main parking area, bioretention or rain gardens at the downspouts, disconnecting downspouts and adding stormwater planters on the side near the secondary parking area.

AC9524 New BMP/LID

This project is located at the Church of Jesus Christ on Inver Chapel Road. Proposed project recommendations include disconnecting downspouts, directing the runoff to rain gardens at the back of the church and treating the parking lot runoff by implementing bioretention at both ends of the parking lot. There is also potential to disconnect downspouts on apartment buildings on Rexford Court and route the flow toward a new bioretention in an open grassy area.

AC9525 New BMP/LID

A series of bioretention filters are proposed at yard inlets draining Tivoli Condominiums behind Torington Drive to treat the impervious runoff. Recommendations include modifying the existing storm drain structure to allow minimal ponding and adding plantings around the structures for uptake.

AC9526 BMP/LID Retrofit

This project recommends a bioretention facility at the rear of the West Springfield Business Center parking lot at the industrial area on Morrissette Drive. The proposed bioretention would treat the runoff from the parking lot used for fleet storage and the fueling area.

AC9527 New BMP/LID

This is a potential parking lot retrofit at Kings Park Elementary School. Three bioretention facilities are proposed at yard inlets on the site to capture and treat stormwater runoff.

5.10.2 Non Structural Projects

AC9903 Inspection/Enforcement Enhancement Project - Outdoor Materials

Materials that are stored outdoors are subjected to precipitation, making them a possible source of stormwater runoff pollution. Three sites in this WMA had an uncovered fueling area, large dirt mounds without cover, or building materials stored outside. This project would be a community-wide enforcement and outreach approach to check for stormwater pollution prevention plans and to educate property owners.

AC9909 Rain Barrel Programs - Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, it includes the areas around Ravensworth, Springfield and Kings Park.

AC9913 Dumpsite/Obstruction Removal - Dumpsite/Obstruction

Four sites were identified with significant obstructions or dumpsites during the stream assessment. This project would be a community-wide program to remove trees and concrete within the stream blocking fish passage.

Table 5-10: Mainstem 4 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9205	Stream Restoration	AC-AC-0270	Lake Accotink Park	Water Quality	County - FCPA	1 - 10
AC9206	Stream Restoration	AC-AC-0270	Kings Park neighborhood	Water Quality	Private - Residential	1 - 10
AC9207	Stream Restoration	AC-AC-0275	Kings Park	Water Quality	County - FCPA	1 - 10
AC9229	Stream Restoration	AC-FR-0000, -0005	Flag Run Park, Lake Accotink Park / I-495	Water Quality	County - FCPA / State - VDOT	1 - 10
AC9302	Area-Wide Drainage Improvements	AC-AC-0240	Ravensworth neighborhood	Water Quality	Private - Residential	1 - 10
AC9303	Area-Wide Drainage Improvements	AC-AC-0260	Kings Park neighborhood	Water Quality	Private	1 - 10
AC9400	Culvert Retrofit	AC-FR-0000	Queensberry Ave	Water Quality	State - VDOT	1 - 10
AC9401	Culvert Retrofit	AC-FR-0005	I-495	Water Quality	State - VDOT	1 - 10
AC9142	New Stormwater Pond	AC-AC-0260	Behind Morrissette Dr	Water Quality and Quantity	Private - Utility	11 - 25
AC9402	Culvert Retrofit	AC-AC-0270	Lake Accotink Park	Water Quality and Quantity	State - VDOT	11 - 25
AC9403	Culvert Retrofit	AC-AC-0270	Lake Accotink Park	Water Quality	State - VDOT	11 - 25
AC9523	BMP/LID	AC-FR-0005	North Springfield Elementary School	Water Quality	County - FCPS	11 - 25
AC9524	BMP/LID	AC-AC-0235	Church of Jesus Christ and behind Rexford Ct	Water Quality	Private	11 - 25
AC9525	BMP/LID	AC-AC-0248	Tivoli Condominiums	Water Quality	Private	11 - 25
AC9526	BMP/LID	AC-AC-0260	West Springfield Business Center	Water Quality	Private - Commercial	11 - 25
AC9527	BMP/LID	AC-AC-0270	Kings Park Elementary School	Water Quality	County - FCPS	11 - 25
AC9703	Outfall Improvement	AC-AC-0270	Lake Accotink Park	Water Quality	County - FCPA	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9903	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9913	Dumpsite/Obstruction Removal	Multiple	Multiple	Water Quality	Multiple

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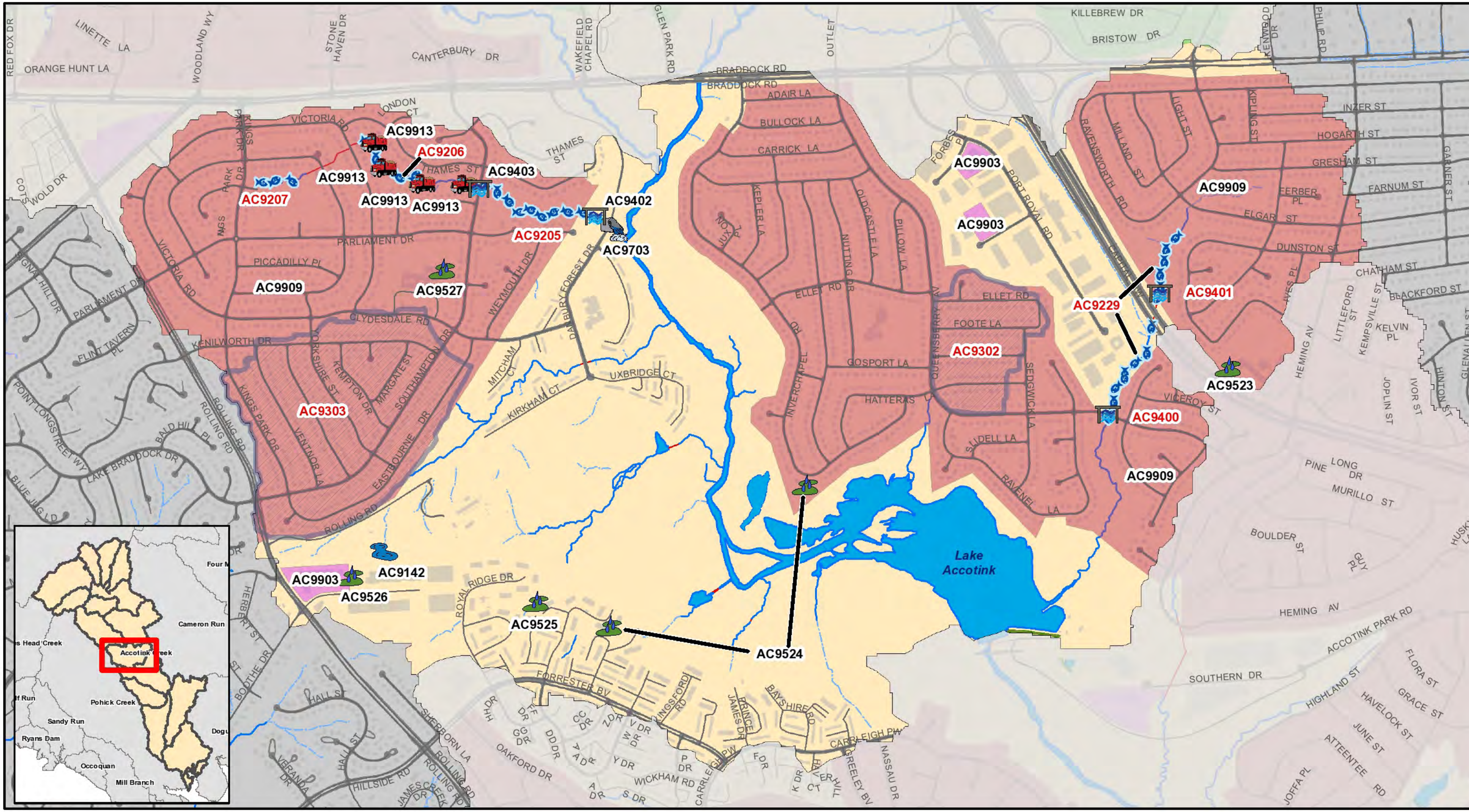

Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.

Map 5.10

WMA: Mainstem 4
Proposed Projects

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5.11 Accotink Mainstem 5

The results of the subwatershed ranking analysis showed all except three subwatersheds in Mainstem 5 WMA to be in good condition, primarily due to the influence of undeveloped parcels of Accotink Stream Valley Park. Only two subwatersheds were ranked as highest priority in the watershed.

5.11.1 Structural Projects

5.11.1.1 10-Year Projects

<u>AC9139 Stormwater Pond Retrofit</u>

This is a retrofit of existing dry pond 0935DP which will be converted to an extended detention facility through removing the concrete channel in the pond and replacing it with a meandering channel and modifying the riser to reduce stream channel erosion downstream.

<u>AC9201 Stream Restoration</u>

This stream restoration parallels Bardu Avenue in the Accotink Stream Valley Park. The upstream portion of the channel is relatively stable except for minor to moderate erosion occurring in isolated areas, and the downstream portion is very sinuous with moderate to severe erosion and over-widening evident. A partially exposed sanitary sewer crossing is present in the downstream portion of the project site. Recommendations include reducing the current channel dimensions, redirecting flows away from eroded meanders and installing grade controls to dissipate stream energy and prevent further widening. Armor-in-place or bioengineering stabilization techniques and stone toe protection may be needed on outer meander bends and at the sanitary sewer line crossing.

<u>AC9202 Stream Restoration</u>

The upstream portion of the channel is relatively stable except for minor to moderate erosion occurring in isolated areas, and the downstream portion is very sinuous with moderate to severe erosion and over-widening evident. A partially exposed sanitary sewer crossing is present in the downstream portion of the project site. The upstream section of the reach is severely eroded near the outfall; the downstream portion of this project is incised and experiencing moderate stream bank erosion. Restoration of the upstream portion of this project will focus on raising the bed elevation of the channel as well as regrading and stabilizing stream banks with armor-in-place or bioengineering techniques. The downstream portion of this project will focus on reconnecting this channel to the floodplain by reducing channel dimensions and raising the bed elevation.

<u>AC9203 Stream Restoration</u>

This proposed project is a stream restoration in Lake Accotink Park. Field investigation indicated areas of high stream bank erosion near Highland Street that require stabilization and an area under the sanitary sewer line that is actively eroding. Project recommendations include stream bank stabilization and installing flow deflectors upstream to direct the stream away from the stream bank.

<u>AC9204 Stream Restoration</u>

This is a potential stream restoration site along Heming Avenue in Lake Accotink Park. Field investigation indicated stream bank erosion on meanders and straight sections, including at a storm drain outfall. Recommendations include reconnecting this channel to the original floodplain by reducing channel dimensions and raising the bed elevation. Grade controls should also be installed and the storm drain outfall corrected.

5.11.1.2 25-Year Projects

AC9137 Stormwater Pond Retrofit

This is a proposed retrofit of existing dry pond 0013DP behind Villa Park Road. Recommendations include removing the concrete channels and adding a riser for the outlet and a forebay micropool. Raising the outlet could provide water quality control and channel erosion control without sacrificing large storm detention.

AC9138 Stormwater Pond Retrofit

This project proposes to retrofit the existing dry pond (DP0049), which treats the stormwater runoff from the Toyota Dealership on Amherst Avenue, by widening and excavating the pond for water quality volume storage. No changes are recommended for the riser.

AC9140 Stormwater Pond Retrofit

This project recommends to retrofit wet pond WP0257 between Attendee Road and Floyd Avenue in Brookfield Park. Field assessment indicated that the only outlet for the pond is the spillway and that the pond receives stormwater but does not provide storage. Proposed recommendations include adding an aquatic bench and modifying the outlet and excavating the pond to provide storage.

AC9141 Stormwater Pond Retrofit

This project proposes a retrofit of dry pond DP0415 along Highland Street in the Highland Business Park. Recommendations include modifying the riser, removing concrete channels and lengthening the flow path. The bottom of the pond is swampy and could potentially be converted to a wetland or a pond with wetland elements.

AC9516 New BMP/LID

This project recommends the installation of a bioretention facility or tree box filters to treat runoff at each storm drain inlet in Lee Valley Apartments.

AC9517 New BMP/LID

This project recommends installing a bioretention facility in the courtyard at Garfield Elementary School to treat parking lot runoff and a grass swale to be constructed between the parking lot and fence.

AC9518 New BMP/LID

There are numerous downspouts that can be disconnected at Springfield United Methodist Church to improve water quality treatment. Additional recommendations include removing a concrete swale and converting the area to a vegetated swale and adding curb cuts at the edge of the parking lot to avoid concentrated flow to the swale.

AC9519 New BMP/LID

This project would treat the southern section of the parking lot of Springfield Shopping Plaza for water quality by creating rain gardens at depressed curb islands and adding bioretention at inlets.

AC9520 BMP/LID Retrofit

The northern section of Springfield Shopping Plaza is treated for water quantity control by existing underground facilities. Recommendations include installing rain gardens at depressed curb islands and providing bioretention at inlets to treat parking lot runoff for water quality.

AC9521 New BMP/LID

This parking lot retrofit is located at Saint Bernadette Church and School. Recommendations include adding a bioretention area in the back of the school and disconnecting downspouts to direct flow to the proposed bioretention facility.

AC9522 New BMP/LID

This proposed retrofit is located at Grace Presbyterian Church on Bath Street. The recommendation is to install a bioretention area along the parking lot to capture uncontrolled runoff. Some runoff is currently bypassing storm drains and causing stream bank erosion downstream of the site.

5.11.2 Non Structural Projects

AC9903 Inspection/Enforcement Enhancement Project - Outdoor Materials

Materials that are stored outdoors are subjected to precipitation, making them a possible source of stormwater runoff pollution. Two sites in this WMA had oil tanks stored outdoors or roofing material stored outdoors. This project would be a community-wide enforcement and outreach approach to check for stormwater pollution prevention plans and to educate property owners.

AC9908 Inspection/Enforcement Enhancement Project - Dumpster Maintenance

One source of litter and pollutants in stormwater runoff is poorly maintained dumpsters and other waste management practices. This project is a community-wide enforcement and outreach approach to properties where problems were identified during the upland reconnaissance. Dumpsters at one location in this WMA were flagged as a hotspot with evidence of being too full and overflowing grease barrels.

AC9909 Rain Barrel Programs - Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, they included the area around Keene Mill Manor, Cardinal Forest, Springfield and Monticello Forest.

AC9914 Community Outreach/Public Education - Turf Management

Outreach to turf managers is similar to that of lawn care; however, it is intended more for data gathering to assess current practices and education about runoff pollution. In this WMA, West Springfield, Hunter Village, Keene Mill Manor and Cardinal Forest were identified as a potential outreach sites.

Table 5-11: Mainstem 5 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9139	Stormwater Pond Retrofit	AC-AC-0185	Westhaven neighborhood	Water Quality	Private - Residential	1 - 10
AC9201	Stream Restoration	AC-AC-0195	Accotink Stream Valley Park	Water Quality	County - FCPA	1 - 10
AC9202	Stream Restoration	AC-AC-0200	Charlestown neighborhood	Water Quality	Private - Residential	1 - 10
AC9203	Stream Restoration	AC-AC-0215	Lake Accotink Park	Water Quality	County - FCPA	1 - 10
AC9204	Stream Restoration	AC-AC-0220	Lake Accotink Park	Water Quality	County - FCPA	1 - 10
AC9137	Stormwater Pond Retrofit	AC-CA-0005	Behind Villa Park Rd	Water Quality and Quantity	Private - Residential	11 - 25
AC9138	Stormwater Pond Retrofit	AC-CA-0010	Toyota Dealership on Amherst Ave	Water Quality and Quantity	Private - Commercial	11 - 25
AC9140	Stormwater Pond Retrofit	AC-AC-0205	Brookfield Park	Water Quality and Quantity	County - FCPA	11 - 25
AC9141	Stormwater Pond Retrofit	AC-AC-0215	Highland Business Park	Water Quality and Quantity	Private - Commercial	11 - 25
AC9516	BMP/LID	AC-CA-0000	Lee Valley Apts	Water Quality	Private	11 - 25
AC9517	BMP/LID	AC-CA-0010	Garfield Elementary School	Water Quality	County - FCPS	11 - 25
AC9518	BMP/LID	AC-CA-0010	Springfield United Methodist Church	Water Quality	Private - Church	11 - 25
AC9519	BMP/LID	AC-CA-0010	Springfield Plaza	Water Quality	Private	11 - 25
AC9520	BMP/LID	AC-CA-0010	Springfield Plaza	Water Quality	Private	11 - 25
AC9521	BMP/LID	AC-AC-0185	Saint Bernadette Church and School	Water Quality	Private - Church	11 - 25
AC9522	BMP/LID	AC-AC-0205	Grace Presbyterian Church	Water Quality	Private - Church	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9903	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9908	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9914	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple

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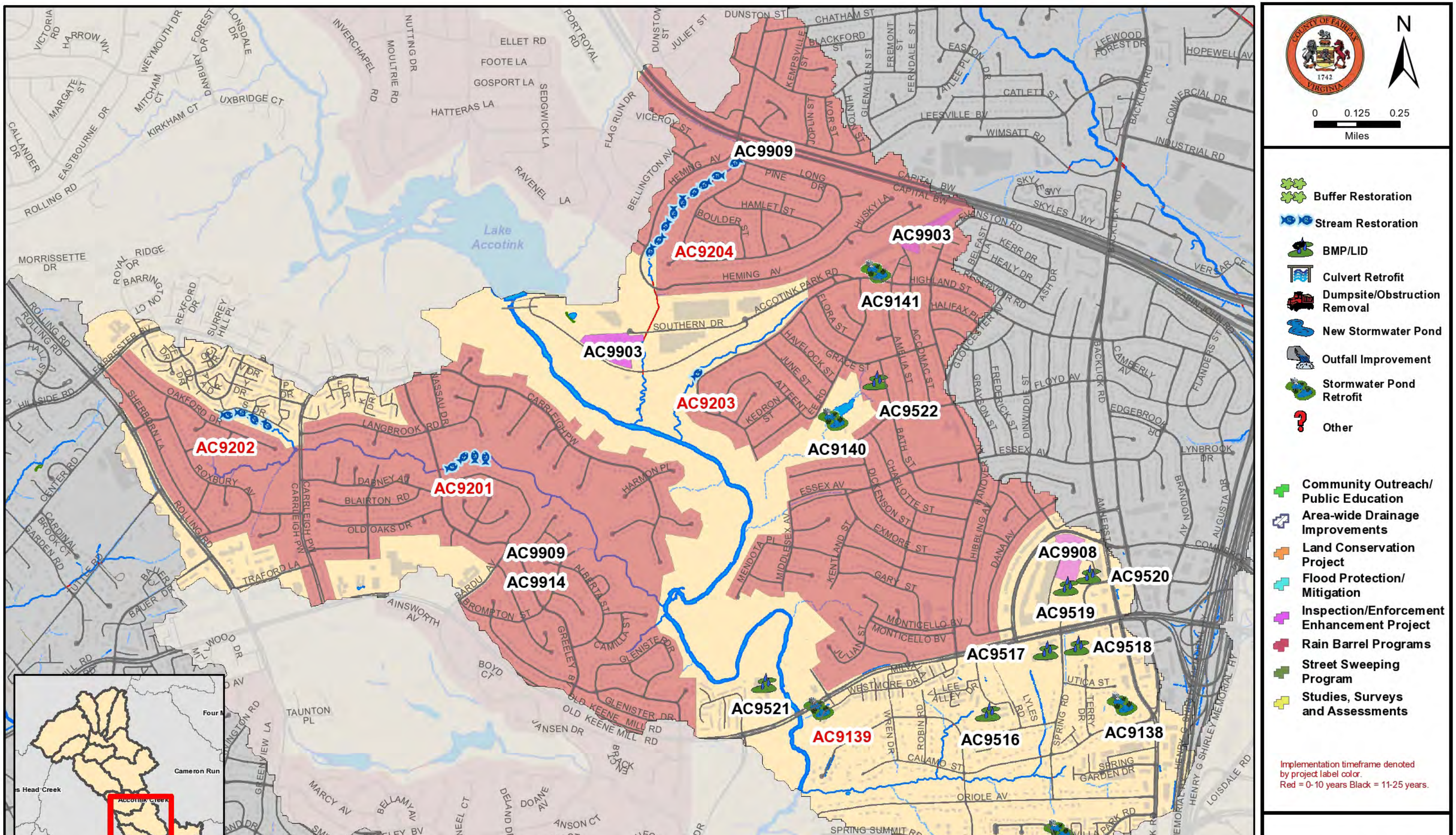

Map 5.11

WMA: Mainstem 5
Proposed Projects

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5.12 Accotink Mainstem 6

The results of the subwatershed ranking analysis showed all except three subwatersheds in Mainstem 6 WMA to be in good condition primarily due to the influence of undeveloped parcels of Ft. Belvoir, West Springfield Park, Accotink Stream Valley Park and Springfield Golf Course. Only two subwatersheds were ranked as highest priority for overall project.

5.12.1 Structural Projects

5.12.1.1 10-Year Projects

AC9133 Stormwater Pond Retrofit

This project is a retrofit of existing dry pond 0462DP located on the upstream side of Hunter Village Drive, which treats a high-density residential area in the Hunter Village neighborhood. To improve the treatment provided at this site, the project recommendation is to install a new riser structure and stabilize the existing stream channel into the facility.

AC9136 Stormwater Pond Retrofit

This project is a retrofit of a dry pond on Kenwood Avenue in the Kenwood Oaks neighborhood. Recommendations include excavating the bottom of the pond to create a shallow wetland and to provide additional storage by adjusting the outlet to maximize detention to improve water quality treatment.

AC9200 Stream Restoration

This project proposes to restore an eroded section of stream channel located in both private and public areas downstream of Greeley Boulevard. Restoration of this channel will focus on regrading and stabilizing eroded stream banks through the use of armor-in-place techniques on outer meander bends and bioengineering techniques on the inside meander bends and any straight portions of the channel.

AC9514 New BMP/LID

This project proposes to treat the parking lot runoff of the Cardinal Forest Plaza for water quality by constructing bioretention cells in the parking lot along Old Keene Mill Road.

AC9515 New BMP/LID

This project proposes to treat the parking lot runoff of the Old Keene Hills Shopping Center by implementing bioretention areas in parking islands or on the periphery of the lot.

5.12.1.2 25-Year Projects

AC9131 Stormwater Pond Retrofit

This project proposes to retrofit existing dry pond 0170DP, which treats the stormwater runoff from a medium-density residential area in the Shirley Springs neighborhood, by removing the concrete channel and excavating a micropool at the inlet to add water quality control.

AC9132 Stormwater Pond Retrofit

This proposed project is to retrofit the existing dry pond (0169DP), which treats the stormwater runoff from the low and medium-density residential areas in the Shirley Springs neighborhood by removing the concrete channel, excavating the bottom for water quality volume storage and adjusting the outlet size. Curb cuts are also recommended to treat runoff from the road.

<u>AC9134 Stormwater Pond Retrofit</u>

This proposed project includes converting the existing pond in the Rolling Forest neighborhood to a detention pond by removing concrete channels, adding plunge pools, modifying the riser and increasing the flow path. This will provide water quality treatment through extended detention.

<u>AC9135 Stormwater Pond Retrofit</u>

This is a project which groups retrofits of two small dry ponds: 0144DP behind Bethnal Place and a pond behind Caton Woods Court. The recommendation is to excavate both ponds for additional capacity to provide water quality along with the original detention control.

<u>AC9513 New BMP/LID</u>

The proposed project is to treat the rooftop runoff of the West Springfield Elementary School with a bioretention facility to improve the water quality onsite.

5.12.2 Non Structural Projects

<u>AC9907 Community Outreach/Public Education - Lawn Care</u>

This project would provide community-wide education and guidance to homeowners on lawn care practices that would potentially reduce pollutants in stormwater runoff. In this WMA, West Springfield and Hunter Village were identified as a potential outreach sites.

<u>AC9908 Inspection/Enforcement Enhancement Project - Dumpster Maintenance</u>

One source of litter and pollutants in stormwater runoff is poorly maintained dumpsters and other waste management practices. This project is a community-wide enforcement and outreach approach to properties where problems were identified during the upland reconnaissance. One area in this WMA was flagged with evidence of overflowing grease barrels.

<u>AC9909 Rain Barrel Programs - Downspout Disconnect</u>

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, they included the area around Keene Mill Manor, West Springfield and Hunter Village.

Table 5-12: Mainstem 6 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9133	Stormwater Pond Retrofit	AC-AC-0145	Hunter Village neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9136	Stormwater Pond Retrofit	AC-AC-0175	Kenwood Oaks neighborhood	Water Quality and Quantity	Private - Residential	1 - 10
AC9200	Stream Restoration	AC-AC-0160	Downstream from Greeley Blvd / Hunter Village Park	Water Quality	Private / County - FCPA	1 - 10
AC9514	BMP/LID	AC-AC-0170	Cardinal Forest Plaza	Water Quality	Private - Commercial	1 - 10
AC9515	BMP/LID	AC-AC-0175	Old Keene Mill Shopping Center	Water Quality	Private - Commercial	1 - 10
AC9131	Stormwater Pond Retrofit	AC-AC-0135	Bonniemill Acres neighborhood	Water Quality	Private - Residential	11 - 25
AC9132	Stormwater Pond Retrofit	AC-AC-0140	Shirley Springs neighborhood	Water Quality	Private - Residential	11 - 25
AC9134	Stormwater Pond Retrofit	AC-AC-0145	Rolling Forest neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9135	Stormwater Pond Retrofit	AC-AC-0180	Bethnal Pl and Caton Woods Ct	Water Quality and Quantity	Private - Residential	11 - 25
AC9513	BMP/LID	AC-AC-0160	West Springfield Elementary School	Water Quality	County - FCPS	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9908	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9914	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple

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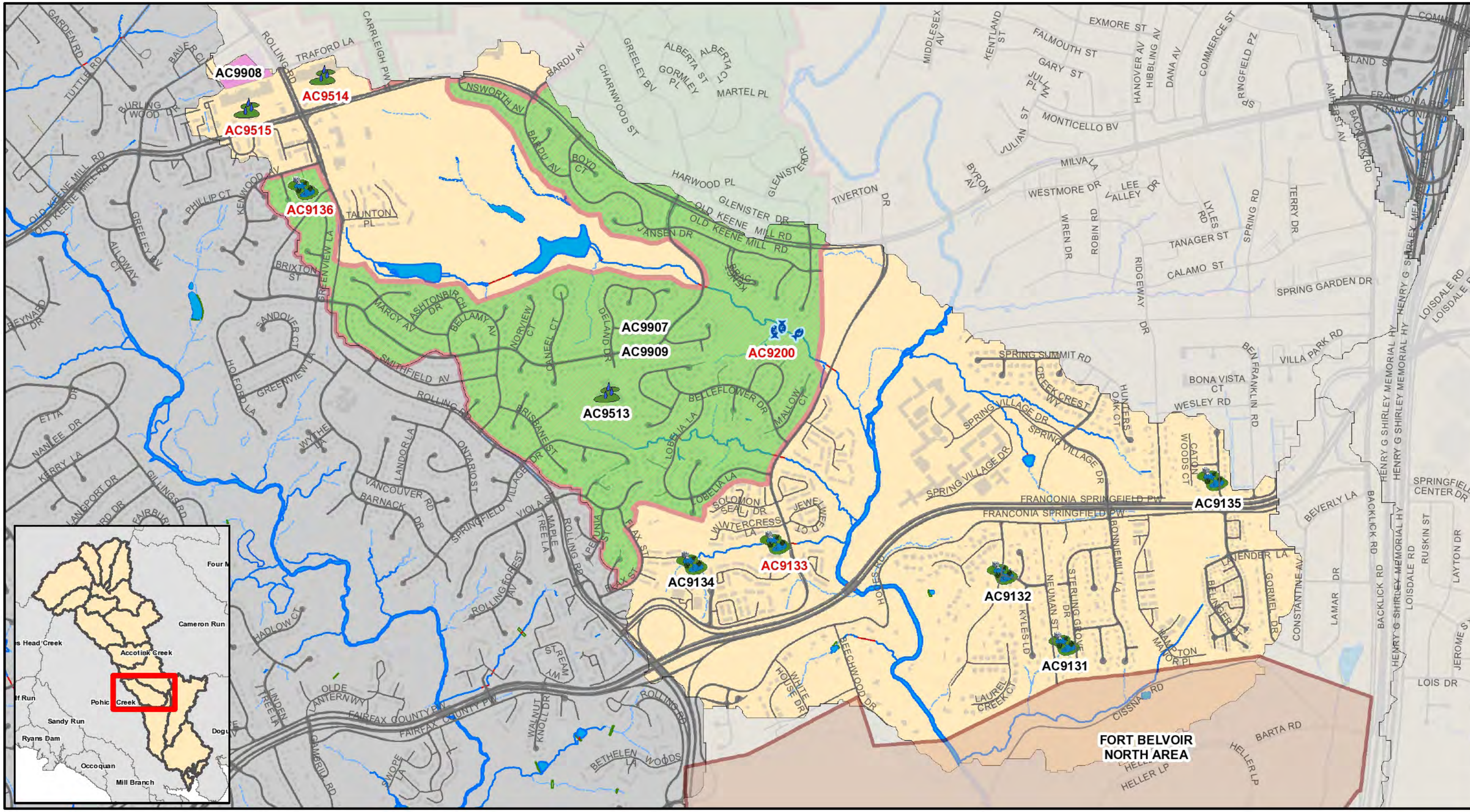

COUNTY OF FAIRFAX VIRGINIA 1742

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Miles

- Buffer Restoration
- Stream Restoration
- BMP/LID
- Culvert Retrofit
- Dumpsite/Obstruction Removal
- New Stormwater Pond
- Outfall Improvement
- Stormwater Pond Retrofit
- Other
- Community Outreach/Public Education
- Area-wide Drainage Improvements
- Land Conservation Project
- Flood Protection/Mitigation
- Inspection/Enforcement Enhancement Project
- Rain Barrel Programs
- Street Sweeping Program
- Studies, Surveys and Assessments

Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.

Map 5.12

WMA: Mainstem 6
Proposed Projects

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5.13 Accotink Mainstem 7

The results of the subwatershed ranking analysis showed six of the 16 subwatersheds in Mainstem 7 have low scores in water quality only; this is primarily due to the influence of industrial areas. Three subwatersheds in the northern portion of the WMA are in good condition because they are within the boundaries of the Fort Belvoir North Area. Four additional subwatersheds in the southern portion of the WMA are in good condition due to the influence of undeveloped park land. Only one subwatershed in the WMA scored among the lowest 40 percent of all the subwatersheds in Accotink Creek.

5.13.1 Structural Projects

5.13.1.1 10-Year Projects

AC9123 Stormwater Pond Retrofit

This project would retrofit the existing dry pond (DP0411) on Cinder Bed Road at Gateway 95 Business Park to provide increased water quality control. Recommendations include modifying the riser, adding plunge pools at the inflows and removing the concrete channels.

AC9126 Stormwater Pond Retrofit

The proposed project consists of retrofitting the existing dry pond (DP0338) at Alban Industrial Center off of Alban Road. The pond has almost no detention as the outlet structure is oversized. Recommendations include modifying the riser with a smaller outlet, removing concrete channels, excavating the bottom and lengthening the flow path.

AC9300 Area-Wide Drainage Improvements

Area-wide drainage improvements are recommended to treat the runoff from the medium-density residential area in the Pohick Estates neighborhood by installing tree box filters at curb inlets and rain gardens at yard inlets.

AC9509 New BMP/LID

The parking lot in Lockport Industrial Park off of Telegraph Square Drive currently drains to the floodplain with no stormwater management. This project recommends a installing a bioretention facility along the edge of the parking lot to treat runoff for water quality.

AC9510 BMP/LID Retrofit

The entire Lockport Industrial park is lacking water quality treatment. Recommend installing tree box filters at storm drain inlets to treat runoff for water quality.

AC9511 New BMP/LID

This project proposes to convert the existing grass swale at the Deer Park parking lot of Lockport Industrial Park to a bioretention facility to treat the parking lot runoff for water quality.

AC9512 New BMP/LID

This project proposes to construct a vegetated swale to provide water quality control in the area adjacent to the HRM Automotive parking lot off of Alban Road. Because of the slope of the site, the best approach is to construct it as a step pool system with check dams.

5.13.1.2 25-Year Projects

AC9124 Stormwater Pond Retrofit

This project proposes to convert existing dry pond DP0299 at Newington Commerce Center to a wet pond by installing a riser. This would promote additional water quality benefits through pollutant removal.

AC9125 Stormwater Pond Retrofit

Field assessment indicated that dry pond 0660DP in the Terra Grande neighborhood is functioning well but is accumulating sediment. Project recommendations include removing sediment and modifying the control structure to provide extended detention.

AC9127 Stormwater Pond Retrofit

This existing pond at the Alban Industrial Center is currently functioning as dry pond. Project recommendations include excavation of accumulated sediment and debris and installation of a new riser structure to provide extended detention for water quality treatment.

AC9128 Stormwater Pond Retrofit

Possible retrofits at dry pond 0582DP, between Springfield Hills Drive and Woodstown Drive in the Terra Grande neighborhood, include removing accumulated debris, modifying the riser and stabilizing the low flow channel to add water quality treatment to the existing quantity control.

AC9129 Stormwater Pond Retrofit

The existing pond at the VA 95 Industrial Park is proposed to be retrofitted to a wet pond by raising the outlet structure to provide additional water quality treatment.

AC9130 New Stormwater Pond

A car dealership on Alban Road has a large amount of untreated impervious surface. Recommendations include excavating for a new wet pond, using the existing storm drains as inflows and installing a riser to provide water quality and quantity treatment.

5.13.2 Non Structural Projects

AC9902 Inspection/Enforcement Enhancement Project - Vehicle Maintenance

This project would provide community-wide targeted enforcement of spill prevention and pollution prevention regulations for sites where vehicles are maintained. The upland reconnaissance identified two car washing areas discharging directly to a tree box filter device and a fleet washing facility discharging through a dry pond without treatment.

AC9903 Inspection/Enforcement Enhancement Project - Outdoor Materials

Materials that are stored outdoors are subjected to precipitation, making them a possible source of stormwater runoff pollution. Three sites in this WMA had an uncovered fueling area or gravel berms around gas storage tanks. This project would be a community-wide enforcement and outreach approach to check for stormwater pollution prevention plans and to educate property owners.

AC9904 Rain Barrel Programs - Rain Barrels

Rain barrels provide the first step for residents to disconnect their downspout. This project would be a community-wide outreach program to encourage their use. One neighborhood, Springfield Oaks, was identified during the upland reconnaissance with roof drainage that would be suitable for this approach.

AC9907 Community Outreach/Public Education - Lawn Care

This project would provide community-wide education and guidance to homeowners on lawn care practices that would potentially reduce pollutants in stormwater runoff. In this WMA, Pohick Estates, Terra Grande and Springfield Oaks were identified as a potential outreach sites.

AC9909 Rain Barrel Programs - Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, they included Pohick Estates and Terra Estates.

Table 5-13: Mainstem 7 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9123	Stormwater Pond Retrofit	AC-AC-0075	Gateway 95 Business Park	Water Quality	Private - Commercial	1 - 10
AC9126	Stormwater Pond Retrofit	AC-AC-0095	Alban Industrial Center	Water Quality and Quantity	Private - Commercial	1 - 10
AC9300	Area-Wide Drainage Improvements	AC-AC-0080	Pohick Estates neighborhood	Water Quality	Private	1 - 10
AC9509	BMP/LID	AC-AC-0070	Lockport Industrial Park	Water Quality	Private - Industrial	1 - 10
AC9510	BMP/LID	AC-AC-0070	Lockport Industrial Park	Water Quality	Private - Industrial	1 - 10
AC9511	BMP/LID	AC-AC-0080	Deer Park parking lot	Water Quality	Private - Industrial	1 - 10
AC9512	BMP/LID	AC-AC-0105	HRM Automotive	Water Quality	Private - Industrial	1 - 10
AC9124	Stormwater Pond Retrofit	AC-AC-0085	Newington Commerce Center	Water Quality	Private - Industrial	11 - 25
AC9125	Stormwater Pond Retrofit	AC-AC-0090	Terra Grande neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9127	Stormwater Pond Retrofit	AC-AC-0095	Alban Industrial Center	Water Quality and Quantity	Private - Commercial	11 - 25
AC9128	Stormwater Pond Retrofit	AC-AC-0095	Terra Grande	Water Quality and Quantity	Private - Residential	11 - 25
AC9129	Stormwater Pond Retrofit	AC-AC-0105	VA 95 Industrial Park	Water Quality	Private - Industrial	11 - 25
AC9130	New Stormwater Pond	AC-FL-0005	Alban Road	Water Quality and Quantity	Private - Commercial	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9902	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9903	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9904	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9914	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple

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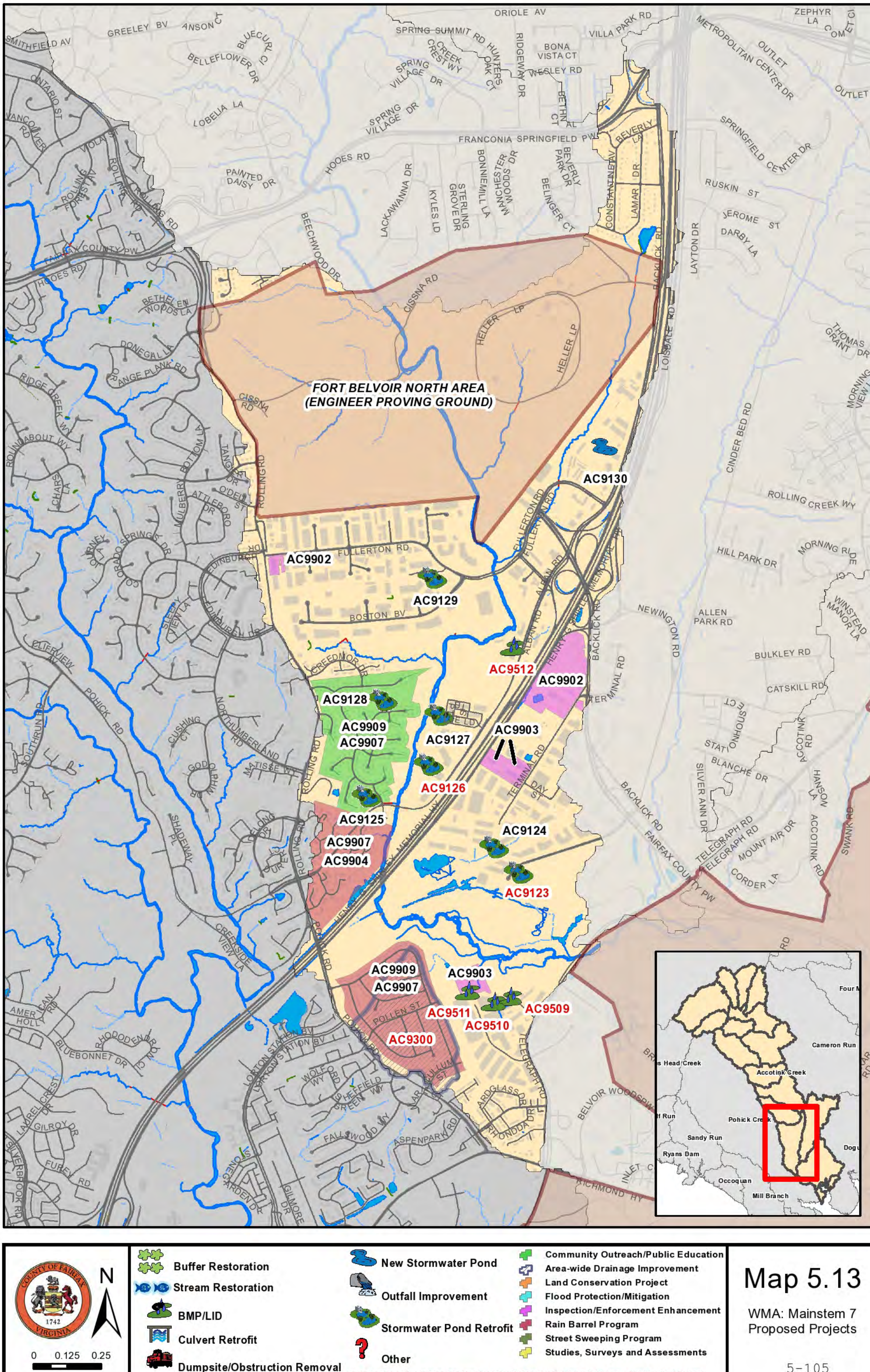

Map 5.13

WMA: Mainstem 7 Proposed Projects

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5.14 Accotink Mainstem 8

Almost all the subwatersheds of Mainstem 8 are either completely or partially within the boundaries of Fort Belvoir. Retrofits or improvement projects were assessed at sites which were outside of the fort and under the jurisdiction of Fairfax County.

5.14.1 Structural Projects

5.14.1.1 10-Year Projects

<u>AC9101 Stormwater Pond Retrofit</u>

This existing dry pond, 0629DP, is on the upstream side of the road culvert underneath Mount Air Drive near Telegraph Road in the Village of Mount Air neighborhood. The pond is located within a forested area where a perennial stream channel flows through the road culvert. There is significant erosion on the downstream side of this culvert. The proposed retrofit consists of installing a weir wall control structure to modify the outflow characteristics to provide water quality treatment. The receiving stream on the downstream side of the road culvert will be stabilized to prevent further erosion.

5.14.1.2 25-Year Projects

<u>AC9100 Stormwater Pond Retrofit</u>

This project proposes converting dry pond DP0401 along Morning Meadow Drive in the Landsdowne neighborhood to a wet pond by removing the low flow outlet to provide additional water quality treatment and stabilizing the downstream channel with step pools or check dams.

<u>AC9500 New BMP/LID</u>

The project recommends converting the unused portions of the parking lot in Pohick Industrial Park to bioretention facilities to increase stormwater treatment and to remove some impervious surface. Reconfiguration of the storm drains may be required for implementation.

5.14.2 Non Structural Projects

<u>AC9900 Community Outreach/Public Education - Stenciling</u>

This community-wide project involves marking the storm drains within the Cook Inlet community. The stencil marking can educate the public, reduce dumping, and reduce the amount of litter and pollutants that enter the storm drain system.

<u>AC9902 Inspection/Enforcement Enhancement Project - Vehicle Maintenance</u>

This project would provide community-wide targeted enforcement of spill prevention and pollution prevention regulations for sites where vehicles are maintained. The upland reconnaissance identified a car wash discharging directly to a storm drain and two outdoor truck repair/maintenance/storage facilities.

<u>AC9903 Inspection/Enforcement Enhancement Project - Outdoor Materials</u>

Materials that are stored outdoors are subjected to precipitation, making them a possible source of stormwater runoff pollution. One site in this WMA had construction rubble stored without cover. This project would be a community-wide enforcement and outreach approach to check for stormwater pollution prevention plans and to educate property owners.

AC9904 Rain Barrel Programs - Rain Barrels

Rain barrels provide the first step for residents to disconnect their downspout. This project would be a community-wide outreach program to encourage their use. A retirement community (The Fairfax) was identified during the upland reconnaissance with roof drainage that would be suitable for this approach.

AC9909 Rain Barrel Programs - Downspout Disconnect

The upland reconnaissance identified several sites where downspouts were directly connected to storm drains. A watershed-wide outreach program could be beneficial in reducing runoff volume or peak flows. In this WMA, they included the area around Hunter Estates and Newberry Station.

Table 5-14: Mainstem 8 Projects

Structural Projects						
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**	**Phase**
AC9101	Stormwater Pond Retrofit	AC-AC-0065	Village of Mount Air neighborhood	Water Quality	Private - Residential	1 - 10
AC9100	Stormwater Pond Retrofit	AC-KR-0005	Landsdowne neighborhood	Water Quality and Quantity	Private - Residential	11 - 25
AC9500	BMP/LID	AC-AC-0050	Pohick Industrial Park	Water Quality	Private	11 - 25

Non-Structural Projects					
Project #	**Project Type**	**Subshed**	**Location**	**Watershed Benefit**	**Land Owner**
AC9900	Community Outreach/Public Education	Multiple	Multiple	Water Quality	Multiple
AC9902	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9903	Inspection/Enforcement Enhancement Project	Multiple	Multiple	Water Quality	Multiple
AC9904	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple
AC9909	Rain Barrels	Multiple	Multiple	Water Quality and Quantity	Multiple

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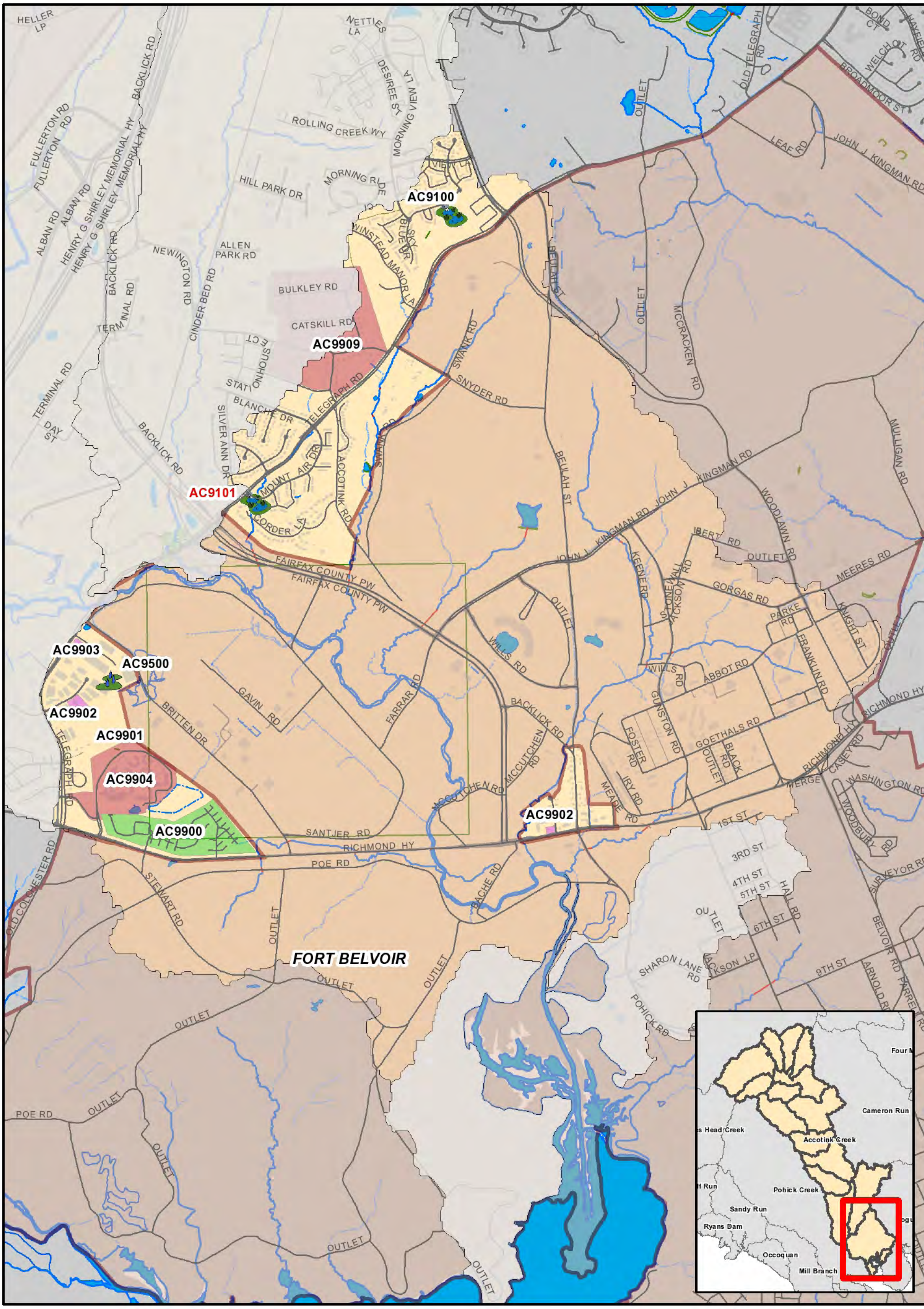

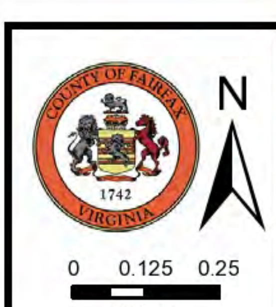

Buffer Restoration
Stream Restoration
BMP/LID
Culvert Retrofit
Dumpsite/Obstruction Removal
New Stormwater Pond
Outfall Improvement
Stormwater Pond Retrofit
Other
Community Outreach/Public Education
Area-wide Drainage Improvement
Land Conservation Project
Flood Protection/Mitigation
Inspection/Enforcement Enhancement
Rain Barrel Program
Street Sweeping Program
Studies, Surveys and Assessments

Implementation timeframe denoted by project label color. Red = 0-10 years Black = 11-25 years.

Map 5.14

WMA: Mainstem 8 Proposed Projects

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5.15 Project Fact Sheets

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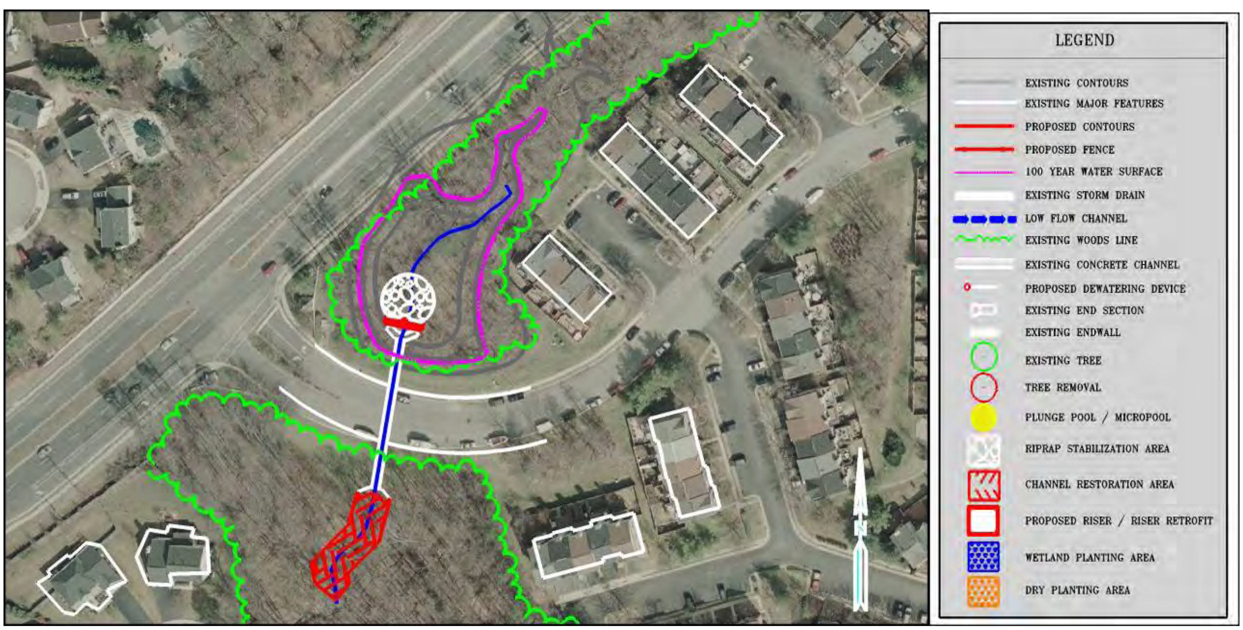
AC9101 - Pond Retrofit

Address:	Under Mount Air Drive, near the intersection of Telegraph Road
Location:	Village of Mount Air
Land Owner:	Private - Residential
PIN:	0994 06 C
Control Type	Water Quality and Quantity
Drainage Area	40.95 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This existing dry pond, 0629DP, is on the upstream side of the road culvert underneath Mount Air Drive near Telegraph Road The pond is located within a forested area where a perennial stream channel flows through the road culvert. There is significant erosion on the downstream side of this culvert. The proposed retrofit consists of installing a weir wall control structure to modify the outflow characteristics to provide water quality treatment. The receiving stream on the downstream side of the road culvert will be stabilized to prevent further erosion.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Adding the control structure will extend the detention time, which will increase the settling of suspended solids and capture of floatables, thus improving the health of the downstream channel. It is estimated that an annual total of 6,479 lbs of sediment, 63 lbs of total nitrogen and 12 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: The road culvert underneath Mount Air Drive is located in a residential community with several townhouse buildings within close proximity. Coordination with residents and possibly a HOA will be necessary to retrofit this site since it is located on private land. The base flow component of the control structure will require maintenance to prevent clogging. All components of the existing embankment and stream channel should be analyzed to ensure that it is designed to handle the impounded water. Environmental permitting issues are expected due to the in-stream location of this facility. Minimal tree loss is expected to obtain access and to clear the upstream embankment during construction. Existing utility conflicts are not anticipated with this retrofit. Access to the site is very good from Mount Air Drive.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	1	AC	$8,500.00	$8,500
New Riser	1	LS	$8,000.00	$8,000
Channel Stabilization	120	LF	$50.00	$6,000
Rip Rap Stabilization	80	SY	$100.00	$8,000
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$39,000**
Plantings	1	LS	5% of Project	$1,950
Ancillary Items	1	LS	5% of Project	$1,950
Erosion and Sediment Control	1	LS	10% of Project	$3,900
			Base Construction Costs	**$46,800**
			Mobilization (5%)	$2,340
			Subtotal 1	$49,140
			Contingency (25%)	$12,285
			Subtotal 2	$61,425
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$27,641
			Estimated Project Cost	**$89,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Control Structure

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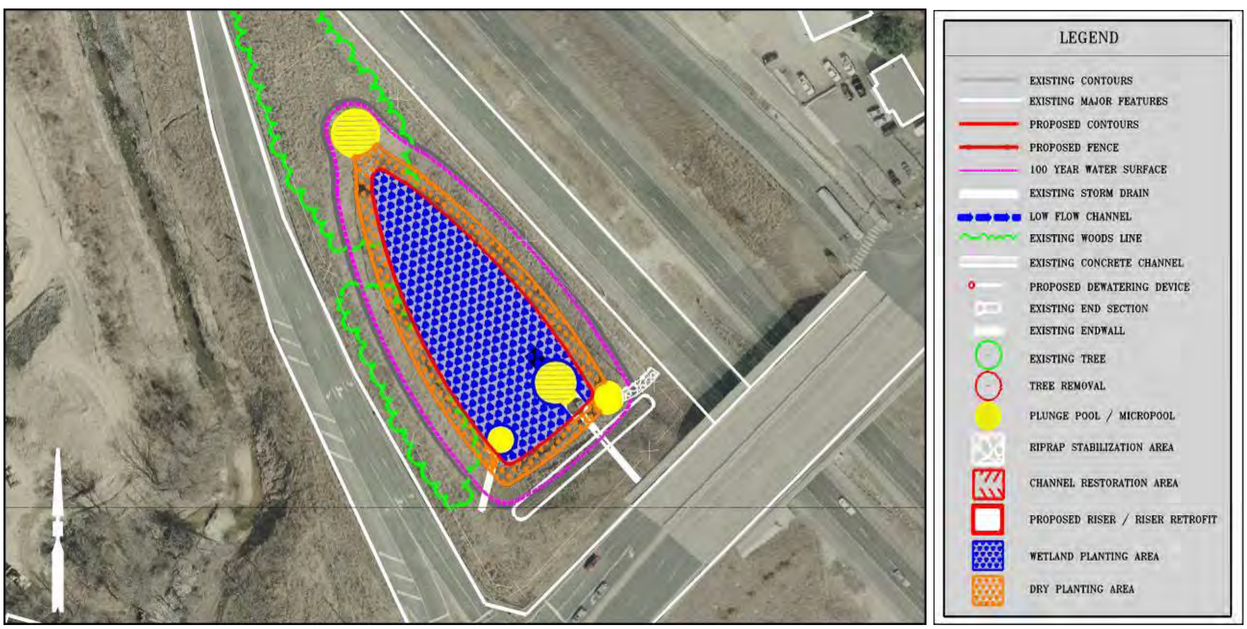
AC9102 - Pond Retrofit

Address:	Along off ramp from Fairfax County Parkway to Telegraph Road
Location:	Intersection of Telegraph Rd and Fairfax County Parkway
Land Owner:	State - VDOT
PIN:	N/A
Control Type	Water Quality and Quantity
Drainage Area	21.29 acres
Receiving Waters	Long Branch

Description: This is an existing dry pond, owned by the Virginia Department of Transportation (VDOT), which provides 2- and 10-year peak flow attenuation. The retrofit will modify the pond to a shallow wetland facility. This project will improve water quality and habitat by excavating for additional storage, adding plunge pools at the inflows, along with wetland and dry plantings.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility has the potential to meet the water quality treatment requirement by providing extended detention of the half-inch, 48-hour storm. Retrofitting this facility will improve the removal of suspended solids and floatables by extending detention time, which will improve water quality and habitat. These proposed improvements will also help prevent future downstream channel erosion. It is estimated that an annual total of 7,046 lbs of sediment, 86 lbs of total nitrogen and 12 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is owned and maintained by VDOT, coordination with VDOT will be necessary. Based on a recent inspection of this facility, no baseflow was found; however, the presence of potential wetlands may present environmental permitting issues. No tree loss will occur with this retrofit. In a recent inspection of this facility, it appears as if there has been some recent maintenance or work performed on this pond. Access to this facility is very good from an access road off of Fairfax County Parkway. Overhead power lines are present over the access road; however, they appear to be relatively high and should not interfere with construction equipment. No other utility conflicts are anticipated with this project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	1.3	AC	$8,500.00	$11,050
Plungepool / Micropool	4	EA	$400.00	$1,600
Grading and Excavation	2591	CY	$35.00	$90,685
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$111,835**
Plantings	1	LS	5% of Project	$5,592
Ancillary Items	1	LS	5% of Project	$5,592
Erosion and Sediment Control	1	LS	10% of Project	$11,184
			Base Construction Costs	**$134,203**
			Mobilization (5%)	$6,710
			Subtotal 1	$140,913
			Contingency (25%)	$35,228
			Subtotal 2	$176,141
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$79,263
			Estimated Project Cost	**$255,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Control Structure

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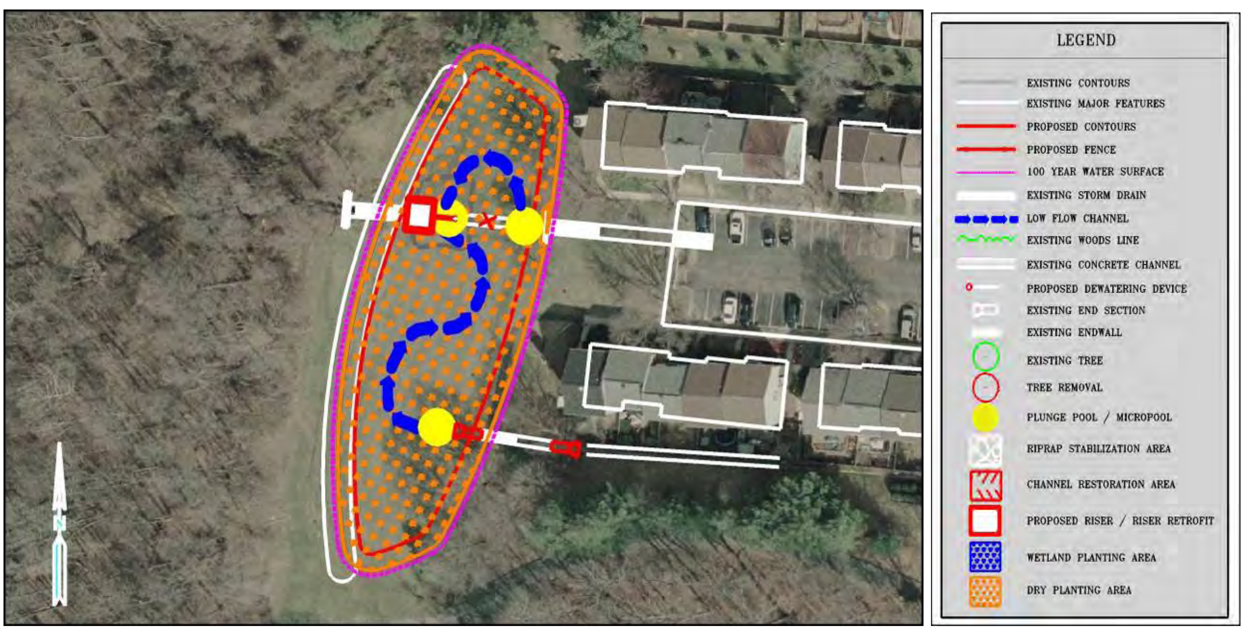
AC9105 - Pond Retrofit

Address:	At the end of Trestle Court
Location:	Pinewood Station
Land Owner:	Private - Residential
PIN:	0994 04 D1
Control Type	Water Quality and Quantity
Drainage Area	17.75 acres
Receiving Waters	Long Branch

Description: This project is a retrofit of an existing dry pond (0095DP) currently providing quantity control for the multifamily residential houses in Pinewood Station. The pond will be upgraded to an extended detention facility to improve water quality and habitat and prevent downstream channel erosion. This project will consist of removing the existing headwalls and adding a riser structure, adding a plunge pool at each inflow for energy dissipation into the facility, excavating for additional storage, and replacing the concrete low-flow channel with a meandering natural channel.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will meet the water quality treatment requirement by providing extended detention of the half-inch, 48-hour storm. It would also likely meet the peak flow management requirements of the 2 and 10-year storm. Retrofitting this facility would promote the removal of suspended solids and floatables through extended detention and the use of micropools at the inlets, thus improving water quality and habitat. These proposed improvements will also help prevent future downstream channel erosion. Peak flow rates, erosive velocities and channel sediment loads will be reduced by this project. It is estimated that an annual total of 2,989 lbs of sediment, 27 lbs of total nitrogen and seven lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in a residential community, installing signs around the facility is recommended to improve public knowledge. Coordination with residents and the HOA will be necessary to retrofit this facility since it is located on private land. Environmental permitting issues may be encountered due to the presence of baseflow into this facility. No tree loss will occur with this retrofit. There is good access to this facility at the end of Trestle Court. Several underground utilities and sanitary sewer manholes were identified near the townhouses located at the end of Trestle Court; however, utility conflicts in the pond or on the pond embankment are not anticipated.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition & Haul Away	50	LF	$30.00	$1,500
Plungepool / Micropool	3	EA	$400.00	$1,200
Excavate to create low-flow channel	220	LF	$25.00	$5,500
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	1229	CY	$35.00	$43,015
Remove Existing Headwall	1	EA	$300.00	$300
New End wall	2	EA	$2,500.00	$5,000
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$73,515**
Plantings	1	LS	5% of Project	$3,676
Ancillary Items	1	LS	5% of Project	$3,676
Erosion and Sediment Control	1	LS	10% of Project	$7,352
			Base Construction Costs	**$88,219**
			Mobilization (5%)	$4,411
			Subtotal 1	$92,630
			Contingency (25%)	$23,158
			Subtotal 2	$115,788
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$52,105
			Estimated Project Cost	**$168,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Control Structure

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AC9106 - Pond Retrofit

Address:	Behind 8157 Backlick Road, In front of 8308 Cinderbed Road
Location:	Backlick and Cinderbed Roads
Land Owner:	State - VDOT, Private - Commercial
PIN:	0993 01 0038, 0994 01 0004B
Control Type	Water Quality and Quantity
Drainage Area	6.96 acres, 13.24 acres
Receiving Waters	Long Branch

Description: This project is a retrofit of two dry ponds that treat runoff from Newington Industrial Park. AC9106A is an existing dry pond, owned by the Virginia Department of Transportation (VDOT), which will be upgraded to a shallow wetland facility to improve water quality and habitat and reduce downstream channel erosion. There is a concrete channel that carries runoff to the plunge pool. The pond will also receive a new riser, dewatering device, and wetland plantings.

AC9106B is also an existing dry pond (DP0474). There are two concrete low-flow channels within the pond that drain runoff from the surrounding industrial area. This project will consist of removing the concrete channels, incorporating a meandering natural channel through each pond, and adding micropools or plunge pools at each inflow. The project will also include modifications to the riser structure and removing curb and gutter along the parking lot to allow for sheetflow into the facility.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: These facilities have the potential to meet the water quality treatment requirement for the contributing drainage areas via extended detention of the one-half inch, 48-hour storm, as well as managing the peak flow of the 2-year and 10-year peak runoff volumes. Retrofitting these facilities will promote the removal of suspended solids and floatables to downstream channels and improve water quality and habitat. These proposed improvements will also help reduce future downstream channel erosion. Peak flow rates, erosive velocities, and channel sediment loads will be reduced by this project. It is estimated that an annual total of 8,238 lbs of sediment, 56 lbs of total nitrogen and 12 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Site AC9106A is owned and maintained by VDOT, coordination with VDOT will be necessary to retrofit this facility. Baseflow and wetlands currently in AC9106A may present environmental permitting issues. Minimal tree loss will occur and existing utility conflicts are not anticipated with retrofitting this site. Access to site AC9106A is very good from an access road off of Terminal Road.

Currently, site AC9106B is located within a fenced, private industrial property. Coordination with the property owners will be necessary to retrofit this site. Other than the fence surrounding the entire property, access is good due to a gravel road leading to the riser from the parking lot. The storm drain may need to be adjusted to ensure the pond bottom remains stable. Retrofitting site AC9106B will require no tree loss. No environmental permitting issues or existing utilities conflicts are expected with retrofitting site AC9106B.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.4	AC	$8,500.00	$3,400
Paved Ditch Demolition & Haul Away	415	LF	$30.00	$12,450
Plungepool / Micropool	7	EA	$400.00	$2,800
Excavate to create low-flow channel	235	LF	$25.00	$5,875
New Riser	1	LS	$8,000.00	$8,000
Riser Retrofit	1	LS	$4,000.00	$4,000
Embedded Dewatering Pipe	2	EA	$500.00	$1,000
Grading and Excavation	838	CY	$35.00	$29,330
Curb-Gutter Removal	225	LF	$5.00	$1,125
Soil Borings	2	LS	$8,500.00	$17,000
			Initial Project Costs	**$84,980**
Plantings	1	LS	5% of Project	$4,249
Ancillary Items	1	LS	5% of Project	$4,249
Erosion and Sediment Control	1	LS	10% of Project	$8,498
			Base Construction Costs	**$101,976**
			Mobilization (5%)	$5,099
			Subtotal 1	$107,075
			Contingency (25%)	$26,769
			Subtotal 2	$133,844
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$60,230
			Estimated Project Cost	**$194,000**


Site Photo: Existing Facility Overview


Site Photo: Existing Facility Overview

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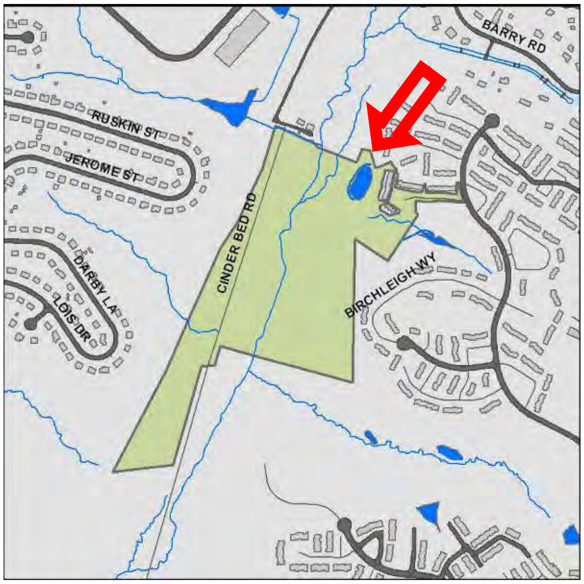
AC9110 - Pond Retrofit



Address:	At the end of Briarleigh Way, near the intersection of Birchleigh Way and Crestleigh Way
Location:	Amberleigh
Land Owner:	Private - Residential
PIN:	0904 10 L, 0904 10 F
Control Type	Water Quality and Quantity
Drainage Area	13.62 acres
Receiving Waters	Unknown tributary of Long Branch

Description: This project is a retrofit of dry pond (0700DP) receives runoff from the high-density residential Amberleigh neighborhood. It is surrounded by woods with some small trees growing within the facility. This project will consist of removing the existing headwall and replacing it with a new riser structure including a dewatering device, a meandering low flow channel, a micropool and a plunge pool at the riser and the pond inflow and excavating for additional storage. The addition of a riser to the outlet pipe of this facility will allow the pond to meet water quality and quantity goals for habitat improvement and prevention of downstream channel erosion.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will meet the water quality treatment requirement for the contributing drainage area by providing extended detention of the half-inch, 48-hour storm. It also meets the peak flow management requirements of the 2 and 10-year storm. By providing extended detention and wet storage in micropools, retrofitting this facility would promote the removal of suspended solids and floatables to downstream channels, which will enhance water quality and habitat. It is estimated that an annual total of 3,501 lbs of sediment, 38 lbs of total nitrogen and eight lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with residents and an HOA will be necessary to retrofit this facility since it is located on private land. No environmental permitting issues are expected with this pond retrofit. Minimal tree loss is expected within the facility and on the embankment with this retrofit. No design or construction issues were identified at this site. Existing utility conflicts are not anticipated. Access to this facility is very good from an access road located at the end of Briarleigh Way.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.6	AC	$8,500.00	$5,100
Plunge pool / Micropool	2	EA	$400.00	$800
Excavate to create low-flow channel	325	LF	$25.00	$8,125
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	1938	CY	$35.00	$67,830
Remove Existing Headwall	1	EA	$300.00	$300
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$99,155**
Plantings	1	LS	5% of Project	$4,958
Ancillary Items	1	LS	5% of Project	$4,958
Erosion and Sediment Control	1	LS	10% of Project	$9,916
			Base Construction Costs	**$118,987**
			Mobilization (5%)	$5,949
			Subtotal 1	$124,936
			Contingency (25%)	$31,234
			Subtotal 2	$156,170
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$70,277
			Estimated Project Cost	**$226,000**


Site Photo: Facility Inflow and Overall Facility

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AC9111 - Pond Retrofit

Address:	Behind 6530 Birchleigh Way, near the intersection of Birchleigh Way and Crestleigh Way
Location:	Amberleigh
Land Owner:	Private - Residential
PIN:	0904 10 F
Control Type	Water Quality and Quantity
Drainage Area	25.49 acres
Receiving Waters	Unknown tributary of Long Branch

Description: This proposed project is a retrofit of dry pond 0180DP, which receives runoff from the high-density residential Amberleigh neighborhood and its associated recreational areas. It has woods on three sides as well as some trees growing within the facility. The stream channel that flows into and within the facility is incised. This project will involve removing the existing headwall, tree removal, dry plantings and rip rap stabilization at the riser.The addition of a riser to the outlet pipe of this facility will allow the facility to achieve water quality and some quantity goals for habitat improvement and reduction of downstream channel erosion.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will meet the water quality treatment requirement via extended detention of the one-half inch, 48-hour storm, as well as manage the 2-year peak runoff volume. Retrofitting this facility would promote the removal of suspended solids and floatables to downstream channels through extended detention, which will improve water quality and habitat. These proposed improvements will also help prevent future downstream channel erosion. Peak flow rates, erosive velocities and channel sediment loads are expected to be reduced by this project. It is estimated that an annual total of 6,121 lbs of sediment, 69 lbs of total nitrogen and 15 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in a residential community, installing signs around the facility is recommended to increase public knowledge of the project. Coordination with residents and the HOA will be necessary to retrofit this facility since it is located on private land. Environmental permitting issues are expected due to the in-stream location of this facility. Some tree loss is expected with this retrofit. In-stream construction will require base flow diversion. The base flow component of the replaced control structure will require monitoring to prevent clogging. Stabilization of the stream channel within the existing facility would be incorporated with this retrofit. Existing utility conflicts are not anticipated. Access to this facility will require crossing through several hundred feet of recreational area located at the intersection of Crestleigh Way and Greenleigh Lane.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.4	AC	$8,500.00	$3,400
Tree Removal	3	EA	$2,000.00	$6,000
Plunge pool / Micropool	1	EA	$400.00	$400
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Rip Rap Stabilization	55	SY	$100.00	$5,500
Remove Existing Headwall	1	EA	$300.00	$300
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$32,600**
Plantings	1	LS	5% of Project	$1,630
Ancillary Items	1	LS	5% of Project	$1,630
Erosion and Sediment Control	1	LS	10% of Project	$3,260
			Base Construction Costs	**$39,120**
			Mobilization (5%)	$1,956
			Subtotal 1	$41,076
			Contingency (25%)	$10,269
			Subtotal 2	$51,345
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$23,105
			Estimated Project Cost	**$74,000**


Site Photo: Existing Facility Inflow

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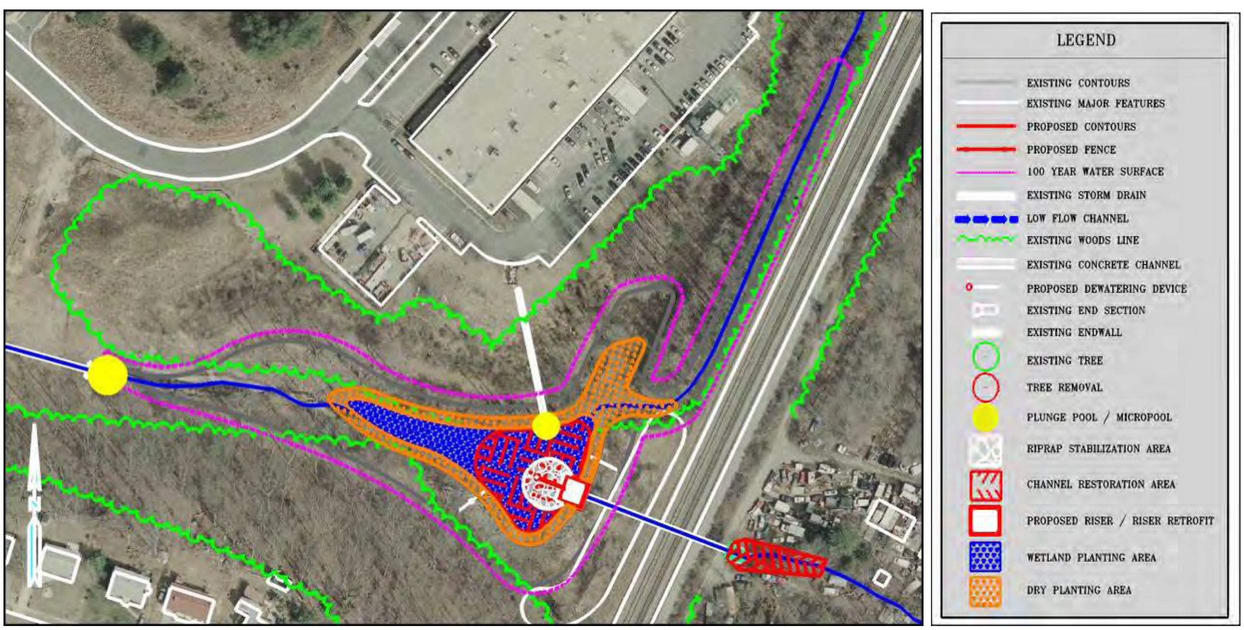
AC9112 - Pond Retrofit

Address:	Behind 6700 Springfield Center Drive
Location:	Springfield Industrial Park
Land Owner:	Private - Commercial
PIN:	0904 01 0011
Control Type	Water Quality and Quantity
Drainage Area	61.84 acres
Receiving Waters	Unknown tributary of Long Branch

Description: This is an existing dry pond (DP0366), which will be converted to a shallow wetland facility. Currently, the riser at this facility appears to be very old. Along with replacing the riser, retrofitting this facility will require removal of accumulated sediment, and additional excavation and grading to provide more storage capacity to manage peak flows. The project would also address stabilization of the outfall of the barrel pipe and the downstream channel due to erosion. The retrofit will allow the pond to meet water quality and quantity goals for habitat improvement and prevention of downstream channel erosion.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will meet the water quality treatment requirement for the contributing drainage area by providing extended detention of the half-inch, 48-hour storm. It will also meet the peak flow management requirements of the 2-year storm and also for a large portion of the 10-year storm. Retrofitting this facility would promote the removal of suspended solids and floatables to downstream channels thus improving water quality and habitat. Retrofitting this facility would also help to reduce future downstream erosion by reducing peak flow rates and erosive velocities. It is estimated that an annual total of 13,283 lbs of sediment, 44 lbs of total nitrogen and 17 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in a private commercial/industrial area, coordination with the property owner and railroad company will be necessary to retrofit this facility. An existing access road off of Springfield Center Drive will need to be used to access this facility. Access will be difficult to this facility and will require the removal of trees, the disturbance of a stream channel or floodplain, and steep slope modification. In-stream construction will require base flow diversion. The base flow component of the replaced control structure will require regular maintenance to prevent clogging. Environmental permitting issues are expected due to the in-stream location of this facility. Some tree removal within the facility and on the upstream side of the pond embankment can be expected with this retrofit. Overhead power lines, sanitary sewer markers, and gas and electric markers are all present within close proximity to the existing riser. These utilities may constrain the retrofit potential of this facility.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.8	AC	$12,000.00	$9,600
Plunge pool / Micropool	2	EA	$400.00	$800
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Channel Stabilization	115	LF	$50.00	$5,750
Rip Rap Stabilization	175	SY	$100.00	$17,500
Grading and Excavation	2367	CY	$35.00	$82,845
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$133,495**
Plantings	1	LS	5% of Project	$6,675
Ancillary Items	1	LS	5% of Project	$6,675
Erosion and Sediment Control	1	LS	10% of Project	$13,350
			Base Construction Costs	**$160,195**
			Mobilization (5%)	$8,010
			Subtotal 1	$168,205
			Contingency (25%)	$42,051
			Subtotal 2	$210,256
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$94,615
			Estimated Project Cost	**$305,000**


Site Photo: Inside Existing Facility


Site Photo: Existing Control Structure

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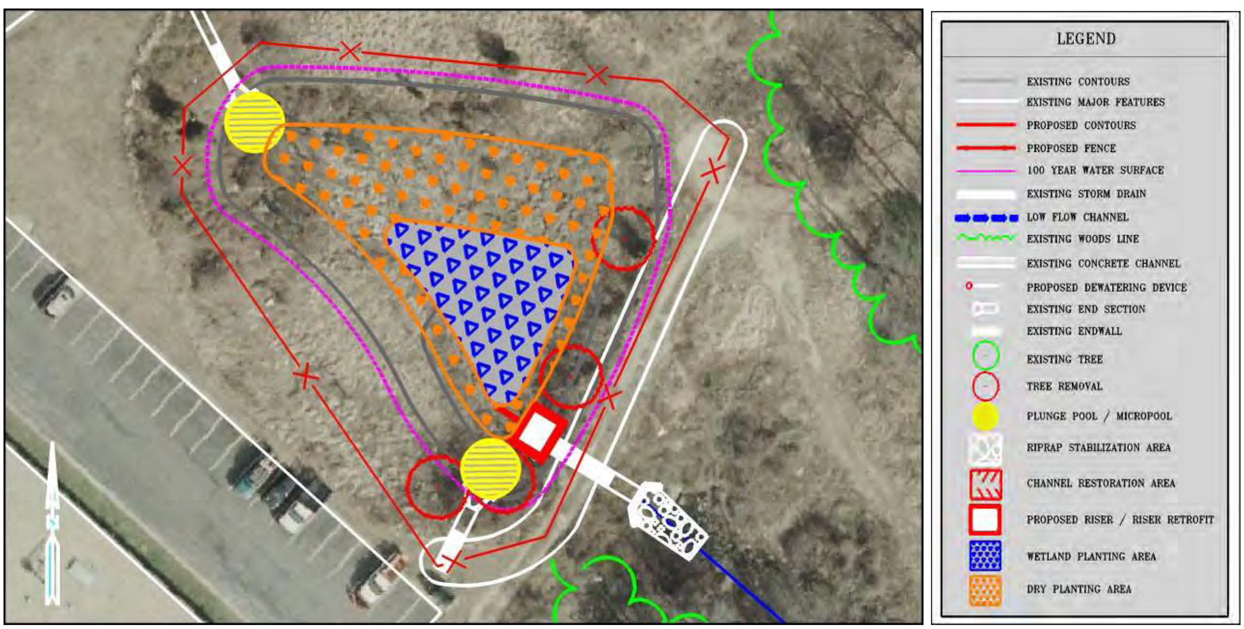
AC9113 - Pond Retrofit

Address:	Next to 6700 Springfield Center Drive
Location:	Springfield Industrial Park
Land Owner:	Private - Commercial
PIN:	0904 01 0011
Control Type	Water Quality
Drainage Area	38.14 acres
Receiving Waters	Unknown tributary of Long Branch

Description: This project is a retrofit of existing dry pond DP0367 located in a highly vegetated area near the Springfield Industrial Park. The retrofit will convert the dry pond to a become a shallow wetland to improve water quality and habitat. The concrete riser of this facility was found to be in disrepair, so, as part of this retrofit, the current riser will be replaced. Two plunge pools and wetland plantings are also proposed as part of this retrofit.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will partially meet the water quality treatment requirements through extended detention of the half-inch, 48-hour storm along with some sedimentation through extended detention and nutrient uptake from wetland vegetation. It is estimated that an annual total of 11,309 lbs of sediment, 101 lbs of total nitrogen and 19 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in a private commercial/industrial area, coordination with the property owner will be necessary to retrofit this facility. Access to this facility is very good from a parking lot along Springfield Center Drive. Environmental permitting issues may be encountered due to the presence of wetlands within this facility. Moderate tree loss is expected with this pond retrofit associated with maintenance clearing of the pond embankment and from expanding the facility. Overhead power lines are present near the downstream embankment, but they appear to be relatively high and should not interfere with construction equipment. No other utility conflicts are anticipated with this project. No other design or construction issues were identified at this site.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	$8,500.00	$2,550
Tree Removal	4	EA	$2,000.00	$8,000
Plunge pool / Micropool	2	EA	$400.00	$800
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	1203	CY	$35.00	$42,105
Fencing	560	LF	$20.00	$11,200
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$81,655**
Plantings	1	LS	5% of Project	$4,083
Ancillary Items	1	LS	5% of Project	$4,083
Erosion and Sediment Control	1	LS	10% of Project	$8,166
			Base Construction Costs	**$97,987**
			Mobilization (5%)	$4,899
			Subtotal 1	$102,886
			Contingency (25%)	$25,722
			Subtotal 2	$128,608
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$57,874
			Estimated Project Cost	**$186,000**


Site Photo: Existing Facility Overview


Site Photo: Existing Control Structur

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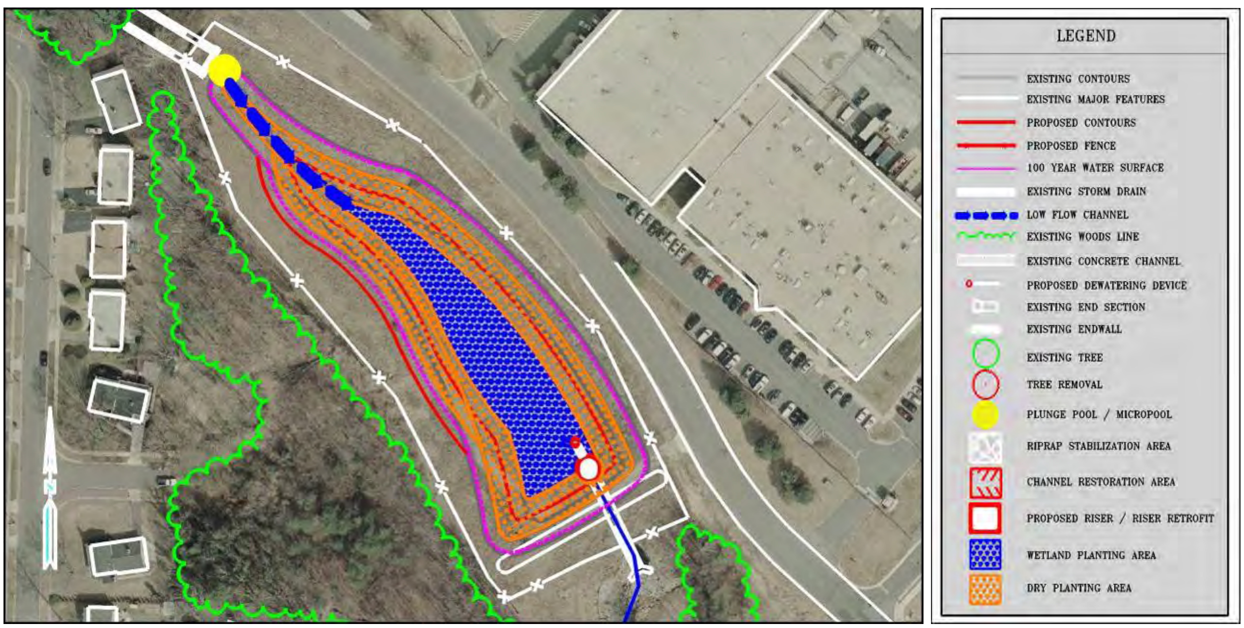
AC9114 - Pond Retrofit

Address:	Across from 6805 Springfield Center Drive
Location:	Springfield Industrial Park
Land Owner:	State - VDOT
PIN:	N/A
Control Type	Water Quality and Quantity
Drainage Area	119.41 acres
Receiving Waters	Unknown tributary of Long Branch

Description: This project is a retrofit of dry pond VDOT29028 that will be converted to a shallow wetland facility. This project will consist of a new riser structure including a dewatering device, excavating for additional storage, a plunge pool at the inflow and wetland plantings.to improve water quality and habitat and reduce downstream channel erosion. This facility has a large drainage area and conveys baseflow.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will meet the water quality treatment requirement through extended detention of the one-half inch, 48-hour storm. It will also manage the 2-year peak runoff volumes as well as the majority of the 10-year peak runoff volume. Retrofitting this facility would help to prevent future downstream erosion by reducing peak flow rates and erosive velocities. This retrofit will also promote the removal of suspended solids and floatables to downstream channels through extended detention, and reduce nutrient pollutant through uptake by wetland vegetation. It is estimated that an annual total of 15,912 lbs of sediment, 148 lbs of total nitrogen and 30 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is owned and maintained by VDOT, coordination with VDOT will be necessary. Access is facility is very good from Springfield Center Drive. Environmental permitting issues may be encountered due to the presence of baseflow from twin 42" storm sewer pipes that discharge into this facility. Minimal tree loss is expected with this pond retrofit. Existing utility conflicts are not anticipated. No design or construction issues were identified at this site. Currently, a chain link fence in good condition surrounds this facility.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	1.4	AC	$8,500.00	$11,900
Plunge pool / Micropool	1	EA	$400.00	$400
Excavate to create low-flow channel	170	LF	$25.00	$4,250
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	8192	CY	$35.00	$286,720
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$320,270**
Plantings	1	LS	5% of Project	$16,014
Ancillary Items	1	LS	5% of Project	$16,014
Erosion and Sediment Control	1	LS	10% of Project	$32,027
			Base Construction Costs	**$384,325**
			Mobilization (5%)	$19,216
			Subtotal 1	$403,541
			Contingency (25%)	$100,885
			Subtotal 2	$504,426
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$226,992
			Estimated Project Cost	**$731,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Control Structure

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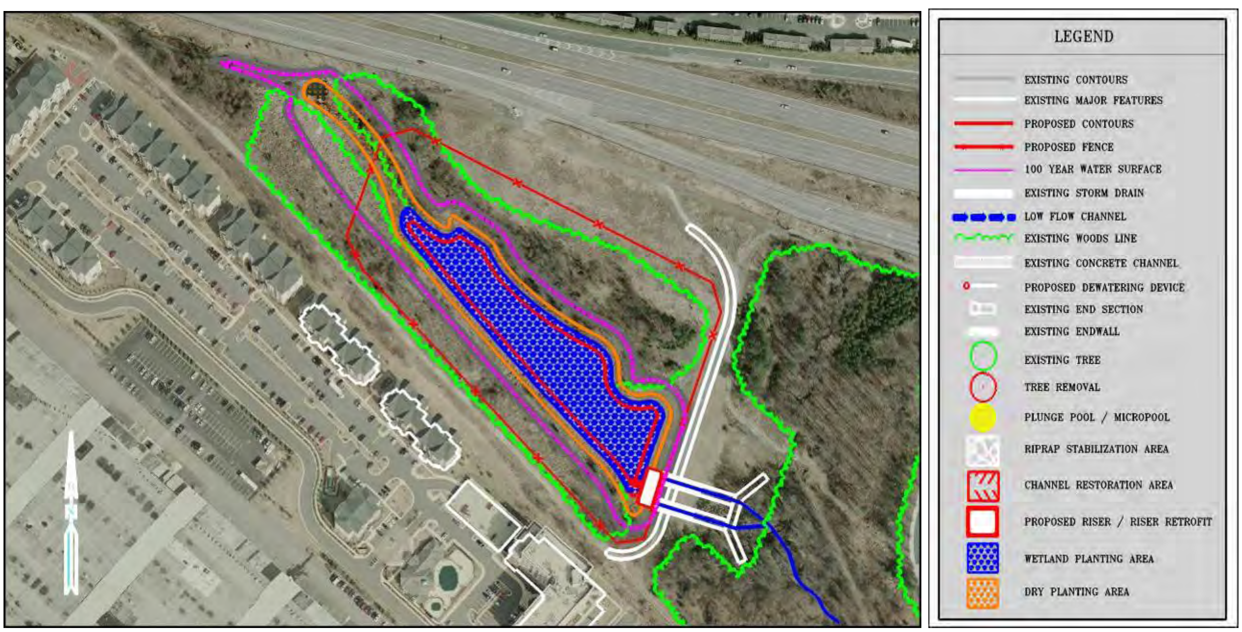
AC9120 - Pond Retrofit

Address:	Behind 6700 Metropolitan Center Drive, At the end of Metropolitan Center Drive
Location:	Franconia / Springfield Metro
Land Owner:	Public - Metro
PIN:	0902 01 0060
Control Type	Water Quality and Quantity
Drainage Area	277.87 acres
Receiving Waters	Long Branch

Description: This in-stream dry pond (DP0296) currently treats the runoff from a high-density residential area near the Springfield Metro Station. The pond has a significant amount of trash and debris around the riser with overgrown vegetation throughout the facility. This project is a quantity control pond that will be converted to a shallow wetland by modifying the spillway characteristics of the existing riser, installing a new dewatering system and excavating to create permanent wet storage for water quality treatment.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Incorporating a permanent wet storage component into this facility will provide approximately 50 percent of the water quality treatment volume required for the contributing drainage area. The available storage volume above the permanent pool has potential to provide peak flow management of the 2-year storm. Retrofitting this facility will promote uptake of nutrients, removal of pollutants, suspension of floatables and overall increases in water quality and habitat. Peak flow rates, erosive velocities and downstream channel sediment loads can also be reduced by this project. It is estimated that an annual total of 14,454 lbs of sediment, 119 lbs of total nitrogen and 27 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Access to this facility is good due to an existing paved road on top of the pond embankment that originates from Franconia Springfield Parkway. Existing utility conflicts are not anticipated. Environmental permitting issues are anticipated due to the in-stream location of this facility. This retrofitted facility would require minor tree removal and impacts to existing stream channels. In-stream construction will require base flow diversion.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.9	AC	$12,000.00	$10,800
Riser Retrofit	1	LS	$4,000.00	$4,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	21248	CY	$35.00	$743,680
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$767,480**
Plantings	1	LS	5% of Project	$38,374
Ancillary Items	1	LS	5% of Project	$38,374
Erosion and Sediment Control	1	LS	10% of Project	$76,748
			Base Construction Costs	**$920,976**
			Mobilization (5%)	$46,049
			Subtotal 1	$967,025
			Contingency (25%)	$241,756
			Subtotal 2	$1,208,781
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$543,951
			Estimated Project Cost	**$1,753,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Control Structure

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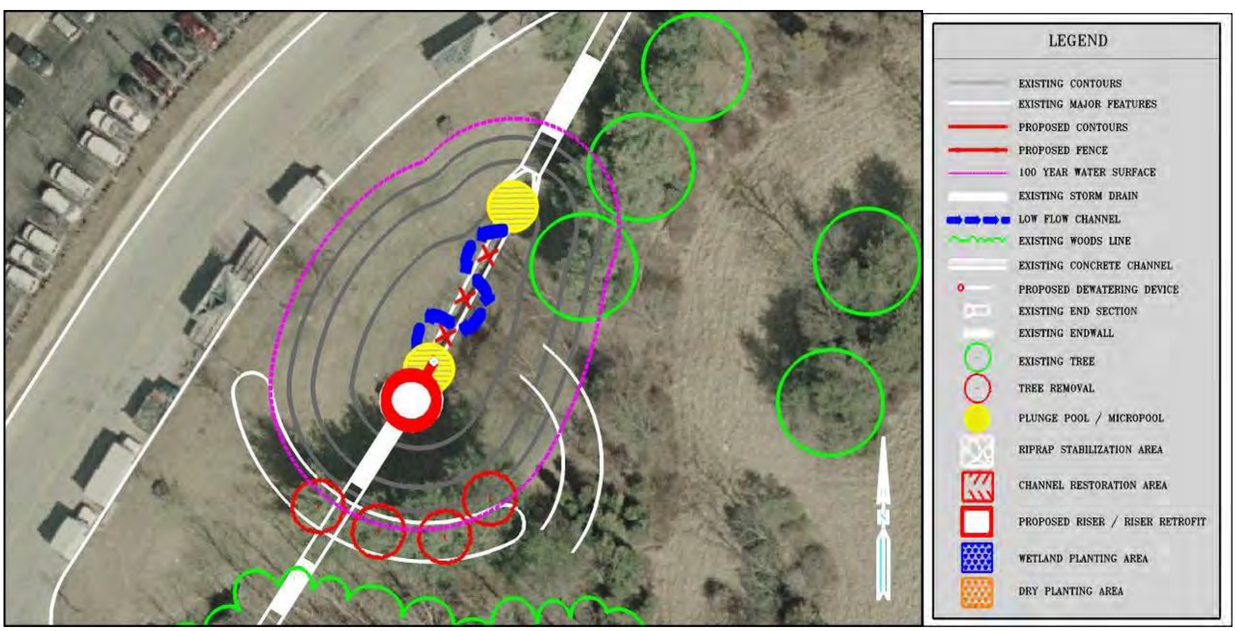
AC9123 - Pond Retrofit

Address:	At the end of 8500 block of Cinder Bed Road, next to 8581 Cinder Bed Road
Location:	Gateway 95 Business Park
Land Owner:	Private - Commercial
PIN:	0993 04 B
Control Type	Water Quality
Drainage Area	17.55 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This project is intended to convert existing dry pond DP0411 on Cinder Bed Road to improve water quality. The pond currently provides 2- and 10-year storm peak flow reduction. There are three inflows into the pond, one of which uses a concrete channel to convey flows to the riser structure. It appears that there used to be rip rap outfall protection at each of the inflows, but it has since been washed away.

To retrofit this pond, the concrete channel will be removed, a micropool and plunge pool will be provided and the riser will be modified. The riser modification will allow the pond to provide full water quality treatment as well as manage the 2-year storm to improve water quality and habitat and reduce downstream channel erosion. Some reduction of the 10-year peak flow would also be provided.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will meet the water quality treatment requirement for the contributing drainage area by providing extended detention of the half-inch, 48-hour storm. Extended detention, combined with wet storage is plumge pools and micropools, will promote the removal of suspended solids and improve water quality and habitat. In particular, retrofitting this facility would help to reduce the impact of oil that was present in the low flow concrete pilot channel during a field inspection of this site. The proposed improvements would also help prevent future downstream channel erosion by reducing peak flows and erosive velocities. It is estimated that an annual total of 6,194 lbs of sediment, 40 lbs of total nitrogen and eight lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in a private commercial/industrial area , coordination with the property owner will be necessary to retrofit this facility. Access to this facility is very good from Cinder Bed Road. Environmental permitting issues may be encountered due to the presence of baseflow from a 42" storm sewer inflow into this facility. Minimal tree loss is expected on the downstream side of the embankment with this pond retrofit, although a few trees will need to removed along the embankment. Existing utility conflicts are not anticipated. Due to the commercial/industrial drainage area to this facility, stormwater controls for oil and grease, sediment, and trash should all be incorporated in the retrofit.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition & Haul Away	95	LF	$30.00	$2,850
Tree Removal	4	EA	$2,000.00	$8,000
Plunge pool / Micropool	2	EA	$400.00	$800
Excavate to create low-flow channel	90	LF	$25.00	$2,250
Riser Retrofit	1	LS	$4,000.00	$4,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$26,900**
Plantings	1	LS	5% of Project	$1,345
Ancillary Items	1	LS	5% of Project	$1,345
Erosion and Sediment Control	1	LS	10% of Project	$2,690
			Base Construction Costs	**$32,280**
			Mobilization (5%)	$1,614
			Subtotal 1	$33,894
			Contingency (25%)	$8,474
			Subtotal 2	$42,368
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$19,066
			Estimated Project Cost	**$61,000**

Site Photo: Existing Control Structure

Site Photo: Concrete Low Flow Channel and Embankment

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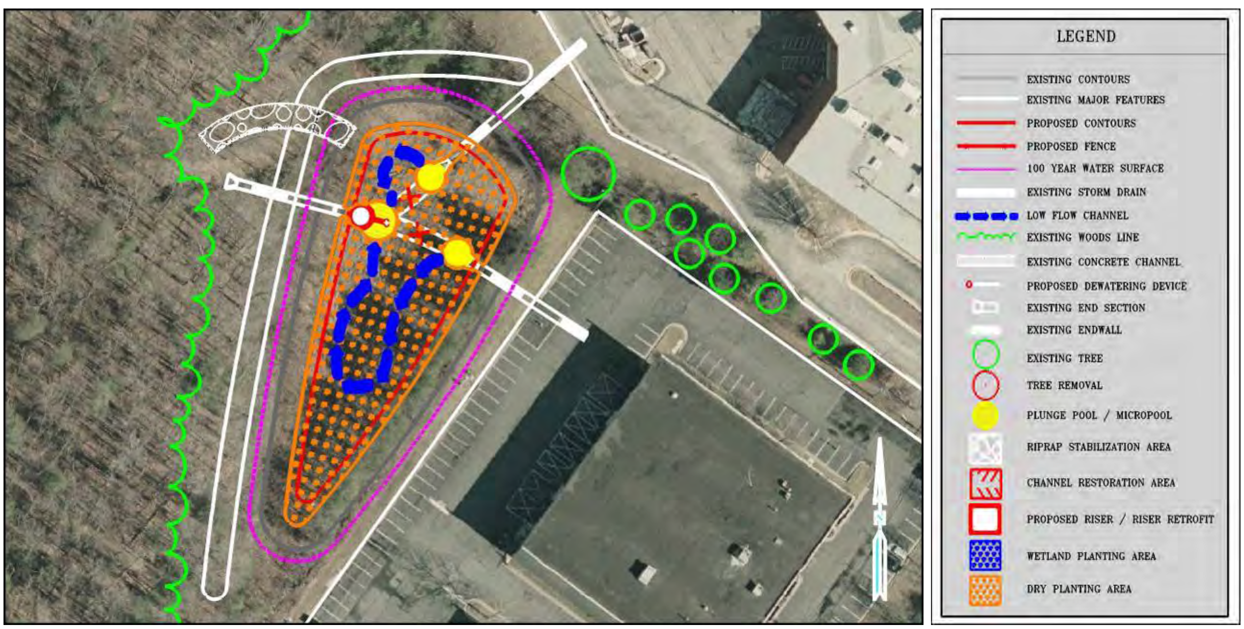
AC9126 - Pond Retrofit

Address:	Near the 8400 block of Alban Road, Behind 8400 Alban Road
Location:	Alban Industrial Center
Land Owner:	Private - Commercial
PIN:	0993 01 0006D
Control Type	Water Quality and Quantity
Drainage Area	21.45 acres
Receiving Waters	Accotink Creek

Description: This existing dry pond, DP0338, provides little to no treatment due to the large size of the outlet pipe. There are currently two inflows into the facility that carry runoff through concrete channels directly to the outlet pipe. To provide water quality treatment, the pond would be excavated, the concrete channels would be removed and replaced with a meandering natural channel, and a new riser structure with a dewatering orifice would be installed.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility would meet the water quality treatment requirement for the contributing drainage area by providing extended detention of the half-inch, 48-hour storm, along with peak flow reduction for both the 2- and 10-year events. Retrofitting this facility would promote the removal of suspended solids and floatables to downstream channels through extended detention and wet storage in plunge pools and micropools. Retrofitting this facility would also help to reduce future downstream erosion by reducing peak flow rates and erosive velocities. It is estimated that an annual total of 7,756 lbs of sediment, 51 lbs of total nitrogen and nine lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in an industrial area off of Alban Road, coordination with the property owner will be necessary to retrofit the facility. Access to this facility is very good from a parking lot off of Alban Road. No environmental permitting issues or tree losses are expected with this retrofit. The addition of a riser would help this facility achieve water quality improvement goals for habitat improvement and prevention of downstream channel erosion. No other design or construction issues were identified at this site. No existing utility conflicts are anticipated.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.7	AC	$12,000.00	$8,400
Paved Ditch Demolition & Haul Away	125	LF	$30.00	$3,750
Plunge pool / Micropool	3	EA	$400.00	$1,200
Excavate to create low-flow channel	260	LF	$25.00	$6,500
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	523	CY	$35.00	$18,305
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$55,155**
Plantings	1	LS	5% of Project	$2,758
Ancillary Items	1	LS	5% of Project	$2,758
Erosion and Sediment Control	1	LS	10% of Project	$5,516
			Base Construction Costs	**$66,187**
			Mobilization (5%)	$3,309
			Subtotal 1	$69,496
			Contingency (25%)	$17,374
			Subtotal 2	$86,870
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$39,092
			Estimated Project Cost	**$126,000**

Site Photo: Existing Facility and Concrete Low Flow Channels

Site Photo: Existing Facility

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AC9133 - Pond Retrofit

Address:	Between the 7200 block of Gentian Court and the 7800 block of Wintercress Lane
Location:	Hunter Village
Land Owner:	Private - Residential
PIN:	0894 15 N
Control Type	Water Quality and Quantity
Drainage Area	48.11 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This project is a retrofit of existing dry pond 0462DP located on the upstream side of Hunter Village Drive, which treats a high-density residential area in the Hunter Village neighborhood. The existing riser structure is mostly buried under debris and sediment. To improve the treatment provided at this site, excavation and clearing are proposed to provide extended detention for water quality. A new riser structure and dewatering device are also proposed. A micropool would be placed at the base of the new riser to settle sediment and other pollutants before being discharged into the downstream channel. A small portion of the channel in the upper portion of the facility would also be stabilized to prevent further erosion. This project is located downstream of the proposed pond retrofit AC9134.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: The replacement of the existing control structure would provide water quality treatment and peak flow management for the contributing drainage area by modifying the outflow characteristics. These proposed improvements will also help reduce future downstream channel erosion by reducing peak flow rates and erosive velocities. It is estimated that an annual total of 6,534 lbs of sediment, 63 lbs of total nitrogen and 15 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with residents and an HOA will be necessary to retrofit this facility as it is located on private land. Access to this facility is very good from Hunter Village Drive. Existing utility conflicts are possible due to a sanitary sewer manhole adjacent to the stream channel. Minimal tree removal will be required on the upstream side of the embankment. Environmental permitting issues are expected with this retrofit due to the in-stream location of this facility.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	$12,000.00	$3,600
Plungepool / Micropool	1	EA	$400.00	$400
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Channel Stabilization	130	LF	$50.00	$6,500
Rip Rap Stabilization	35	SY	$100.00	$3,500
Grading and Excavation	449	CY	$35.00	$15,715
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$46,715**
Plantings	1	LS	5% of Project	$2,336
Ancillary Items	1	LS	5% of Project	$2,336
Erosion and Sediment Control	1	LS	10% of Project	$4,672
			Base Construction Costs	**$56,059**
			Mobilization (5%)	$2,803
			Subtotal 1	$58,862
			Contingency (25%)	$14,716
			Subtotal 2	$73,578
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$33,110
			Estimated Project Cost	**$107,000**


Site Photo: Existing Facility


Site Photo: Existing Control Structure

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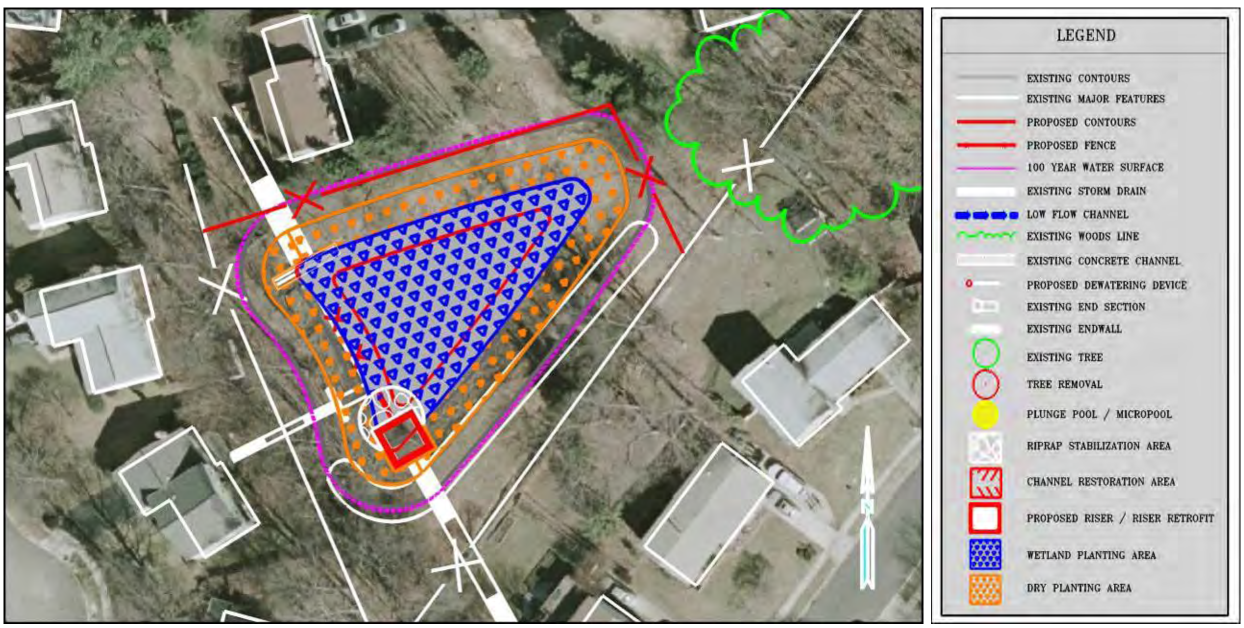
AC9136 - Pond Retrofit

Address:	At the end of Kenwood Avenue Near 8311 Kenwood Avenue
Location:	Kenwood Oaks
Land Owner:	Private - Residential
PIN:	0891 14 0004, 0891 14 0005, 0891 14 0006
Control Type	Water Quality and Quantity
Drainage Area	37.10 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This project is an existing dry pond that will be converted to a shallow wetland. Recommendations include excavating the bottom to create the wetalnd, excavation for additional storage,and modifying the spillway characteristics of the riser structure to change the ouflow characteristics. Retrofit would also include installing a new dewatering system, and removing the concrete low-flow channels and replacing them with natural, meandering channels to lengthen the flow path.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility would provide some of the water quality treatment required for the contributing drainage area by providing extended detention of the half-inch, 48-hour storm. Wetland vegetation and natural processes would help reduce nutrients. Retrofitting this facility would promote the removal of suspended solids and floatables to downstream channels. Approximately 5,800 lbs of sediment, 57 lbs of total nitrogen and 12 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: As this facility is located on private land, coordination with local landowners will be necessary to retrofit this facility. Access to this facility is very good from a shared driveway along Kenwood Avenue. Existing utility conflicts are not anticipated and minimal tree removal is required for this retrofit. Environmental permitting issues may be encountered due to the presence of baseflow.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.4	AC	$8,500.00	$3,400
Paved Ditch Demolition & Haul Away	90	LF	$30.00	$2,700
Riser Retrofit	1	LS	$4,000.00	$4,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Rip Rap Stabilization	45	SY	$100.00	$4,500
Grading and Excavation	704	CY	$35.00	$24,640
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$48,240**
Plantings	1	LS	5% of Project	$2,412
Ancillary Items	1	LS	5% of Project	$2,412
Erosion and Sediment Control	1	LS	10% of Project	$4,824
			Base Construction Costs	**$57,888**
			Mobilization (5%)	$2,894
			Subtotal 1	$60,782
			Contingency (25%)	$15,196
			Subtotal 2	$75,978
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$34,190
			Estimated Project Cost	**$110,000**

Site Photo: Existing Facility Overview

Site Photo: Concrete Low Flow Channel and Control Structure

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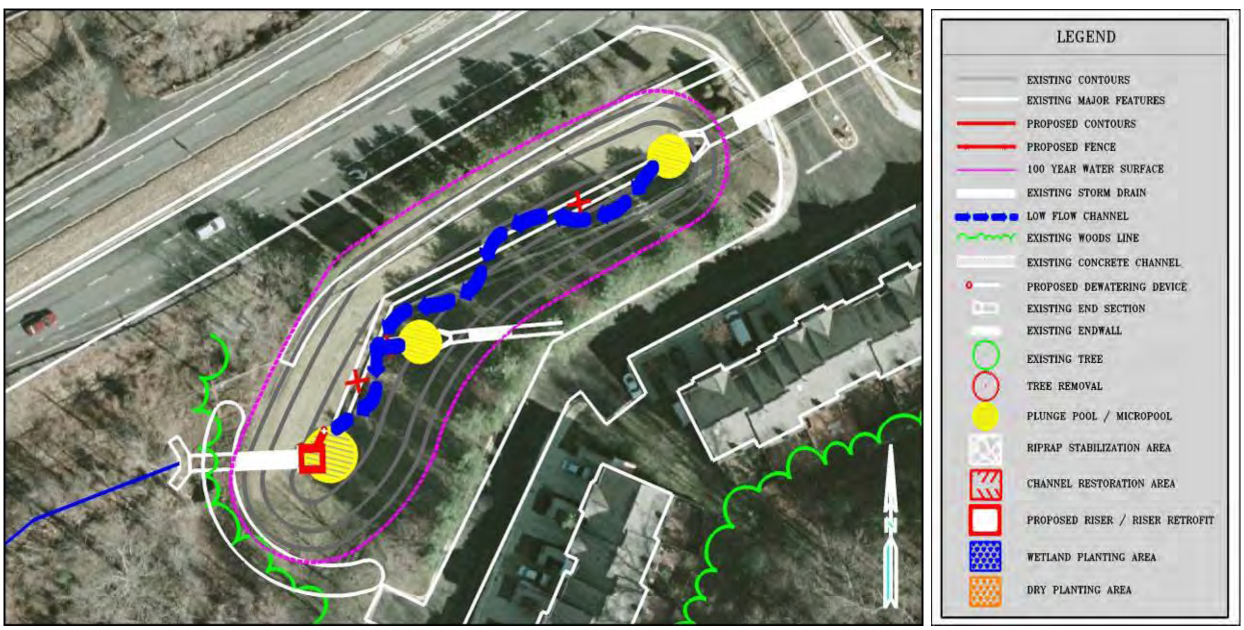
AC9139 - Pond Retrofit

Address:	Near the intersection of Old Keene Mill Road and Westmore Drive
Location:	Westhaven
Land Owner:	Private - Residential
PIN:	0901 18 C
Control Type	Water Quality
Drainage Area	31.68 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This is an existing dry pond, 0935DP, which will be converted to an extended detention facility. There is a concrete channel that carries runoff as well as baseflow from the inflow point to the outlet structure. This project will consist of modifying the spillway characteristics of the riser structure, installing a new dewatering device, removing the concrete low-flow channels and replacing them with meandering channels, and adding a micropool or plunge pool at each inflow into the facility. All of these proposed improvements will help improve water quality.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility has the potential to meet the water quality treatment requirement for the contributing drainage area via extended detention of the one-half inch, 48-hour storm, along with the wet storage provided by the micropools. The retrofit will also provide management of the 2-year peak flow rates. It is estimated that an annual total of 3,745 lbs of sediment, 37 lbs of total nitrogen and nine lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with residents and an HOA will be necessary to retrofit this facility since it is located on private land. Access to this facility is good; however, no existing access road is present. Access is possible down a relatively steep slope at the end of Westmore Drive. A portion of the embankment has an asphalt pedestrian trail on top; however, the top width of the embankment is too narrow for construction vehicles. Overhead power lines and underground utilities are present on the interior embankment adjacent to Westmore Drive at the upstream end of the facility. Minimal tree removal is required for this retrofit. Environmental permitting issues may be encountered due to the presence of baseflow from a 33" storm sewer inflow into this facility.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition & Haul Away	265	LF	$30.00	$7,950
Plunge pool / Micropool	3	EA	$400.00	$1,200
Excavate to create low-flow channel	215	LF	$25.00	$5,375
Riser Retrofit	1	LS	$4,000.00	$4,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$27,525**
Plantings	1	LS	5% of Project	$1,376
Ancillary Items	1	LS	5% of Project	$1,376
Erosion and Sediment Control	1	LS	10% of Project	$2,753
			Base Construction Costs	**$33,030**
			Mobilization (5%)	$1,652
			Subtotal 1	$34,682
			Contingency (25%)	$8,671
			Subtotal 2	$43,353
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$19,509
			Estimated Project Cost	**$63,000**

Site Photo: Existing Facility and Control Structure

Site Photo: Existing Facility

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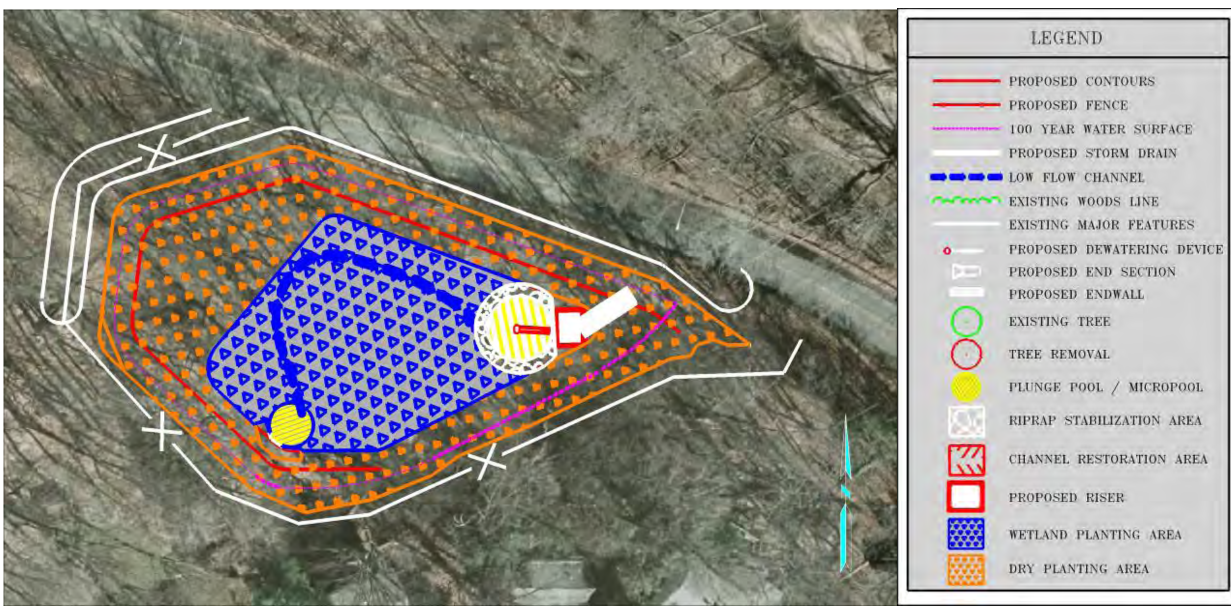
AC9144 - New Pond

Address:	Along Danbury Forest Drive, South of the intersection of Danbury Forest Drive and Braddock Road
Location:	Kings Park
Land Owner:	County - FCPA
PIN:	0703 04 A
Control Type	Water Quality and Quantity
Drainage Area	11.38 acres
Receiving Waters	Long Branch

Description: The proposed facility between Danbury Forest Drive and Thames Street would be an extended detention dry pond which would provide water quality and water quantity treatment at the outfall of the existing storm drain system, before it crosses under the road and into the floodplain. The new riser structure would connect to the existing culvert under Danbury Forest Drive to avoid having to close the road and perform roadway work. The existing storm drain and culvert would be modified as little as possible



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project would provide water quality treatment via extended detention of the half-inch, 48-hour storm and water quantity management of 2- and 10-year peak runoff volumes. The erosion at the outfall will be corrected and a forebay provided, which will reduce the amount of sediment flowing downstream to the next storm drain structure and into receiving waters. This will improve habitat through reduction of suspended sediment and various other nutrients. The new facility will have a new riser structure to detain water before it enters Accotink Creek. It is estimated that a total of 862 lbs of sediment, nine lbs of total nitrogen and two lbs of total phosphorus would be reduced by this project.

Project Design Considerations: This project would be located behind a residential community with easy access to the site, so the design should take this into consideration. FCPA will require any trees damaged by construction to be replaced or trimmed. The eroded outfall is located at the edge of a forest, so the new facility would impact some mature trees. The site is located in a headwater area and would impound an intermittent stream, so environmental permitting would be required. Access is available along the storm drain easement between houses.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.7	AC	$15,000.00	$10,500
Plungepool / Micropool	2	EA	$400.00	$800
Excavate to create low-flow channel	175	LF	$25.00	$4,375
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
New Endwall	1	EA	$2,500.00	$2,500
Outfall Pipe	35	LF	$300.00	$10,500
Rip Rap Stabilization	65	SY	$100.00	$6,500
Grading and Excavation	7000	CY	$35.00	$245,000
Embankment	1750	CY	$50.00	$87,500
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$384,675**
Plantings	1	LS	5% of Project	$19,234
Ancillary Items	1	LS	5% of Project	$19,234
Erosion and Sediment Control	1	LS	10% of Project	$38,468
			Base Construction Costs	**$461,611**
			Mobilization (5%)	$23,081
			Subtotal 1	$484,692
			Contingency (25%)	$121,173
			Subtotal 2	$605,865
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$272,639
			Estimated Project Cost	**$879,000**


Site Photo: Storm Drain Outfall to Proposed Facility


Site Photo: Proposed Facility Location

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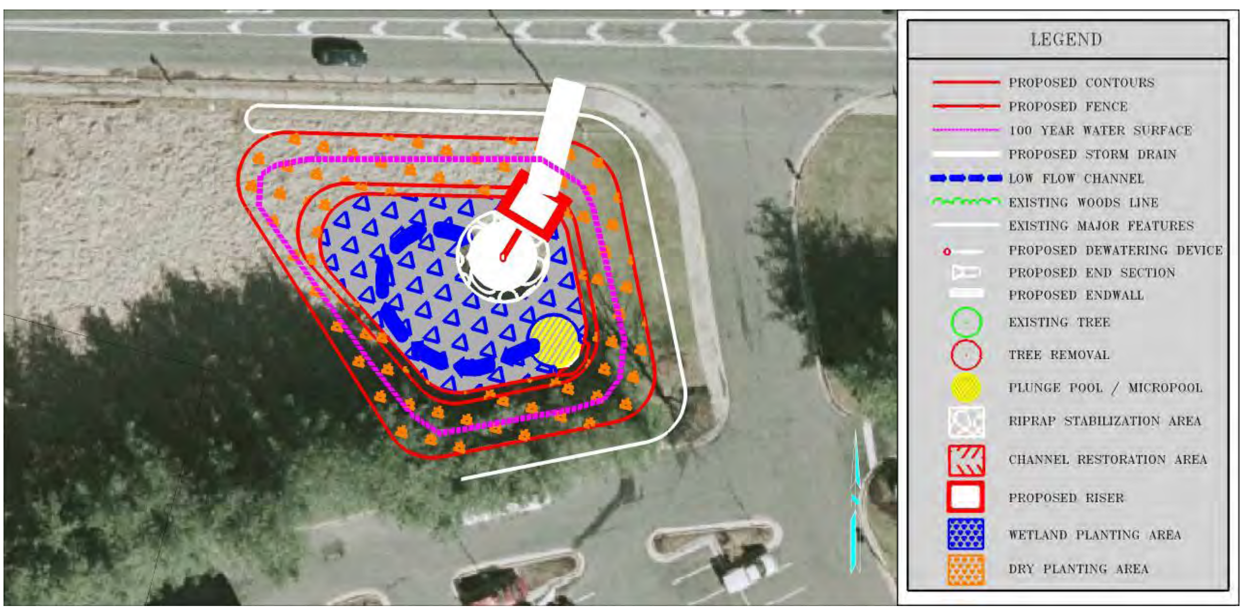
AC9147 - New Pond

Address:	Between the intersections of Braccock Road with Rolling Road and Burke Lake Road
Location:	Kings Park Shopping Center
Land Owner:	Private - Commercial
PIN:	
Control Type	Water Quality and Quantity
Drainage Area	3.95 acres
Receiving Waters	Unknown tributary of Long Branch

Description: A new extended detention dry pond is proposed in a grass median between Braddock Road and the Kings Park Shopping Center. Existing storm drains from the Shopping Center cross underneath the site before crossing Braddock Road and discharging into a stream, giving the potential for treatment of both water quality and quantity. This project would require modification of the storm drain system to discharge into the proposed facility. The proposed riser would connect to the existing storm drain under Braddock Road to avoid road work.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project would provide water quantity management of 2- and 10-year peak runoff and water quality treatment, through extended detention, of the half-inch, 48-hour storm. Micropools will provide wet storage to augment pollutant removal and provide more sedimentation. An estimated 656 lbs of sediment, seven lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: There appear to be no utilities in the project area except overhead lines. The adjacent land use is commercial, so no environmental constraints or permitting issues are anticipated. Access to the site is excellent from the road and parking lot.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	$15,000.00	$3,000
Plunge pool / Micropool	2	EA	$400.00	$800
Excavate to create low-flow channel	105	LF	$25.00	$2,625
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Outfall Pipe	35	LF	$300.00	$10,500
New End Wall	1	EA	$2,500.00	$2,500
Rip Rap Stabilization	30	SY	$100.00	$3,000
Grading and Excavation	1447	CY	$35.00	$50,645
Embankment	362	CY	$50.00	$18,100
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$108,170**
Plantings	1	LS	5% of Project	$5,409
Ancillary Items	1	LS	5% of Project	$5,409
Erosion and Sediment Control	1	LS	10% of Project	$10,817
			Base Construction Costs	**$129,805**
			Mobilization (5%)	$6,490
			Subtotal 1	$136,295
			Contingency (25%)	$34,074
			Subtotal 2	$170,369
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$76,666
			Estimated Project Cost	**$247,000**

Site Photo: Proposed Facility Location

Site Photo: Proposed Facility Drainage Area

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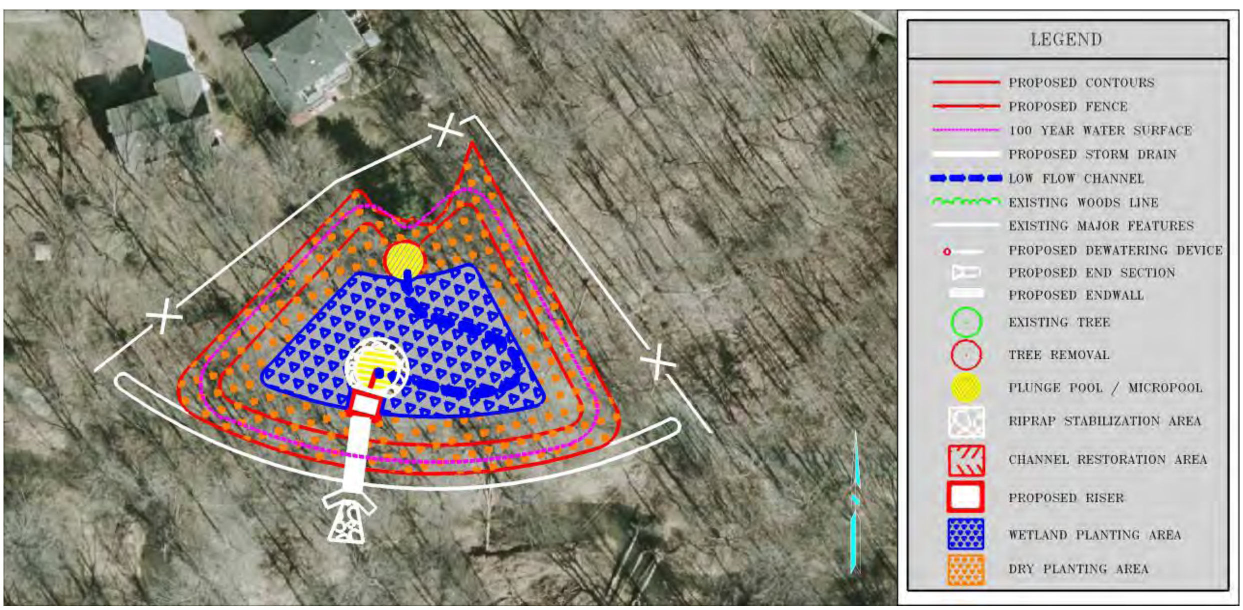
AC9148 - New Pond

Address:	Behind 4808 Springbrook Drive, at the end of Hercules Court
Location:	Long Branch Park
Land Owner:	County - FCPA
PIN:	0694 12 B
Control Type	Water Quality and Quantity
Drainage Area	35.66 acres
Receiving Waters	Unknown tributary of Long Branch

Description: An extended detention dry pond is proposed at the existing storm drain outfall behind the houses on Springbrook Drive to treat both the water quality and quantity of the runoff from this residential neighborhood. The new pond would involve excavation, construction of an embankment, installation of a riser structure, and internal pond features including a plungepool, a micropool, and a meandering low-flow channel. The outfall of the facility would need to be under the pedestrian path so as to allow the path to remain in use.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project would provide water quality treatment via extended detention of the half-inch, 48-hour storm and water quantity management of 2- and 10-year peak runoff volumes. The storm drain at this location does not convey baseflow, only stormwater, so this is an excellent location for an extended detention stormwater facility. A micropool will enhance the treatment of a stormwater facility at this location and increase the removal of suspended sediment and nutrients. An estimated 2,628 lbs of sediment, 29 lbs of total nitrogen and six lbs of total phosphorus would be reduced by this project.

Project Design Considerations: There are likely no utilities in the project area, although this should still be investigated to confirm. The removal of some trees would be required, although many of the trees in the area are already dead. In any event, FCPA will require any trees damaged by construction to be replaced or trimmed. No permitting is anticipated. There is an existing pedestrian path between the proposed facility and the main channel, which may need to be relocated in some places to allow for construction of the embankment. The path provides easy access to the site for construction equipment as well as for residents, so it provides an opportunity for interpretive signs and outreach.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.5	AC	$15,000.00	$7,500
Plungepool / Micropool	2	EA	$400.00	$800
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Rip Rap Stabilization	40	SY	$100.00	$4,000
Grading and Excavation	6398	CY	$35.00	$223,930
Embankment	1600	CY	$50.00	$80,000
Outfall Pipe	40	LF	$300.00	$12,000
Outlet Protection	1	EA	$8,000.00	$8,000
New Endwall	1	EA	$2,500.00	$2,500
Excavate to create low-flow channel	170	LF	$25.00	$4,250
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$359,980**
Plantings	1	LS	5% of Project	$17,999
Ancillary Items	1	LS	5% of Project	$17,999
Erosion and Sediment Control	1	LS	10% of Project	$35,998
			Base Construction Costs	**$431,976**
			Mobilization (5%)	$21,599
			Subtotal 1	$453,575
			Contingency (25%)	$113,394
			Subtotal 2	$566,969
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$255,136
			Estimated Project Cost	**$822,000**

Site Photo: Storm Drain Outfall to Proposed Facility

Site Photo: Proposed Facility Location

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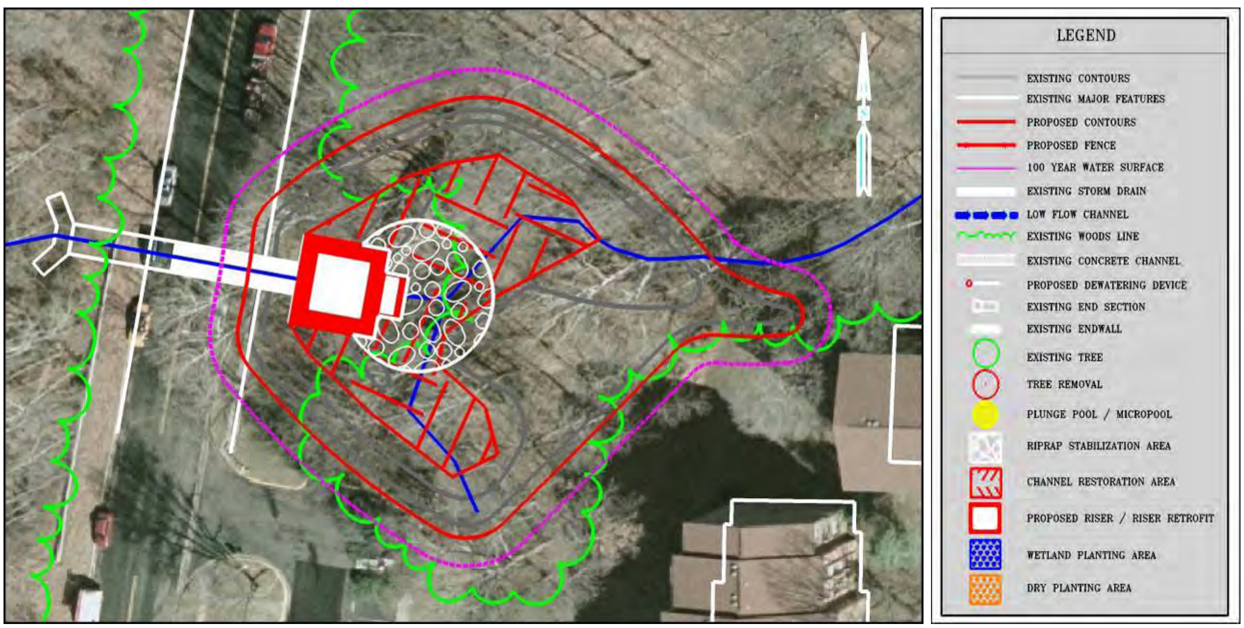
AC9161 - Pond Retrofit

Address:	Near the intersection of Americana Drive and Commons Drive
Location:	Patriot Village
Land Owner:	Private - Residential
PIN:	0702 01 0026
Control Type	Water Quality
Drainage Area	80.55 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This is an existing dry pond, 0294DP, which will be retrofit to provide water quality treatment. Field observations indicated that the existing riser structure is failing, so the pond is only functioning as a culvert with little detention. The project recommendations include retrofitting the pond by replacing the riser and repair of portions of badly eroded channel.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: The replacement of the existing control structure located on the upstream side embankment of Americana Drive has the potential to provide water quality treatment for the contributing drainage area; however, it is unlikely that 2-year or 10-year detention could be met. Replacing the current riser and changing the outflow characteristics will promote the removal of pollutants, floatables, and suspended solids. It is estimated that an annual total of 7,580 lbs of sediment, 75 lbs of total nitrogen and 14 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with the apartment complex owners will be necessary to retrofit this facility since it is located on private land. Access to this facility is very good from Americana Drive. Existing utility conflicts are not anticipated with this retrofit. Environmental permitting issues are expected due to the in-stream location of this facility. Some tree removal may be necessary as well. In-stream construction will require base flow diversion. The base flow component of the replaced control structure will require regular maintenance to prevent clogging.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.5	AC	$12,000.00	$6,000
New Riser	1	LS	$8,000.00	$8,000
Rip Rap Stabilization	150	SY	$100.00	$15,000
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$37,500**
Plantings	1	LS	5% of Project	$1,875
Ancillary Items	1	LS	5% of Project	$1,875
Erosion and Sediment Control	1	LS	10% of Project	$3,750
			Base Construction Costs	**$45,000**
			Mobilization (5%)	$2,250
			Subtotal 1	$47,250
			Contingency (25%)	$11,813
			Subtotal 2	$59,063
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$26,578
			Estimated Project Cost	**$86,000**

Site Photo: Existing Facility Embankment

Site Photo: Existing Facility and Control Structure

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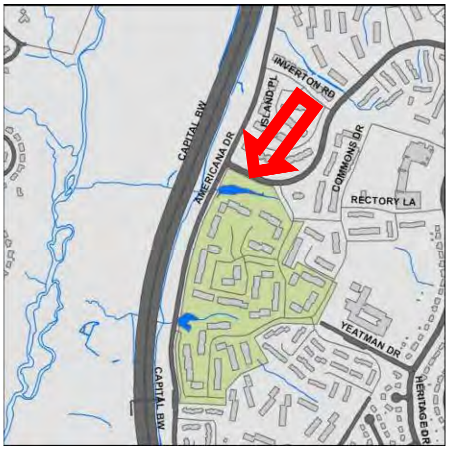
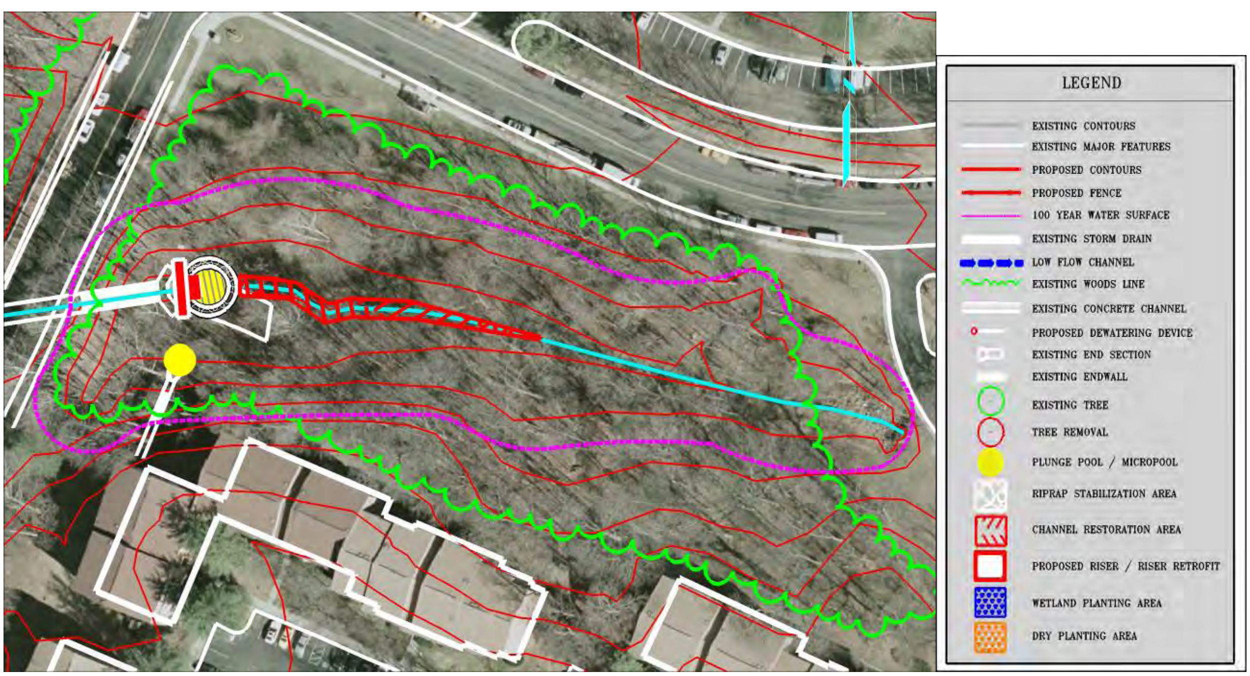
AC9162 - Pond Retrofit



Address:	Americana Drive at Patriot Drive
Location:	Patriot Village
Land Owner:	Private - Residential
PIN:	0702 01 0026
Control Type	Water Quality and Quantity
Drainage Area	82.8 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This existing dry pond, 0393DP, is located on the upstream side of the culvert underneath Americana Drive directly upstream of Capital Beltway. This facility is in an existing perennial stream channel in a forested area between residential communities. There is moderate erosion on the upstream side of this culvert. The proposed project will remove the existing concrete channel that is failing, restore the deteriorating stream channel, and install a new control structure on the upstream side of the culvert to provide water quality treatment and some management of the 2-year storm event. The receiving stream on the downstream side of the culvert will also be stabilized to prevent further erosion.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project has the potential to manage up to the 2 year design storm with the addition of a control structure on the upstream side of the existing cross culvert underneath Americana Drive near Patriot Drive. Managing this design storm will help to reduce flow rates which will reduce the potential for future downstream channel erosion. Water quality treatment will be provided with the addition of a plungepool and micropool and extended detention. It is estimated that an annual total of 11,578 lbs of sediment, 113 lbs of total nitrogen and 21 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Due to the size of the contributing drainage area, peak flow management of the 10-year design storm is unlikely. All components of the existing embankment and stream channel should be analyzed to ensure that the integrity of the cross culvert is not compromised as a result of the change in hydraulic characteristics at this site. This project is located within the 100 year floodplain so any adjustments to the characteristics of stream must adhere to FEMA regulations. Retrofitting a control structure will cause water levels to rise on the upstream side of the embankment within the pond footprint. The base flow component of the control structure will require regular maintenance inspection to prevent clogging. Environmental permitting measures are expected due to the in-stream location of this facility. Tree clearing is expected to provide access to the culvert and stream channel. Existing utility conflicts are not anticipated with this retrofit; however, sanitary sewer manholes and a sewer pipe crossing under the channel are present on the floodplain upstream of this culvert. Access is good from Americana Drive.

The project is upstream of stream restoration project AC9233. Design work for both projects should be carried out concurrently.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.4	AC	$8,500.00	$3,400
Paved Ditch Demolition & Haul Away	60	LF	$30.00	$1,800
Plungepool / Micropool	2	EA	$400.00	$800
New Control Structure - Weir	1	LS	$10,000.00	$10,000
Channel Stabilization	200	LF	$50.00	$10,000
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$34,500**
Plantings	1	LS	5% of Project	$1,725
Ancillary Items	1	LS	5% of Project	$1,725
Erosion and Sediment Control	1	LS	10% of Project	$3,450
			Base Construction Costs	**$41,400**
			Mobilization (5%)	$2,070
			Subtotal 1	$43,470
			Contingency (25%)	$10,868
			Subtotal 2	$54,338
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$24,452
			Estimated Project Cost	**$79,000**

Site Photo: Existing Stream Channel

Site Photo: Existing Control Structure

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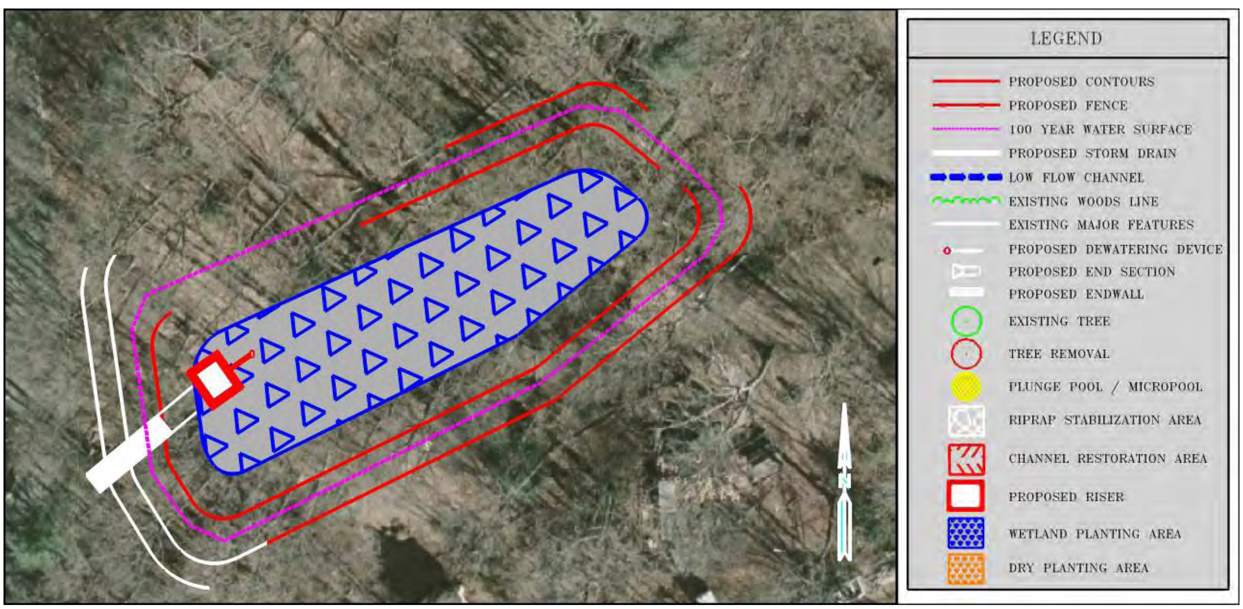
AC9172 - New Pond

Address:	Next to 7820 Libeau Lane,
Location:	End of Libeau Lane
Land Owner:	Private - Residential
PIN:	0592 01 0033
Control Type	Water Quality and Quantity
Drainage Area	10.77 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: On the east side of Wheatwheel Lane, there is an existing flood control structure which does not provide any water quality treatment and only provides water quantity treatment for larger storms. To provide water quality and water quantity treatment at this location, an extended detention facility will be built upstream of the flood control structure by creating a secondary impoundment and riser. The proposed facility would be set back from the existing control structure to ensure that it does not impact the flood control function.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment via extended detention of the half-inch, 48 hour storm and water quantity management of 2- and 10-year peak runoff volumes. An additional impoundment structure would provide an area for settlement of pollutants and suspended sediments. Plantings within the impoundment area would provide additional nutrient uptake. Attenuation of peak flows would be provided by the secondary impoundment structure as well as the existing flood control structure. It is estimated that a total of 996 lbs of sediment, 10 lbs of total nitrogen and two lbs of total phosphorus would be reduced by this project.

Project Design Considerations: The presence of utilities in the project area would need to be determined before the final design can be implemented. Both existing wetlands and forest would be impacted and would require permitting. Access to the site is possible from Wheatwheel Lane. Maintenance on the site, once completed, would be important because of the amount of leaves and debris that originate from the forested area.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.8	AC	$15,000.00	$12,000
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	8120	CY	$35.00	$284,200
Embankment	2030	CY	$50.00	$101,500
Outfall Pipe	60	LF	$300.00	$18,000
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$432,700**
Plantings	1	LS	5% of Project	$21,635
Ancillary Items	1	LS	5% of Project	$21,635
Erosion and Sediment Control	1	LS	10% of Project	$43,270
			Base Construction Costs	**$519,240**
			Mobilization (5%)	$25,962
			Subtotal 1	$545,202
			Contingency (25%)	$136,301
			Subtotal 2	$681,503
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$306,676
			Estimated Project Cost	**$988,000**

Site Photo: Existing Flood Control Structure

Site Photo: Existing Channel Into Flood Control Structure

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AC9175 - Pond Retrofit

Address:	Between Hunting Pines Court and Hunting Pines Place, Behind 3901 Bentwood Court, Behind 8922 Little River Turnpike
Location:	Hunters Glen, Ridgelea Hills, Bethlehem Lutheran Church
Land Owner:	Private
PIN:	0584 32 B, 0584 28 D, 0584 01 0061
Control Type	Water Quality
Drainage Area	15.32 acres, 107.01 acres, 3.55 acres
Receiving Waters	Unknown tributary of Crook Branch

Description: This project consists of retrofit of three existing dry ponds. AC9175A (0137DP) treats the runoff from Hunter's Glen neighborhood. AC9175B (0045DP) provides flood control for large storms in the Ridglea Hills neighborhood. It is located in a heavily forested area between residential neighborhoods. AC9175C (DP0133) is an existing dry pond at Bethlehem Church. The concrete channel within the facility directs runoff from the inflow directly to the riser structure. This project will consist of a new riser/control structures for each of the ponds, including a dewatering device, excavating for additional storage, and adding a micropool to each riser structure and a plunge pool to each inflow.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Site AC9175A and Site AC9175C will meet the water quality treatment requirement via extended detention of the one-half inch, 48 hour storm. Site AC9175B has the potential to attenuate peak runoff volumes for high-frequency design storms with the addition of a control structure on the upstream side of the existing culvert. At site AC9175B, a control structure on the upstream side of the culvert will allow the pond to achieve water quality goals for habitat improvement and prevent downstream erosion. It is estimated that an annual total of 8,977 lbs of sediment, 95 lbs of total nitrogen and 22 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Site AC9175B is located between cul-de-sacs in a residential community with several houses within close proximity to this facility. Coordination with residents and an HOA will be necessary to retrofit sites AC9175A and AC9175B since they are located on private land. For site AC9175C, coordination with the church will be required. The storm drains that drain to Sites AC9175A and AC9175C may need to be adjusted to maintain stability within the facilities. Adding a control structure at AC9175B would cause water levels to rise on the upstream side of the embankment within the pond footprint, it is recommended to consider this in the design phase. All existing components of site AC9175B should be analyzed to ensure their integrity. Environmental permitting issues, utility conflicts, and tree impacts are not anticipated with sites AC9175A and AC9175C. At Site AC9175B, environmental permitting issues are anticipated due to the in-stream location of this facility and moderate tree loss, although existing utility conflicts are not anticipated. Access to Site AC9175A is good from Hunting Pines Place. Access to Site AC9175C is very good from the Bethlehem Lutheran Church. Access to Site AC9175B is difficult and will either need to occur from the end of Autumn Leaf Court or Bentwood Court.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	1.7	AC	$8,500.00	$14,450
Paved Ditch Demolition & Haul Away	100	LF	$30.00	$3,000
Tree Removal	5	EA	$2,000.00	$10,000
Plungepool / Micropool	6	EA	$400.00	$2,400
Excavate to create low-flow channel	150	LF	$25.00	$3,750
New Riser	3	LS	$8,000.00	$24,000
Embedded Dewatering Pipe	3	EA	$500.00	$1,500
Remove Existing Headwall	1	EA	$300.00	$300
Rip Rap Stabilization	55	SY	$100.00	$5,500
Grading and Excavation	50	CY	$35.00	$1,750
Soil Borings	3	LS	$8,500.00	$25,500
			Initial Project Costs	**$92,150**
Plantings	1	LS	5% of Project	$4,608
Ancillary Items	1	LS	5% of Project	$4,608
Erosion and Sediment Control	1	LS	10% of Project	$9,215
			Base Construction Costs	**$110,581**
			Mobilization (5%)	$5,529
			Subtotal 1	$116,110
			Contingency (25%)	$29,028
			Subtotal 2	$145,138
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$65,312
			Estimated Project Cost	**$210,000**


Site Photo: Existing Facility Overview (AC9175A)


Site Photo: Existing Facility Overview (AC9175B)

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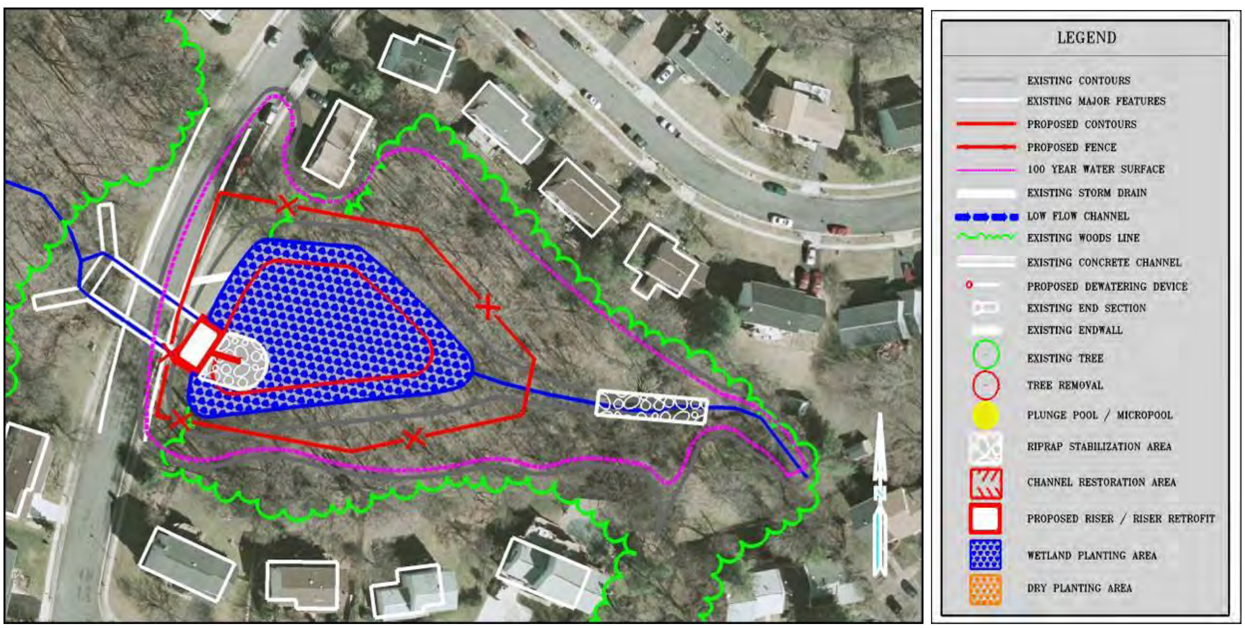
AC9178 - Pond Retrofit

Address:	Near the intersection of Monarch Lane and Happy Heart Lane, Next to 3351 Monarch Lane
Location:	Prosperity Heights
Land Owner:	Private - Residential
PIN:	0591 27 D
Control Type	Water Quality and Quantity
Drainage Area	25.79 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This facility is an existing dry pond (0169DP) treating the runoff from a residential area in the Prosperity Heights neighborhood. The proposed retrofit will convert the pond to a wetland facility. This project will consist of a removing the existing headwall and replacing with a new riser structure including a new dewatering system, and riprap stabilization.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility would meet the water quality treatment requirement for the contributing drainage area via extended detention of the one-half inch, 48 hour storm, as well as peak flow management of the 2-year peak runoff volume. Retrofitting this facility would promote the removal of suspended solids and floatables through extended detention. These proposed improvements will also help prevent future downstream channel erosion. It is estimated that an annual total of 7,360 lbs of sediment, 60 lbs of total nitrogen and 16 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with residents and HOA will be necessary to retrofit this facility since it is located on private land. Environmental permitting issues are expected due to the in-stream location and the presence of wetlands in this facility. Some tree removal along the sides of the facility and modifications to an existing stream channel that flows to this facility will be necessary. In-stream construction will require base flow diversion. Existing utility conflicts are not anticipated. Access to this facility is very good as it is located directly off of Monarch Lane.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.5	AC	$8,500.00	$4,250
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Rip Rap Stabilization	160	SY	$100.00	$16,000
Grading and Excavation	3941	CY	$35.00	$137,935
Remove Existing Headwall	1	EA	$300.00	$300
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$175,485**
Plantings	1	LS	5% of Project	$8,774
Ancillary Items	1	LS	5% of Project	$8,774
Erosion and Sediment Control	1	LS	10% of Project	$17,549
			Base Construction Costs	**$210,582**
			Mobilization (5%)	$10,529
			Subtotal 1	$221,111
			Contingency (25%)	$55,278
			Subtotal 2	$276,389
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$124,375
			Estimated Project Cost	**$401,000**


Site Photo: Existing Facility Overview


Site Photo: Existing Facility Inflow and Control Structure

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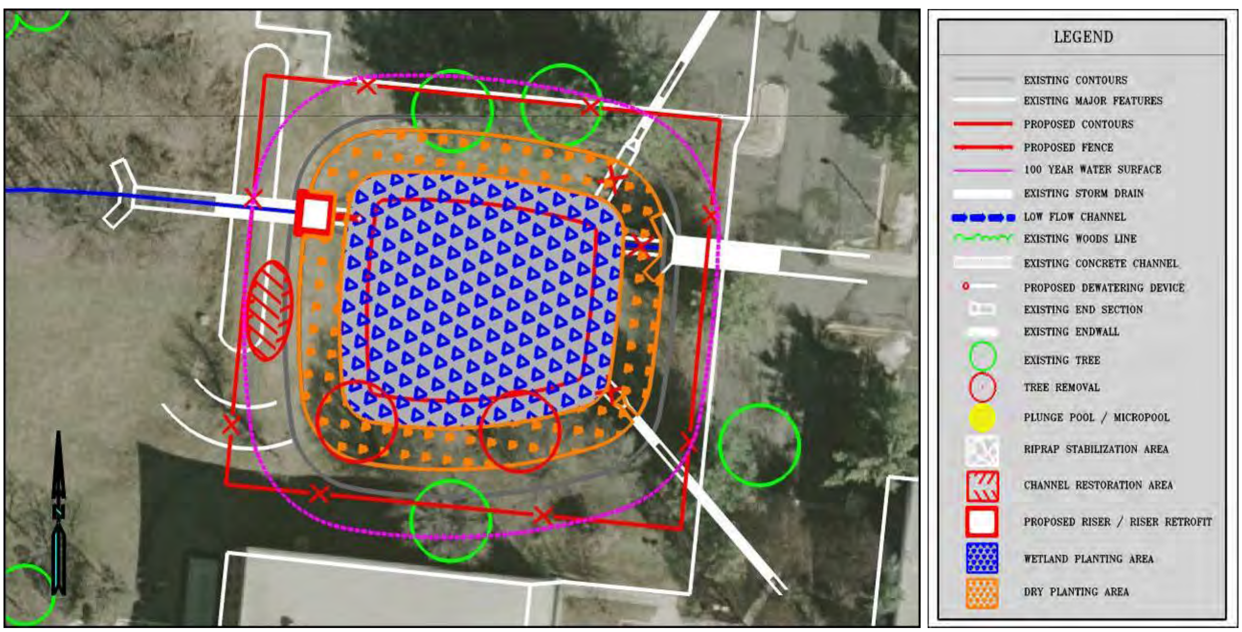
AC9181 - Pond Retrofit

Address:	Behind 2720 Prosperity Avenue
Location:	Prosperity Business Campus
Land Owner:	Private - Commercial
PIN:	0491 19 G
Control Type	Water Quality
Drainage Area	43.61 acres
Receiving Waters	Unknown tributary of Long Branch

Description: Dry pond DP0146 receives runoff from the nearby business park. This project is a retrofit that convert the pond to a shallow wetland by removing the existing concrete low-flow channels, excavating to create permanent wet storage and replacing the existing riser with a new riser and dewatering system.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility has the potential to meet approximately two-thirds of the water quality treatment requirement for the contributing drainage area in the form of permanent wet storage volume. Retrofitting this facility would promote the removal of suspended solids and floatables through settling in the new wet storage areas, as well as reduce nitrogen and phosphorus through uptake by wetlan plants. These proposed improvements will also help prevent future downstream channel erosion by reducing peak flows and erosive velocities. It is estimated that an annual total of 10,185 lbs of sediment, 110 lbs of total nitrogen and 20 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: The proposed wet storage element in the facility is not capable of meeting 100 percent of the water quality volume requirement for the contributing drainage area. Since this facility is located in a private commercial/industrial area, coordination with the property owner will be necessary. Converting this facility to a wetland will create a permanent pool that is below the invert of the existing outlet pipe and, therefore, will not positively drain. Access to this facility is good and can be accessed from three different parking lots that surround this facility. Environmental permitting issues may be encountered due to the presence of baseflow from several storm drain inflows into this facility. Existing utility conflicts are not anticipated.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition & Haul Away	235	LF	$30.00	$7,050
Tree Removal	2	EA	$2,000.00	$4,000
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	2271	CY	$35.00	$79,485
Slope Stabilization	1	LS	$1,200.00	$1,200
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$108,735**
Plantings	1	LS	5% of Project	$5,437
Ancillary Items	1	LS	5% of Project	$5,437
Erosion and Sediment Control	1	LS	10% of Project	$10,874
			Base Construction Costs	**$130,483**
			Mobilization (5%)	$6,524
			Subtotal 1	$137,007
			Contingency (25%)	$34,252
			Subtotal 2	$171,259
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$77,067
			Estimated Project Cost	**$248,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Control Structure and Concrete Low Flow Channels

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AC9182 - Pond Retrofit

Address:	At the end of Readsborough Court
Location:	Mantua Park
Land Owner:	County - FCPA
PIN:	0484 18 D
Control Type	Water Quality
Drainage Area	9.57 acres
Receiving Waters	Bear Branch

Description: This is an existing dry pond (0043DP), which will be retrofitted to improve water quality treatment and provide some peak flow management. There is a small baseflow through the facility with existing wetlands within and downstream of the facility. The existing wetlands and stream provide some water quality improvement and will be disturbed as little as possible. This project will consist of a new weir or control structure and riprap stabilization on both the upstream and downstream side of the existing culvert.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Retrofitting this facility will promote removal of suspended solids through extended detention and improve the removal of nitrogen and phophorus through sedimentation in the floodplain and uptake by wetland plants. It is estimated that an annual total of 1,358 lbs of sediment, five lbs of total nitrogen and two lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in a residential community, installing signs around the facility is recommended for public awareness. Little coordination will be necessary to retrofit this facility since it is located on County land. Access to this facility is good from either the end of Eakin Park Court or Readsborough Courts and will require minimal tree removal. However, if trees are damaged by construction FCPA will require replacement or trimming. Several underground utilities and sanitary sewer manholes were identified behind the houses at the end of Eakin Park Court. Utility conflicts on the pond embankment or near the outlet pipe are not anticipated. Construction will focus on the area of the proposed control structure where some tree removal can be expected.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.2	AC	$12,000.00	$2,400
New Riser	1	LS	$8,000.00	$8,000
Rip Rap Stabilization	45	SY	$100.00	$4,500
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$23,400**
Plantings	1	LS	5% of Project	$1,170
Ancillary Items	1	LS	5% of Project	$1,170
Erosion and Sediment Control	1	LS	10% of Project	$2,340
			Base Construction Costs	**$28,080**
			Mobilization (5%)	$1,404
			Subtotal 1	$29,484
			Contingency (25%)	$7,371
			Subtotal 2	$36,855
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$16,585
			Estimated Project Cost	**$53,000**


Site Photo: Existing Facility Overview


Site Photo: Inflow into Facility

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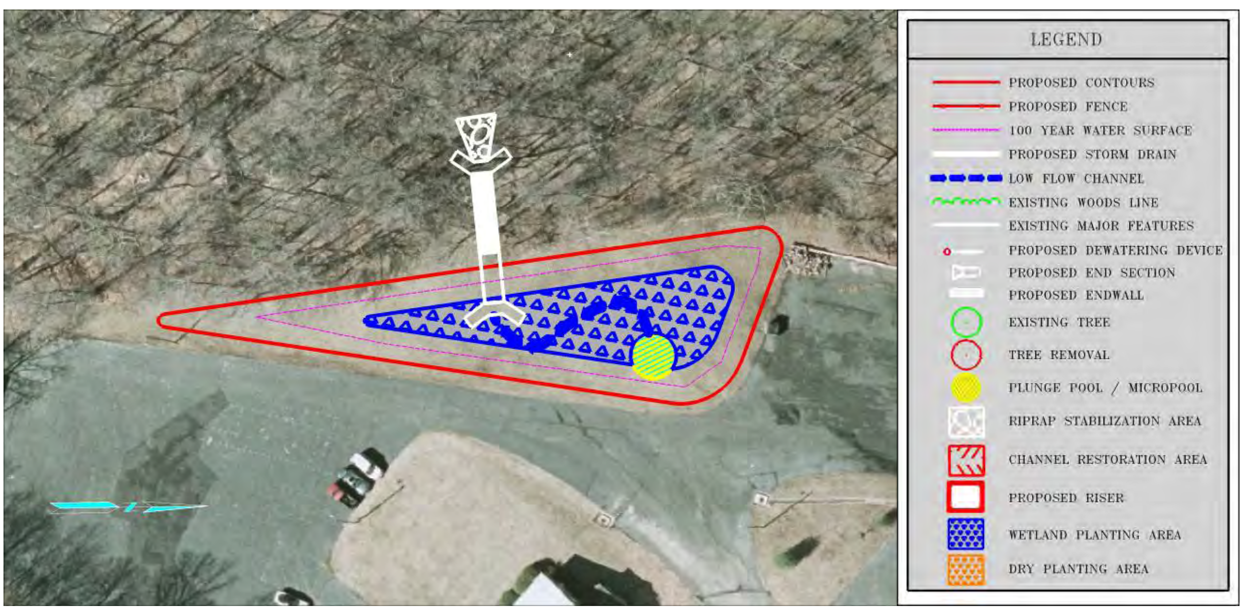
AC9183 - New Pond

Address:	9001 Arlington Boulevard
Location:	Kena Shriners
Land Owner:	Private
PIN:	0484 01 0042A
Control Type	Water Quality and Quantity
Drainage Area	9.02 acres
Receiving Waters	Bear Branch

Description: The project site at the Kena Shriner Temple has a lot of curbed, paved area with storm drains and no existing treatment. The proposed facility would be located on the southwest portion of the site. Part of the existing storm drain system runs underneath this area. The existing pipe will be cut so that it discharges into the proposed facility for treatment. A riser structure will be used to provide detention before the water is discharged into the stream. Water quality will also be provided within the proposed facility. Although runoff from all the paved area will not reach the proposed facility, the treatment provided within the facility is sufficient for all of the impervious area on site if the lot is regraded in the future.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project would provide water quality treatment of the half-inch, 48 hour storm as well as management of the 2-year peak flow volume. This large parking lot, which is currently untreated, likely contributes oil, grease, sediment, and pollutants to the forested area on the downstream side. A new facility will reduce loads of nutrients and suspended solids from the runoff before it reaches the stream, which would help improve the water quality and habitat. It is estimated that a total of 1,229 lbs of sediment, 15 lbs of total nitrogen and four lbs of total phosphorus would be reduced by this project.

Project Design Considerations: This facility would require the modification of the storm drain system to discharge the runoff within the open space next to the parking lot. As the property is privately owned, coordination and input from the owner will be required for this project. No environmental permitting issues are anticipated with this project and little to no tree removal is required; however, the area is near a Native American site (44FX0014). All construction access and staging should occur on paved areas to limit further disturbance. There are no anticipated conflicts with utilities.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.3	AC	$8,500.00	$2,550
Plungepool / Micropool	1	EA	$400.00	$400
Excavate to create low-flow channel	95	LF	$25.00	$2,375
Outlet Protection	1	EA	$8,000.00	$8,000
Outfall Pipe	65	LF	$300.00	$19,500
New Endwall	2	EA	$2,500.00	$5,000
Grading and Excavation	1546	CY	$35.00	$54,110
Embankment	387	CY	$50.00	$19,350
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$119,785**
Plantings	1	LS	5% of Project	$5,989
Ancillary Items	1	LS	5% of Project	$5,989
Erosion and Sediment Control	1	LS	10% of Project	$11,979
			Base Construction Costs	**$143,742**
			Mobilization (5%)	$7,187
			Subtotal 1	$150,929
			Contingency (25%)	$37,732
			Subtotal 2	$188,661
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$84,897
			Estimated Project Cost	**$274,000**


Site Photo: Existing Parking Area


Site Photo: Open Space For Proposed Facility

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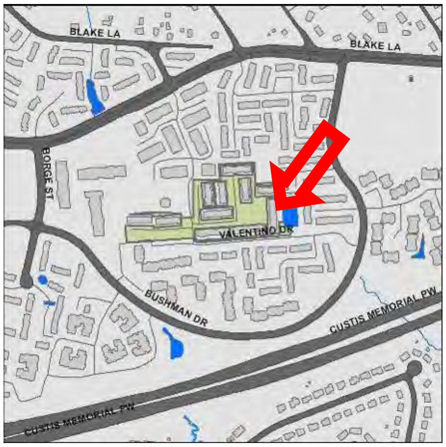
AC9195 - Pond Retrofit



Address:	Between the 10100 block of Turnberry Place and the 10100 block of Ebenshire Court, Across from 10141 Valentino Drive
Location:	Oakton Village
Land Owner:	Private - Residential
PIN:	0474 09 B, 0474 21 L, 0472 21 C, 0474 21 G
Control Type	Water Quality and Quantity
Drainage Area	30.19 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This is an existing dry pond, 0935DP, which will be converted to an extended detention facility. There is a concrete channel that carries runoff as well as baseflow from the inflow point to the outlet structure. This project will consist of a new riser structure including a dewatering device, removing the concrete low-flow channels and replacing them with a meandering low flow channel and adding a plunge pool to each inflow into the facility.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility will meet the water quality treatment requirement via extended detention of the one-half inch, 48 hour storm. Retrofitting this facility would help to prevent future downstream erosion by reducing peak flow rates and erosive velocities. It is estimated that an annual total of 3,958 lbs of sediment, 39 lbs of total nitrogen and nine lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with residents and the Concord Village HOA will be necessary to retrofit this facility as it is located on private land. Environmental permitting issues may be encountered due to the presence of baseflow. No tree loss is expected with this pond retrofit. Existing utility conflicts are not anticipated. Access to this facility is very good from Valentino Drive.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Paved Ditch Demolition & Haul Away	195	LF	$30.00	$5,850
Plungepool / Micropool	3	EA	$400.00	$1,200
Excavate to create low-flow channel	195	LF	$25.00	$4,875
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$28,925**
Plantings	1	LS	5% of Project	$1,446
Ancillary Items	1	LS	5% of Project	$1,446
Erosion and Sediment Control	1	LS	10% of Project	$2,893
			Base Construction Costs	**$34,710**
			Mobilization (5%)	$1,736
			Subtotal 1	$36,446
			Contingency (25%)	$9,112
			Subtotal 2	$45,558
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$20,501
			Estimated Project Cost	**$66,000**


Site Photo: Existing Facility Inflow and Control Structure


Site Photo: Existing Facility Overview

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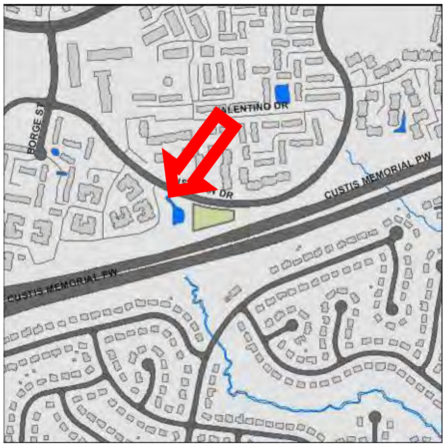
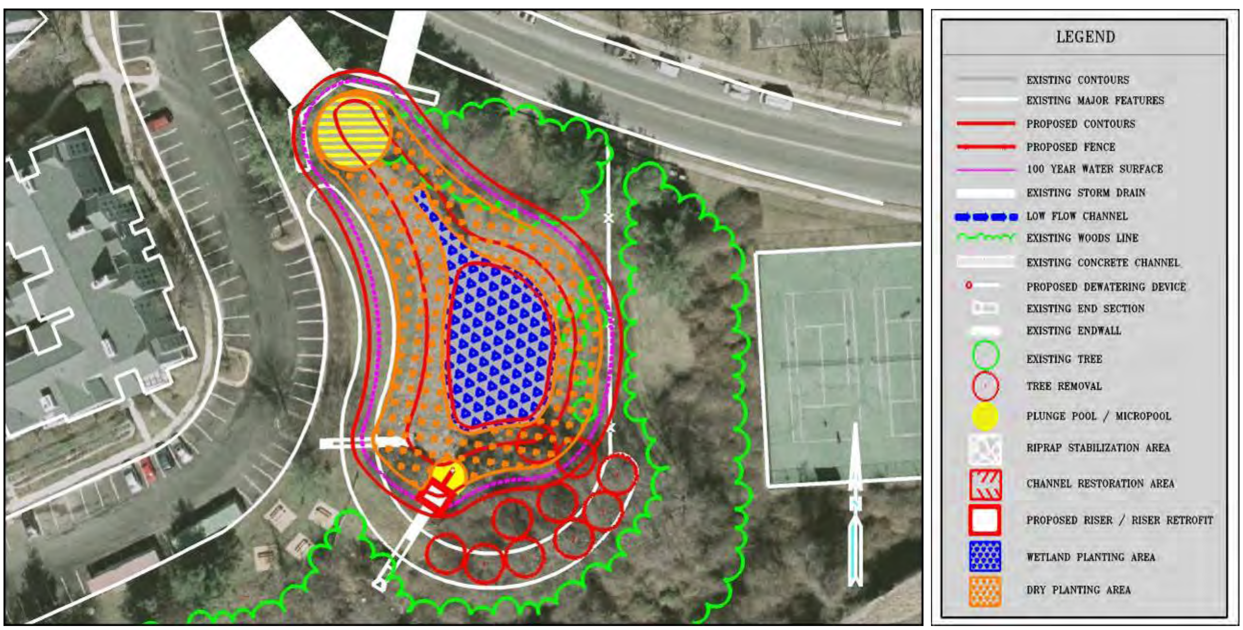
AC9196 - Pond Retrofit



Address:	Near the intersection of Appalachian Circle and Bushman Drive
Location:	Four Winds at Oakton Condominium
Land Owner:	Private - Residential
PIN:	
Control Type	Water Quality and Quantity
Drainage Area	30.19 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This is an existing wet pond (WP0271) that will be converted to a wetland facility. The outlet pipe from the pond is moderately eroded and would be stabilized during this retrofit. This project will consist of a new riser structure including a dewatering device, excavating for additional storage, tree removal, and a micropool and plunge pool at the riser and inflow, respectively. The new riser should be designed to allow baseflow to pass through the facility.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Retrofitting the existing control structure located on the upstream side of the embankment has the potential to provide water quality treatment and some peak flow management. Installing a new riser and enlarging the facility will promote the removal of pollutants, floatables and suspended solids through extended detention. These proposed improvements will also help reduce future downstream channel erosion. Peak flow rates, erosive velocities and channel sediment loads will be reduced by this project. It is estimated that an annual total of 9,581 lbs of sediment, 94 lbs of total nitrogen and 20 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Since this facility is located in a residential community and is adjacent to recreational areas and parking lots, installing signs around the facility is recommended to promote public awareness. Coordination with residents and The Four Winds at Oakton HOA will be necessary to retrofit this facility since it is located on private land. Environmental permitting issues are expected due to the presence of extensive wetlands and the in-stream location of this facility. In-stream construction will require base flow diversion. Significant tree loss is expected on the embankment, around the edges, and at the upstream end of this facility. Existing utility conflicts are not anticipated. Access to this facility is very good from parking areas located along Appalachian Circle.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.6	AC	$8,500.00	$5,100
Tree Removal	10	EA	$2,000.00	$20,000
Plungepool / Micropool	2	EA	$400.00	$800
New Riser	1	LS	$8,000.00	$8,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	976	CY	$35.00	$34,160
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$77,060**
Plantings	1	LS	5% of Project	$3,853
Ancillary Items	1	LS	5% of Project	$3,853
Erosion and Sediment Control	1	LS	10% of Project	$7,706
			Base Construction Costs	**$92,472**
			Mobilization (5%)	$4,624
			Subtotal 1	$97,096
			Contingency (25%)	$24,274
			Subtotal 2	$121,370
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$54,617
			Estimated Project Cost	**$176,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Facility Inflow

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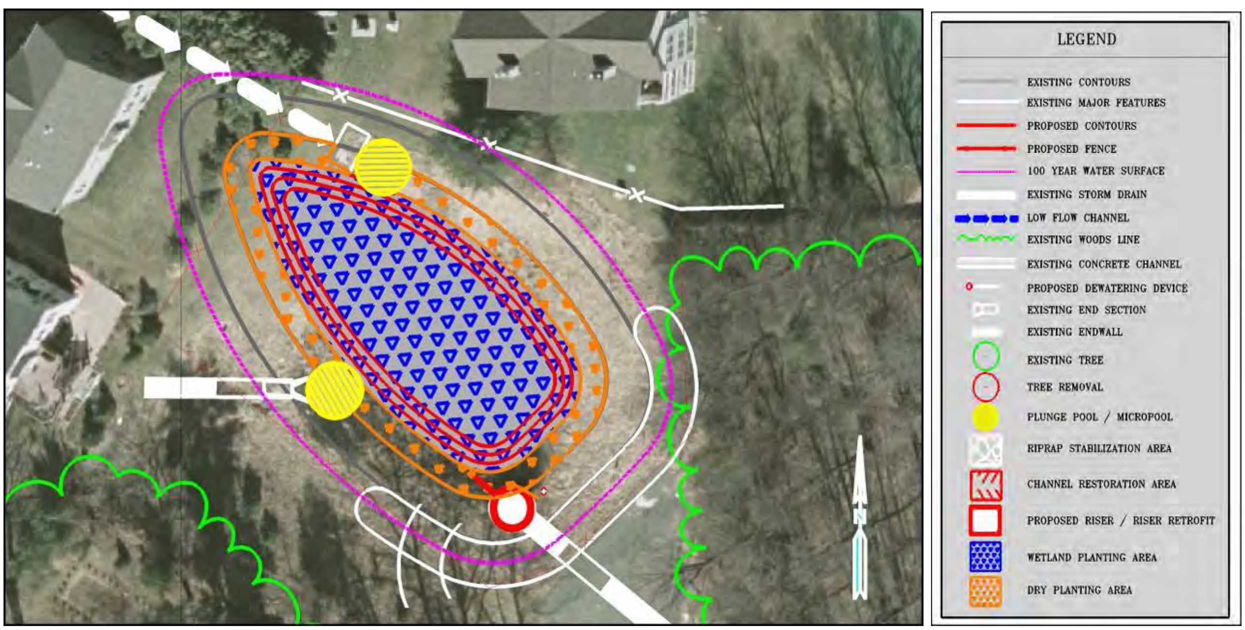
AC9199 - Pond Retrofit

Address:	At the end of Arrowhead Circle, Behind 10695 Dudley Heights Court
Location:	Rosehaven Estates
Land Owner:	Private - Residential
PIN:	0473 18 C
Control Type	Water Quality and Quantity
Drainage Area	32.65 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This is an existing dry pond (1235DP), which will be modified to provide a greater water quality volume and peak flow reduction. Over time, wetland vegetation has become established in the bottom of the pond, so it is not worth disturbing this area to create additional storage. This project will consist of modifying the existing riser structure including adding a dewatering device, installing plunge pool and a micropool for energy dissipation and settling, and wetland and dry plantings.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This facility has the potential to meet some of the water quality treatment requirement by providing extended detention of the half-inch, 48 hour storm. The permanent wet storage will promote uptake of nutrients and the removal of suspended solids and pollutants from the downstream channel. Retrofitting this facility would help to reduce future downstream erosion by reducing peak flow rates and erosive velocities. It is estimated that an annual total of 1,758 lbs of sediment, 17 lbs of total nitrogen and five lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with residents and appropriate HOAs will be necessary to retrofit this facility since it is located on private land. Environmental permitting issues are expected due to the presence of extensive wetlands and baseflow from an inflow pipe. Minimal tree loss is expected with this retrofit. Existing utility conflicts are not anticipated. There is an access road that leads to this pond located off of Rosehaven Street near the intersection with Spruce Street.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Clear and Grub	0.4	AC	$8,500.00	$3,400
Tree Removal	5	EA	$2,000.00	$10,000
Plungepool / Micropool	3	EA	$400.00	$1,200
Riser Retrofit	1	LS	$4,000.00	$4,000
Embedded Dewatering Pipe	1	EA	$500.00	$500
Grading and Excavation	8	CY	$35.00	$280
Soil Borings	1	LS	$8,500.00	$8,500
			Initial Project Costs	**$27,880**
Plantings	1	LS	5% of Project	$1,394
Ancillary Items	1	LS	5% of Project	$1,394
Erosion and Sediment Control	1	LS	10% of Project	$2,788
			Base Construction Costs	**$33,456**
			Mobilization (5%)	$1,673
			Subtotal 1	$35,129
			Contingency (25%)	$8,782
			Subtotal 2	$43,911
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$19,760
			Estimated Project Cost	**$64,000**

Site Photo: Existing Facility Overview

Site Photo: Existing Control Structure

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AC9200 – Stream Restoration

Vicinity Map

Address:	Between 7823 and 7829 Greeley Boulevard
Location:	Downstream from Greeley Boulevard / Hunter Village Park
Land Owner:	Private / County - FCPA
PIN:	0892 14 0006A, 0892 14 0030C
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project proposes to restore an eroded section of stream channel located in both private and public areas. Severe erosion is occurring along this channel where the floodplain is constricted by the valley walls. Within this channel concrete slabs are found lying along the banks. In addition, what appears to be an abandoned sanitary sewer vault or junction is also present on the left bank facing downstream. Erosion is also evident from a storm drain outfall that drains Harwood Place and in a tributary channel that drains along Bluecurl Circle. Any restoration should also address these small areas.

Restoration of this channel will focus on regrading and stabilizing eroded stream banks through the use of armor-in-place techniques on outer meander bends and bioengineering techniques on the inside meander bends and any straight portions of the channel. Redirecting future flows away from the currently eroded banks in addition to the use of grade controls or stone-toe protection will prevent future bank instability.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: The goal of this project is to stabilize an eroded section of stream channel that has discharged a large amount of sediment in this channel and watershed. Channel armoring and redirection of flow will help to reduce sediment transport within this channel. Sediment load reductions may also be achieved by preventing bank scour, meander bend migration, and over-widening conditions. It is estimated that a total of 33,371 lbs of sediment, 27 lbs of total nitrogen and 10 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Access to this project will be difficult and will most likely need to occur from Hunter Village Drive. Access from this point is relatively far from the project site and steep slopes will need to be accounted for. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will require tree removal. The amount of forest impacts due to access and construction may counteract some of the restoration benefits. This project will also require environmental permitting due to modifications to a perennial stream channel. There are a number of Native American sites above the stream channel. Depending on the amount of disturbance to the terrain, this project may require Phase I archaeological survey, and subsequent archaeological work if sites are found.

Removal of several large concrete slabs from the channel will be necessary for this restoration. Several sanitary sewer utilities were found within the project limits including a large concrete vault area that may constrain design and construction.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	604	LF	$200	$120,800
Clear and Grub	2.08	AC	$10,000	$20,799
Plantings	2.08	AC	$25,000	$51,997
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$293,596
Ancillary Items	1	LS	5% of project	$14,680
Erosion and Sediment Control	1	LS	10% of project	$29,360
			Base Construction Cost	**$337,636**
			Mobilization (5%)	$16,882
			Subtotal 1	$354,518
			Contingency (25%)	$88,630
			Subtotal 2	$443,148
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$199,417
			Estimated Project Cost	**$643,000**

Site Photo: Severe bank erosion

Site Photo: Over-widened channel with moderate erosion

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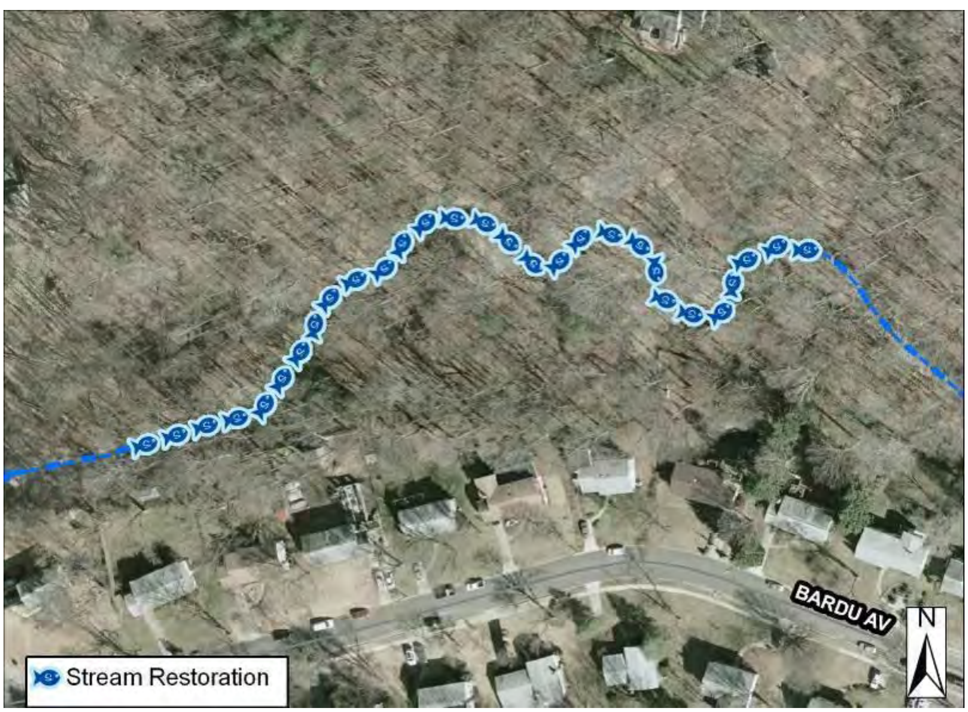
AC9201 - Stream Restoration

Vicinity Map

Address:	6100 Block Bardu Ave
Location:	Accotink Stream Valley Park
Land Owner:	County-FCPA
PIN:	0794 07 0013P
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project parallels Bardu Avenue, between the culvert under Greeley Boulevard and Lamont Court. The upstream portion of the channel is relatively stable except for minor to moderate erosion occurring in isolated areas, and the downstream portion is very sinuous with moderate to severe erosion and over-widening evident. A partially exposed sanitary sewer crossing is present in the downstream portion of the project site.

Restoration of this channel will focus on changing the current channel dimensions to reconnect the original floodplain; redirecting flows away from eroded meanders, and installing grade controls to dissipate stream energy. Armor-in-place or bioengineering stabilization techniques and stone toe protection may be needed on outer meander bends and at the sewer crossing, depending on peak flows and velocities.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to stabilize the channel at the location of an existing sanitary sewer crossing and promote the use of the original floodplain,thus reducing sediment loads currently being transported downstream in this watershed. By reducing sedimentation within this channel and providing stable habitat along restored banks, overall instream water quality and habitat may be also be improved. It is estimated that a total of over 37,902 lbs of sediment, 30 lbs of total nitrogen and 12 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: A partially exposed sanitary sewer pipe and another buried sewer pipe may constrain design and construction along this project. Since access to the floodplain will need to occur from Greeley Boulevard, steep slopes will need to be addressed. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will require significant tree removal. However, in this case, experience has shown that restoration benefits will outweigh overall construction impacts and impacted forest will be replanted. This project will require environmental permitting due to construction and modifications to a perennial stream channel.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	795	LF	$200	$159,000
Clear and Grub	1.83	AC	$10,000	$18,251
Plantings	1.83	AC	$25,000	$45,627
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$322,878
Ancillary Items	1	LS	5% of project	$16,144
Erosion and Sediment Control	1	LS	10% of project	$32,288
			Base Construction Cost	**$371,310**
			Mobilization (5%)	$18,566
			Subtotal 1	$389,876
			Contingency (25%)	$97,469
			Subtotal 2	$487,345
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$219,305
			Estimated Project Cost	**$707,000**


Site Photo: Moderate to severe erosion on outside meander bends


Site Photo: Sinuous and over-widened channel with moderate erosion on outside meanders

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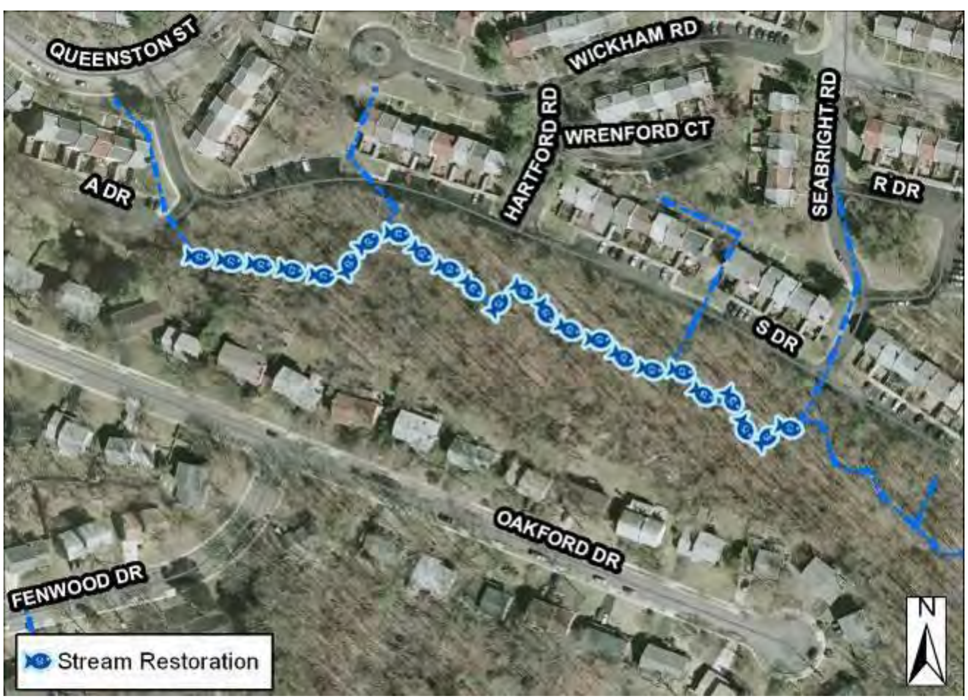
AC9202 - Stream Restoration

Vicinity Map

Address:	Between A Drive, S Drive and Oakford Drive
Location:	Charlestowne
Land Owner:	Private - Residential
PIN:	0793 14 0012, 0793 14 A3, 0793 14 A1
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is located between Oakford Drive and S Drive from the intersection of A and S Drives to the intersection of Seabright Road and S Drive. The upstream portion of this project is severely eroded and incised with very tall unstable banks. The downstream portion of the project is also incised, but experiencing only moderate erosion. Bank heights and overall incision gradually dissipate further downstream along the floodplain.

Restoration of the upstream portion of this project will focus on raising the channel bed elevation as well as regrading and stabilizing stream banks. Since the upstream portion of this project is located in an area with tall streambanks, reconnecting this portion of the channel to the floodplain is not feasible. Reconnection the downstream channel to the floodplain is feasible by reducing channel dimensions and raising the bed elevation. Lastly, all storm drain outfalls to this channel should be restored and stabilized with this project.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This restoration will be designed to withstand large, flashy flows that are discharged from the outfall at the headwaters, along with the other stormwater inputs. Implementation of this project will help to dissipate energy and erosion by restoring the function of the floodplain. This project will also include grade controls to address bank instability and scour, bed incision, and over-widening, which all result in excessive sediment loads being discharged to downstream channels. Reduced sediment loads and new channel creation with a stable habitat along restored banks will also help to improve instream water quality and increase aquatic habitat. It is estimated that a total of over 75,104 lbs of sediment, 60 lbs of total nitrogen and 23 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: This project is entirely contained within private HOA property and will require significant coordination with property owners for access and construction. It will require environmental permitting due to construction and modifications to a perennial stream channel. This stream is buffered by forest, so tree loss is expected to accommodate construction activities. However, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts. Access most likely will need to occur off of S Drive. Utility impacts are not anticipated with this restoration.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	983	LF	$200	$196,600
Clear and Grub	2.26	AC	$10,000	$22,567
Plantings	2.26	AC	$25,000	$56,416
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$375,583
Ancillary Items	1	LS	5% of project	$18,779
Erosion and Sediment Control	1	LS	10% of project	$37,558
			Base Construction Cost	**$431,920**
			Mobilization (5%)	$21,596
			Subtotal 1	$453,516
			Contingency (25%)	$113,379
			Subtotal 2	$566,895
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$255,103
			Estimated Project Cost	**$822,000**


Site Photo: Incised channel with severe meander bend erosion


Site Photo: Incised and over-widened channel with unstable banks

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AC9203 - Stream Restoration

Vicinity Map

Address:	Across from 7600 block of Highland Street
Location:	Lake Accotink Park
Land Owner:	County - FCPA
PIN:	0803 01 0001A
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Acootink Creek

Description: This project is entirely contained within County owned park property and is located between Highland Street and Lake Accotink Access Road. This project involves a short section of existing stream channel that parallels Highland Street. The existing stream channel is incised and over-widened with severe erosion occurring on both banks. Restoring this channel will focus on reducing the current channel dimensions, redirecting flows away from eroded meanders, and installing grade controls to dissipate stream energy and prevent further overwidening. Armor-in-place or bioengineering stabilization techniques or stone toe protection may be needed on outer meander bends to prevent erosion.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to decrease sediment loads to downstream portions of the watershed by stabilizing the channel bed and banks, especially on outer meanders. By reducing sedimentation within the channel and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. It is estimated that a total of 26,630 lbs of sediment, 23 lbs of total nitrogen and eight lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: Existing utility impacts are possible with this restoration due to a sanitary sewer easement within the vicinity of the existing stream channel. This utility may impact access as well as design or construction. Access to this project could occur from Highland Street, but would require significant tree removal and manipulation of steep slopes. Although tree loss is expected, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	194	LF	$200	$38,800
Clear and Grub	0.30	AC	$10,000	$3,000
Plantings	0.30	AC	$25,000	$7,500
Additional Cost, First 500 LF	194	LF	$200	$38,800
			Initial Project Cost	**$88,100**
Ancillary Items	1	LS	5% of project	$4,405
Erosion and Sediment Control	1	LS	10% of project	$8,810
			Base Construction Cost	**$101,315**
			Mobilization (5%)	$5,066
			Subtotal 1	$106,381
			Contingency (25%)	$26,595
			Subtotal 2	$132,976
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$59,839
			Estimated Project Cost	**$193,000**

Figure 1: Eroded banks along Highland Street

Figure 2: Eroded banks with large depositional features in the channel

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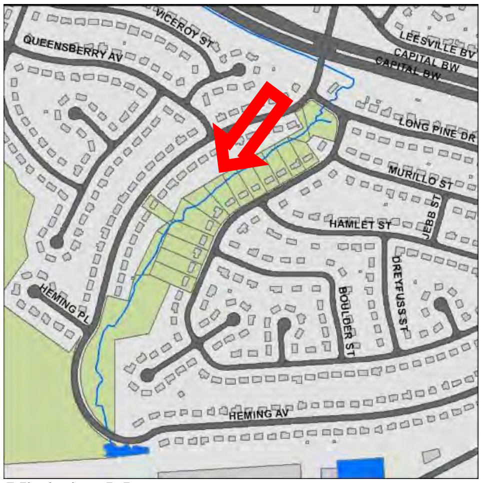
AC9204 - Stream Restoration



Vicinity Map

Address:	Behind 6500 block of Heming Ave and behind 7600 block of Long Pine Drive
Location:	Lake Accotink Park
Land Owner:	Public - FCPA
PIN:	0792 01 0001A, 0792 0268 B1, 0792 02630011, 10, 9, 8, 7, 6, 5, 4, 3, 2, 0801 0268 A, 0801 0263 B
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is located between Long Pine Drive and Heming Place. The upper channel is confined in a narrow valley where the stream banks have been stabilized with concrete that is failing. The downstream portions of the stream section include storm drain outfalls that are also failing. The channel is currently incised and overwidended.

Restoration efforts should focus on removing the failed concrete bank stabilization measures in the upper reaches of the stream channel and replacing it with armor-in-place and bioengineering techniques. The channel should be stabilized by installing grade controls to dissipate energy and some stone toe protection to ensure future bank stability. Restoration efforts in the lower reaches should include redirecting flows away from eroding banks and reconnecting the channel to the floodplain. Storm outfalls will need scour protection to reduce the potential for further erosive forces and headcuts.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Restoring this channel will help to protect storm drain and utility infrastructure as well as private residential property. Creating a new channel geometry and reconnecting the channel to the floodplain will allow for reduced sediment loads to downstream channels. Reductions in sedimentation and the creation of stable habitat may provide improved instream water quality and habitat conditions. Removing of the concrete in the channel will alleviate erosion of the stream banks It is estimated that a total load of 274,031 lbs of sediment, 354 lbs of total nitrogen and 137 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: Since this restoration is located on mostly private residential properties, coordination with these property owners will be necessary for access and construction. Access for this project will need to occur off of Heming Avenue and Long Pine Drive. Steep slopes, tree removal, and confined areas of movement especially in the upstream portion of this restoration will be encountered with this access. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel. Since this stream is buffered by forest on both banks, access and construction for this project will cause a significant amount of tree loss; however, restoration benefits will outweigh overall construction impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	2161	LF	$200	$432,200
Clear and Grub	1.98	AC	$10,000	$19,800
Plantings	1.98	AC	$25,000	$49,500
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$601,500
Ancillary Items	1	LS	5% of project	$30,075
Erosion and Sediment Control	1	LS	10% of project	$60,150
			Base Construction Cost	**$691,725**
			Mobilization (5%)	$34,586
			Subtotal 1	$726,311
			Contingency (25%)	$181,578
			Subtotal 2	$907,889
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$408,550
			Estimated Project Cost	**$1,317,000**


Figure 1: Severe meander bend erosion


Figure 2: Existing concrete lined channel breaking up


Figure 3: Severe erosion and stormdrain outfall damage

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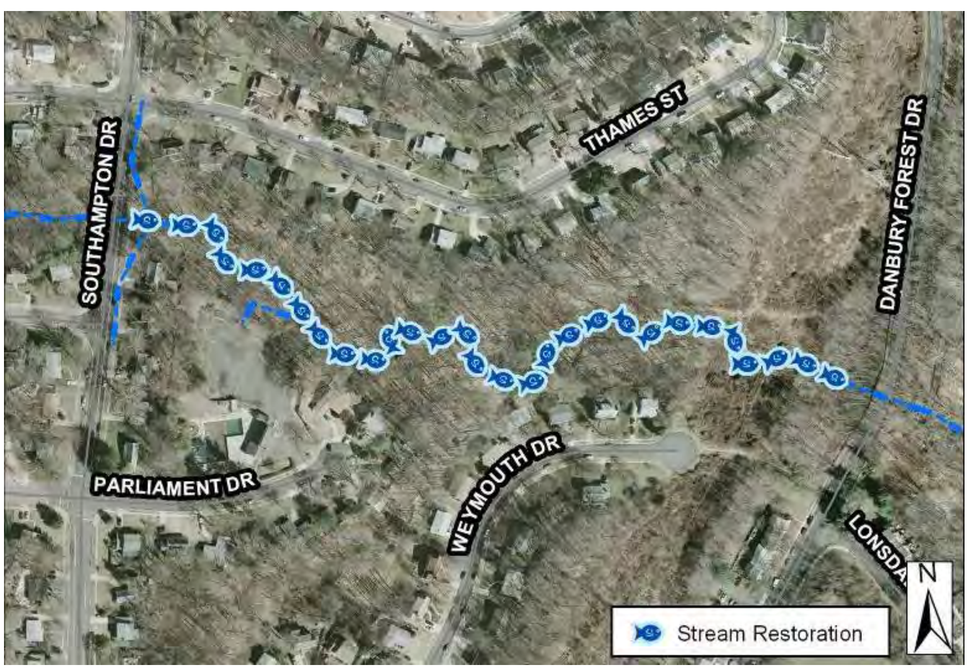
AC9205 - Stream Restoration

Vicinity Map

Address:	Behind 8400/8500 Blocks Thames St
Location:	Lake Accotink Park
Land Owner:	County - FCPA
PIN:	0703 04 B1, 0703 12 J, 0703 04 B
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is designed to restore an existing stream channel located within Lake Accotink Park from Southampton Drive to Danbury Forest Drive. This channel is experiencing moderate erosion on outside meander bends and has become over-widened. The conditions in the channel become worse moving downstream. In many cases, the ephemeral channels created by storm drain outfalls that drain to this project are also eroded and unstable.

Restoration will focus on reconnecting this channel to the floodplain by reducing channel dimensions and raising the bed elevation. Reconnection to the floodplain, along with installing grade controls, will help to prevent further incision and over-widening. In areas where the existing channel will be maintained, regrading and stabilization may need to occur with armor-in-place or bioengineering techniques. In particular, these techniques may be required where a sanitary sewer utility is within close proximity or where the channel is eroding the valley walls.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to reduce sediment loads that could be transported downstream toward Lake Accotink. Sediment loads to those downstream channels will be reduced through the creation of new channel geometry as well as through the stabilization of existing banks. Reconnecting the channel to the floodplain will also reduce downstream sediment loads by depositing suspended sediment on the floodplain. It is estimated that a total of 266,730 lbs of sediment, 213 lbs of total nitrogen and 83 lbs of total phosphorus would be reduced by this project. This project will also protect a sanitary sewer utility line that runs parallel to this channel on the floodplain.

Project Design Considerations: Access for this project will most likely need to occur from Southampton Drive. An existing sanitary sewer utility clearing can be used from this access point to travel along the floodplain; however, the utility also has the potential to constrain design or construction. Overhead power transmission lines are present in the downstream portion of this project; however, no construction impacts are anticipated. Since this stream is buffered by forest on both banks, construction for this project will likely result in loss of trees. However, as in similar situations, experience has shown that restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel. Steep slopes, especially where the channel meanders along the valley wall, will require special attention.. This project should also be designed with reference to AC9403 and AC9402, which occur at the upstream and downstream culverts along this stream channel.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1831	LF	$200	$366,200
Clear and Grub	4.20	AC	$10,000	$42,034
Plantings	4.20	AC	$25,000	$105,085
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$613,319
Ancillary Items	1	LS	5% of project	$30,666
Erosion and Sediment Control	1	LS	10% of project	$61,332
			Base Construction Cost	**$705,317**
			Mobilization (5%)	$35,266
			Subtotal 1	$740,583
			Contingency (25%)	$185,146
			Subtotal 2	$925,729
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$416,578
			Estimated Project Cost	**$1,343,000**

Site Photo: Upstream end with moderate erosion and adjacent sanitary sewer

Site Photo: Over-widened channel with moderate meander bend erosion

Site Photo: Downstream end with moderate to severe meander erosion

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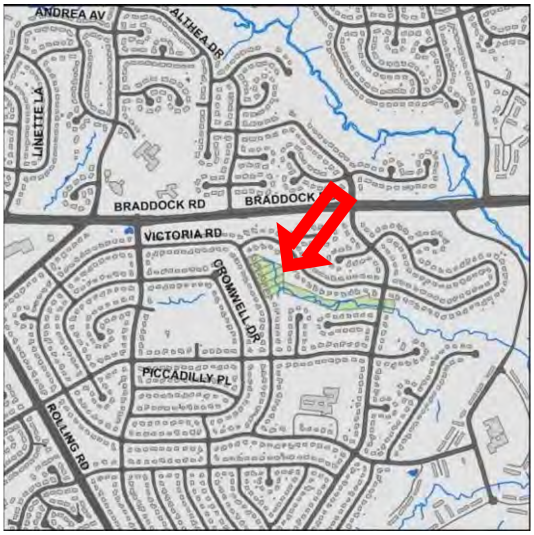
AC9206 - Stream Restoration



Vicinity Map

Address:	Behind 8500-8600 Block of Thames Street
Location:	Lake Accotink Park
Land Owner:	Private – Residential / County - FCPA
PIN:	0703 03 0065, 0703 03 0066, 0703 03 0067, 0703 03 0068, 0703 0069, 0703 04 B
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is located on private residential properties as well as park land and is located between Thames Street, Victoria Street, and Perth Court. The stream channel is experiencing moderate incision and bank erosion with over-widened conditions.

Restoration efforts should focus on reconnecting this channel to the floodplain, which, along with installing grade controls, will help prevent further downcutting and over-widening. As an option, channel relocation could be considered in this situation, to help redirect flows away from existing infrastructure. Several storm drain outfalls drain to this project and should be stabilized in conjuction with channel restoration using armor-in-place or bioengineering techniques. In addition, protection of an existing sanitary sewer crossing and an exposed sewer manhole standpipe should also be addressed with the channel restoration.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to stabilize conditions at an existing sanitary sewer manhole and crossing. It will also promote the use of the floodplain, which can reduce sediment loads being transported to downstream portions of this watershed. By reducing sedimentation within this channel and providing stable habitat along restored banks, overall instream water quality and habitat may also be improved with this project. It is estimated that a total of over 181,645 lbs of sediment, 145 lbs of total nitrogen and 56 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with private residential property owners for access and construction will be necessary with this project, as the existing stream channel is partially located on many of these privately owned parcels. A partially exposed sanitary sewer pipe and manhole may constrain design and construction along this project, in that it may be more advantageous to redirect stream flow away from the manhole standpipe by relocating those stream segments. Access to the floodplain will require the use of the floodplain upstream adjacent to Southampton Drive, while access might be possible along storm drain easments at the end of Perth Court or Durham Court and along Thames Street and Victoria Road. However, all of these access points will be adjacent to private residential properties and will require construction access approval. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will likely require tree removal. However, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1068	LF	$200	$213,600
Clear and Grub	2.45	AC	$10,000	$24,518
Plantings	2.45	AC	$25,000	$61,295
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$399,413
Ancillary Items	1	LS	5% of project	$19,971
Erosion and Sediment Control	1	LS	10% of project	$39,941
			Base Construction Cost	**$459,325**
			Mobilization (5%)	$22,966
			Subtotal 1	$482,291
			Contingency (25%)	$120,573
			Subtotal 2	$602,864
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$271,289
			Estimated Project Cost	**$875,000**

Site Photo: Moderate erosion on meander banks

Site Photo: Over-widened with moderate erosion

Site Photo: Sanitary sewer manhole in eroded channel

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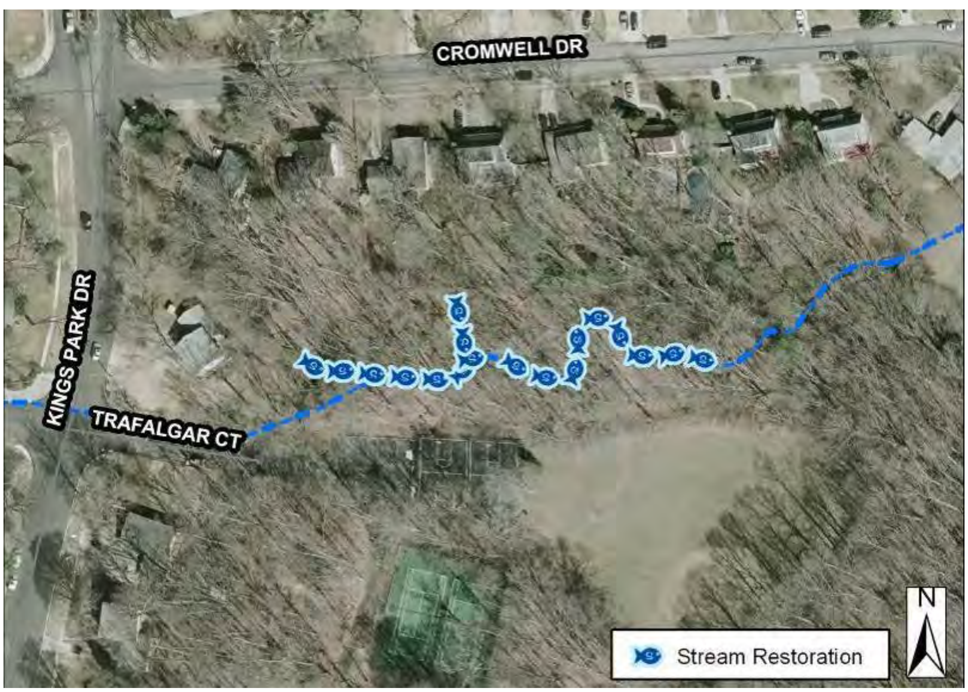
AC9207 - Stream Restoration

Vicinity Map

Address:	8717 Trafalgar Ct
Location:	Kings Park
Land Owner:	County - FCPA
PIN:	0703 01 0027
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is located entirely within Kings Park and extends from the end of Trafalgar Court to a culvert under Cromwell Drive. The current sinuous, incised, and over-widened stream channel is eroding on the outside of meander bends as well as along straight segments of the steam. A small tributary channel originating from an outfall off of Cromwell Drive is also eroding and should be restored in conjunction with this project.

Restoration of the channel will focus on creating a nested channel, in which the floodplain and banks of the current channel will be regraded to allow for creation of a new floodplain at an elevation lower than the original. Restoration will include reducing the existing channel dimensions and installing grade controls to dissipate streamflow energy, thus avoiding further incision and over-widening. Armor-in-place stabilization techniques or stone toe protection may also be needed near the 42” outfall or on outer meander bends.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This restoration will be designed to withstand large, flashy flows that may originate from the 42” outfall. Implementation of the project will effectively provide for a reduction in sediment loads to downstream channels by reducing bank scour and meander bend migration, while also providing a floodplain to dissipate energy and encourage sediment deposition. By providing for a more stable flow regime, instream water quality and habitat may be improved with this project. It is estimated that a total of 246,009 lbs of sediment, 197 lbs of total nitrogen and 76 lbs of total phosphorus would be reduced by this project.

The project will also stabilize several storm drain outfalls and conveyances that drain to this channel. This project is within park property, so it may provide an environmental education orstewardship opportunity for residents of this community and park patrons.

Project Design Considerations: This project will require environmental permitting due to construction and modifications to a perennial stream channel. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will require tree removal. However, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts.

The project area contains two Native American quarry sites. Both are south of the proposed area of stream restoration and associated with the athletic facilities in the park. It is recommended that those sites be avoided by staging and access activities. Therefore, access for this project will need to occur from the parking lot within Kings Park at the end of Trafalgar Court. Impacts to existing utilities are not anticipated.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	501	LF	$200	$100,200
Clear and Grub	1.15	AC	$10,000	$11,501
Plantings	1.15	AC	$25,000	$28,753
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$240,454
Ancillary Items	1	LS	5% of project	$12,023
Erosion and Sediment Control	1	LS	10% of project	$24,045
			Base Construction Cost	**$276,522**
			Mobilization (5%)	$13,826
			Subtotal 1	$290,348
			Contingency (25%)	$72,587
			Subtotal 2	$362,935
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$163,321
			Estimated Project Cost	**$527,000**


Site Photo: Incised and over-widened with moderate to severe erosion


Site Photo: Over-widened with moderate to severe erosion on meander bends

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AC9208 - Stream Restoration

Vicinity Map

Address:	5021 King David Boulevard
Location:	Longbranch Falls Park
Land Owner:	County - FCPA
PIN:	0694 01 0017
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Long Branch

Description: This project extends from a storm drain outfall at King David Boulevard to a culvert under Windflower Lane. The upstream portion of this channel is stable, as it lies over bedrock. There are, however, isolated areas of erosion evident along the outside meander bends and several segments of this channel have become over-widened. One outside meander, in particular, is encroaching upon a private residential property located along King David Boulevard. The homeowner in question is currently placing yard waste and debris on the outer bank of this meander in an effort to stop future bank erosion.

Restoration of this channel will focus on reducing the current channel dimensions, redirecting flows away from eroded meanders, and installing grade controls to dissipate stream energy and prevent further over-widening. Armor-in-place, bioengineering techniques or stone toe protection may be needed to stabilize outer meander bends.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to reduce sediment loads that could be transported to downstream portions of the watershed by stabilizing the channel bed and banks, especially on outer meanders. By reducing sedimentation within the channel and thus providing for stable habitat along restored banks, overall instream water quality and habitat may also be improved. The project's stabilzation goal will also help to protect private property located along King David Boulevard. It is estimated that a total of 84,320 lbs of sediment, 68 lbs of total nitrogen and 26 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: The project will require environmental permitting to allow for construction and modifications within a perennial stream channel. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will require moderate tree removal, however, as in similar projects, experience has shown that restoration benefits often outweigh overall construction impacts, as tree removal needs are temporary. Access will need to occur off of King David Boulevard and may involve some steep slopes. Existing utility impacts are not anticipated. Coordination with the impacted homeowner for possible property access along King David Boulevard will likely be necessary.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	620	LF	$200	$124,000
Clear and Grub	1.42	AC	$10,000	$14,233
Plantings	1.42	AC	$25,000	$35,583
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$273,816
Ancillary Items	1	LS	5% of project	$13,691
Erosion and Sediment Control	1	LS	10% of project	$27,382
			Base Construction Cost	**$314,889**
			Mobilization (5%)	$15,744
			Subtotal 1	$330,633
			Contingency (25%)	$82,658
			Subtotal 2	$413,291
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$185,981
			Estimated Project Cost	**$600,000**

Site Photo: Over-widening channel with moderate to severe erosion

Site Photo: Erosion on meander bend adjacent to property owner

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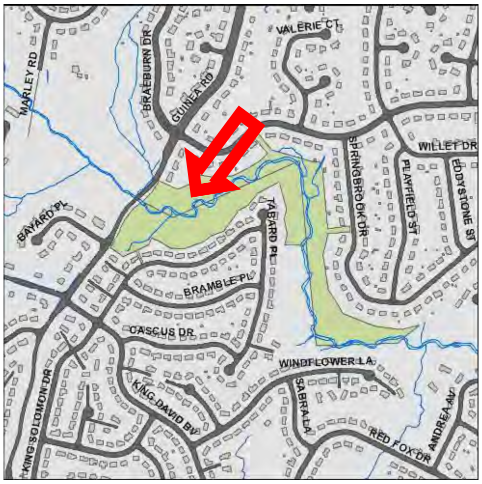
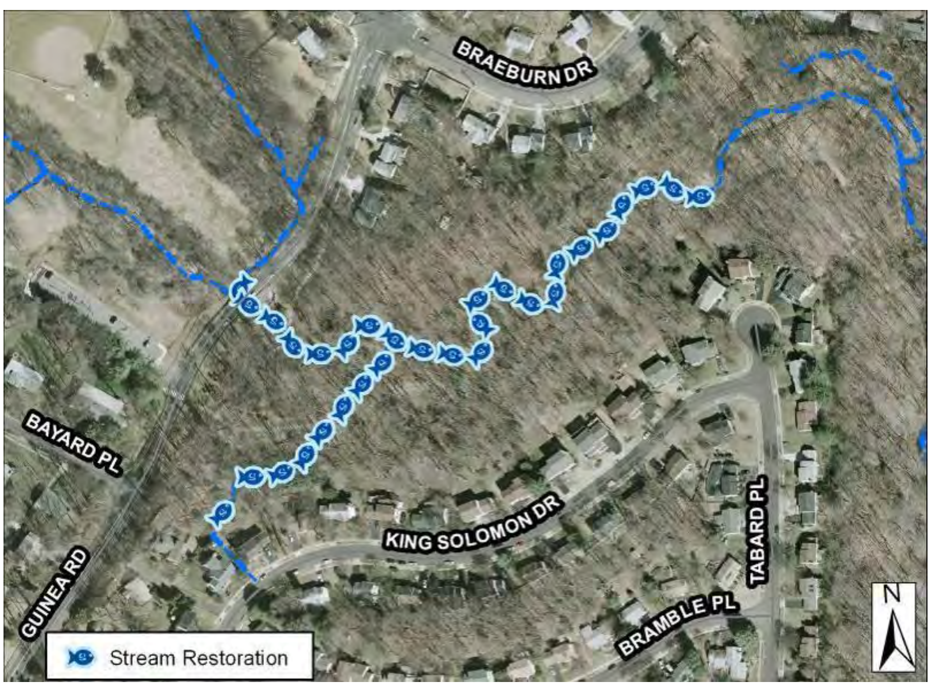
AC9209 - Stream Restoration



Address:	Behind 4700 / 4800 Block Guinea Road
Location:	Long Branch Park
Land Owner:	County - FCPA
PIN:	0692 15 G, 0692 01 0016
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Long Branch

Description: This project is located within Long Branch Park, immediately downstream of Guinea Road. This currently sinuous, incised, and over-widened stream channel is eroding, primarily on outside meander bends. A small tributary channel originating from a storm drain outfall off of King Solomon Drive is also experiencing severe erosion and should be restored in conjunction with this project.

Restoration of these channels will include regrading and stabilizing eroded stream banks with armor-in-place techniques on outer meander bends and bioengineering techniques on inside meander bends and straight portions of the channel. Raising the bed elevation in these channels and installing grade controls will help to prevent further incision within the channel while reconnecting higher flows to the floodplain.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementation of this project will effectively reduce the sediment supply load to receiving stream channels by reducing bank scour and meander bend migration. Reconnecting these channels to the floodplain will also reduce the amount of sediment in downstream channels by depositing suspended sediment on the floodplain. By reducing sedimentation within the channels and providing stable habitat along restored banks, overall instream water quality and habitat may also be improved. Also, as a result of this project, fish passage will again be possible once the downstream channel bed is raised up to the elevation of the downstream culvert invert.

Stabilizing the migration of outer meander bends in this area will also protect an existing access road that parallels this channel from eroding. An existing access road on the floodplain of this project parallels the stream channel. Using this road during construction will help to reduce the amount of tree removal needed for construction access. It is estimated that a total of 548,046 lbs of sediment, 438 lbs of total nitrogen and 170 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: This project will require environmental permitting due to the need for construction and modifications within perennial stream channels. The stream is buffered by forest, so some tree loss is expected to allow access to the channel and to clear the eroded areas during construction. This tree loss will be minimized to the extent possible, especially if the existing access road is able to be used for construction purposes. As in similar projects, experience has shown that restoration benefits often outweigh overall construction impacts. Other than the tree removal, construction access is good at this project off of Guinea Road to the existing access road. An existing sanitary sewer line parallels the stream channel and is within close proximity to the eroded banks. Design and construction may be constrained due to the location of this utility. This entire project is surrounded by County park land and residential properties are at a safe distance from the proposed work. It should be noted that the area has moderate potential to contain Native American artifacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1791	LF	$200	$358,200
Clear and Grub	6.17	AC	$10,000	$61,674
Plantings	6.17	AC	$25,000	$154,184
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$674,058
Ancillary Items	1	LS	5% of project	$33,703
Erosion and Sediment Control	1	LS	10% of project	$67,406
			Base Construction Cost	**$775,167**
			Mobilization (5%)	$38,758
			Subtotal 1	$813,925
			Contingency (25%)	$203,481
			Subtotal 2	$1,017,406
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$457,833
			Estimated Project Cost	**$1,476,000**

Site Photo: Severe meander bend erosion

Site Photo: Erosion along tributary channel

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AC9210 - Stream Restoration

Vicinity Map

Address:	Behind 8000 Block Braddock Road
Location:	Wakefield Park
Land Owner:	County - FCPA
PIN:	0704 01 0002
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project involves restoring three stream channels located within Wakefield Park draining commercial areas located along Braddock Road and the Capital Beltway. These channels are currently incised and over-widened with moderate to severe erosion occurring on meander bends and along straight sections.

Restoration of these channels will focus on reducing the channel dimensions and raising the bed elevations to reconnect each channel to the floodplain. The bed elevation of the downstream channel is several feet lower than the invert of the culvert that flows under I-495. Reconnection with the floodplain, along with the installation of grade controls, will help to prevent further incision and over-widening. In areas where the existing channel is to be maintained, regrading and stabilization may need to occur with armor-in-place or bioengineering techniques.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Restoration of these channels by stabilizing the banks and establishing a new channel geometry will help to reduce sediment loads. Reconnecting the channels to the floodplain will also reduce downstream sediment transport by depositing suspended sediment along the floodplain. It is estimated that 393,312 lbs of sediment, 315 lbs of nitrogen and 122 lbs of phosphorus would be reduced by this project annually.

An existing sanitary sewer utility and clearing may be utilized for access near this channel that may reduce the amount of tree removal needed for construction. This project could also provide an educational opportunity for residents using Wakefield Park.

Project Design Considerations: These stream are both buffered by forest, so access and construction will cause a significant amount of tree loss. However, as with similar projects, restoration benefits often outweigh overall construction impacts over the long term. This project will also require environmental permitting due to the need for construction in, and modifications to, a perennial stream channel. An existing sanitary sewer line parallels the stream channel originating from I-495. This sanitary sewer is not within close proximity to the existing banks. The culvert under I-495 should be analyzed during the channel design to determine if modifications to the channel or floodplain will cause any adverse impacts to this infrastructure. Park operations, including mountain bike trails in the vicinity of the stream, will need to be identified and included in the design. There are three archeological sites in the vicinity that should be avoided during construction access or staging.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1741	LF	$200	$348,200
Clear and Grub	6.00	AC	$10,000	$59,952
Plantings	6.00	AC	$25,000	$149,879
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$658,031
Ancillary Items	1	LS	5% of project	$32,902
Erosion and Sediment Control	1	LS	10% of project	$65,803
			Base Construction Cost	**$756,736**
			Mobilization (5%)	$37,837
			Subtotal 1	$794,573
			Contingency (25%)	$198,643
			Subtotal 2	$993,216
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$446,947
			Estimated Project Cost	**$1,441,000**


Site Photo: Over-widened channel downstream of I-495


Site Photo: Moderate to severe erosion on meander bends

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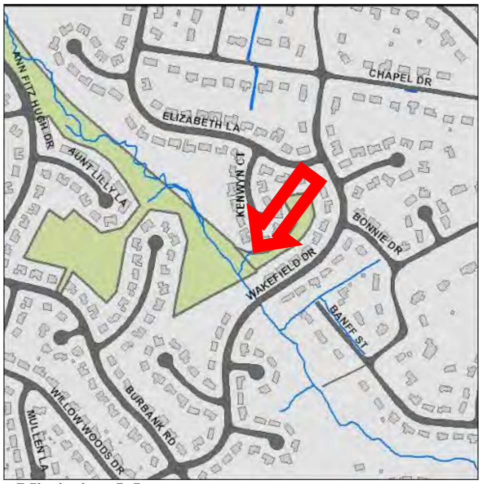
AC9211 - Stream Restoration



Vicinity Map

Address:	129530 Kenwen Ct
Location:	Truro, between Kenwen Court and Wakefield Drive
Land Owner:	Private - Residential
PIN:	0701 12 0107, 0701 12 H, 0701 12 M
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Turkey Run

Description: This project is located between Kenwen Court and Wakefield Drive. The project involves the restoration of a short section of existing stream channel that starts at a large storm drain outfall and extends southwest to the mainstem of Turkey Run. Currently, this channel is incised with moderate erosion on both banks.

Restoration of the channel will include regrading and stabilizing eroded stream banks with natural channel design to direct flows, armoring-in-place including natural rock and bioengineering materials. Stone-toe protection may be needed near the storm drain outfall and underneath the foot bridge to prevent future erosion. Raising the bed elevation of this channel and installing grade controls will help to prevent further incision within the channel and will effectively reconnect higher flows to the floodplain.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementation of this project will reduce bank erosion and bank scour thus reducing sediment transport to downstream channels. Raising the bed elevation will also allow flows to enter the floodplain, which will also dissipate energy and reduce suspended sediment loads available for transport downstream. Overall, instream water quality and habitat may also be improved due to the restoration of stable habitat and reduced sediment loads. It is estimated that 17,340 lbs of sediment, 14 lbs of nitrogen and five lbs of phosphorus would be reduced by this project annually.

This project will stabilize a trail footbridge and protect the storm drain outfall and a nearby sanitary sewer utility from future scour and erosion. The asphalt walking trail near this project may be used for access during construction to limit forest impacts and to provide an educational opportunity for residents.

Project Design Considerations: Access to the project site is good and should occur from Wakefield Drive. An existing trail on the floodplain may be used as access to the channel. Environmental permitting is necessary due to need for construction and modifications within the existing channel. Moderate tree loss is anticipated. Mature trees will be preserved as much as possible. Experience has shown that restoration benefits often outweigh overall construction impacts.

This project is entirely contained within private property and will require significant coordination with property owners for access during construction. Design possibilities and construction may be constrained due to the location of an existing sanitary sewer utility located along the channel. This project is located downstream of proposed projects AC9212 and AC9213. To ensure proper design and construction sequencing, the combined projects should be constructed from upstream to downstream with this project occuring last.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	170	LF	$200	$34,000
Clear and Grub	0.39	AC	$10,000	$3,903
Plantings	0.39	AC	$25,000	$9,757
Additional Cost, First 500 LF	170	LF	$200	**$34,000**
			Initial Project Cost	$81,660
Ancillary Items	1	LS	5% of project	$4,083
Erosion and Sediment Control	1	LS	10% of project	$8,166
			Base Construction Cost	**$93,909**
			Mobilization (5%)	$4,695
			Subtotal 1	$98,604
			Contingency (25%)	$24,651
			Subtotal 2	$123,255
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$55,465
			Estimated Project Cost	**$179,000**


Site Photo: Moderate erosion under footbridge


Site Photo: Moderate bank erosion

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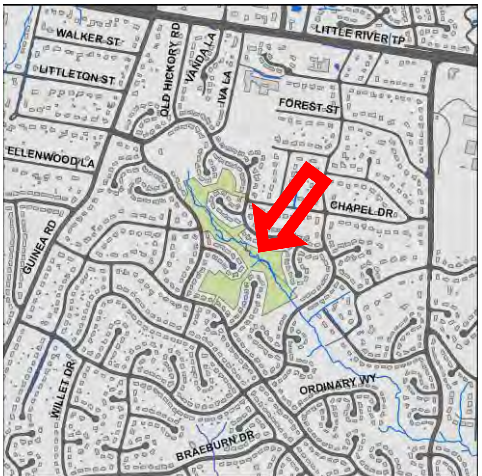
AC9212 - Stream Restoration



Vicinity Map

Address:	4200-4300 blocks of Elizabeth Lane
Location:	Truro, between Elizabeth Lane and Aunt Lilly Lane
Land Owner:	Private - Residential
PIN:	0701 12 G, M
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Turkey Run

Description: This project involves a stream channel located between Elizabeth Lane, Aunt Lilly Lane, Kenwen Court, and Ossian Hall Lane. This sinuous channel is currently incised, and over-widened. It has eroded primarily on outside meander bends and along some straight sections. The severity of erosion and incision increases downstream.

In conjunction with restoration of the channel, storm drain outfalls and their drainage channels should also be stabilized. Restoration efforts should focus on reconnecting this channel to the floodplain by reducing channel dimensions and raising bed elevations, along with grade controls to help prevent further downcutting and over-widening. Channel relocation may also be beneficial where the existing channel meanders close to private property boundaries along Elizabeth Lane. Natural channel design to redirect stream flows and the use of natural rocks or boulders, should be used to the extent possible.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Reductions in channel downcutting, bank scour, over-widening, and meander bend migration will from restoration result in reducing sediment loads and protecting private property. Reconnecting the channel to the original floodplain will also help to dissipate the energy associated with high flows that may cause erosion and will effectively reduce downstream sediment loads as suspended sediment will deposit on the reconnected floodplain. This project will also stabilize storm drain outfalls and conveyances and protect walking trails and infrastructure. It is estimated that a total of 88,913 lbs of sediment, 71 lbs of total nitrogen and 28 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: This project is entirely contained within private residential property and will require significant coordination with property owners for access and construction. It will also require environmental permitting, as construction and modifications to a perennial stream channel are required. As this stream is buffered by forest, significant tree loss can be expected to allow access to the channel during construction, but mature trees will be preserved to the maximum extent possible. Restoration benefits will likely outweigh overall construction impacts in the long term.

Access is limited and may have to occur along Elizabeth Lane where there is a break in residential properties. An existing trail on the floodplain may be utilized for some access to the project site. Design and construction may be constrained due to the location of the existing channel near two properties along Elizabeth Lane. Existing utility impacts are not anticipated. This project is located between proposed projects AC9211 and AC9213.Therefore, to ensure proper design and construction sequencing, the projects should be constructed in conjunction with one another, and should occur from upstream to downstream, starting with AC9213.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	872	LF	$200	$174,400
Clear and Grub	2.00	AC	$10,000	$20,018
Plantings	2.00	AC	$25,000	$50,046
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$344,464
Ancillary Items	1	LS	5% of project	$17,223
Erosion and Sediment Control	1	LS	10% of project	$34,446
			Base Construction Cost	**$396,133**
			Mobilization (5%)	$19,807
			Subtotal 1	$415,940
			Contingency (25%)	$103,985
			Subtotal 2	$519,925
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$233,966
			Estimated Project Cost	**$754,000**

Site Photo: Incised channel with severe meander bank erosion

Site Photo: Incised and over-widened channel with moderate bank erosion

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AC9213 - Stream Restoration

Vicinity Map

Address:	4200-4300 blocks of Ann Fitzhugh Drive
Location:	Truro, between Ann Fitzhugh Drive, Mary Lee Lane and Elizabeth Lane
Land Owner:	Private - Residential
PIN:	0584 21 B, 0701 12 G, 0701 12 M
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Turkey Run

Description: This project is located between Ann Fitzhugh Drive, Aunt Lilly Lane, Turkey Creek Court, and Mary Lee Lane. Currently, there is an exposed sanitary sewer concrete casing acting as grade control for an active headcut in the stream channel near the end of Mary Lee Lane. on either side of the sewer utility the stream channel is beginning to over-widen. Although the sewer line is acting to maintain the upstream bed elevation, storm flow will eventually result in scouring out the sewer crossing.

Restoring this channel will include raising the stream bed using natural materials to reconnect the channel to the floodplain and installing grade controls of natural stone and boulders to help prevent future downcutting and over-widening. Natural channel techniques using rock to redirect stream flows would be used to the maximum extent possible. All storm drain outfalls that drain to the project site would also be stabilized during the channel restoration.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Restoring this channel will prevent erosion in the channel and stabilize and protect the exposed sanitary sewer casing, storm drain outfalls, walking trails along the channel, and floodplain from advancing erosion. The project will reconnect the channel back to the original floodplain allowing sediment to be deposited along the floodplain. It will also effectively reduce overall stream energy and reduce sediment discharge to downstream channels by correcting channel downcutting, bank scour, over-widening and meander bend migration. It is estimated that a total of 237,966 lbs of sediment, 190 lbs of total nitrogen and 74 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Environmental permitting will be necessary with this restoration due to the need for construction and modifications within a perennial stream channel. In addition there will be impacts to forest resources, however, as with similar projects, restoration benefits often outweigh overall construction impacts over the long term and mature trees will be protected to the extent possible.

This project is entirely contained within private residential property and will require significant coordination with property owners for access and construction. Access will most likely occur off of Ann Fitzhugh Drive where the channel and floodplain are adjacent to this road. An existing trail on the floodplain may also be used for construction access. The exposed sanitary sewer casing within the project limits may constrain design of the proposed channel. This project is located upstream of proposed projects AC9211 and AC9212. To ensure proper design and construction sequencing, the projects should be constructed from upstream to downstream, starting with this project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1291	LF	$200	$258,200
Clear and Grub	2.96	AC	$10,000	$29,637
Plantings	2.96	AC	$25,000	$74,093
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$461,930
Ancillary Items	1	LS	5% of project	$23,097
Erosion and Sediment Control	1	LS	10% of project	$46,193
			Base Construction Cost	**$531,220**
			Mobilization (5%)	$26,561
			Subtotal 1	$557,781
			Contingency (25%)	$139,445
			Subtotal 2	$697,226
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$313,752
			Estimated Project Cost	**$1,011,000**


Site Photo: Exposed sanitary sewer casing and headcut


Site Photo: Incising and over-widening channel with moderate bank erosion

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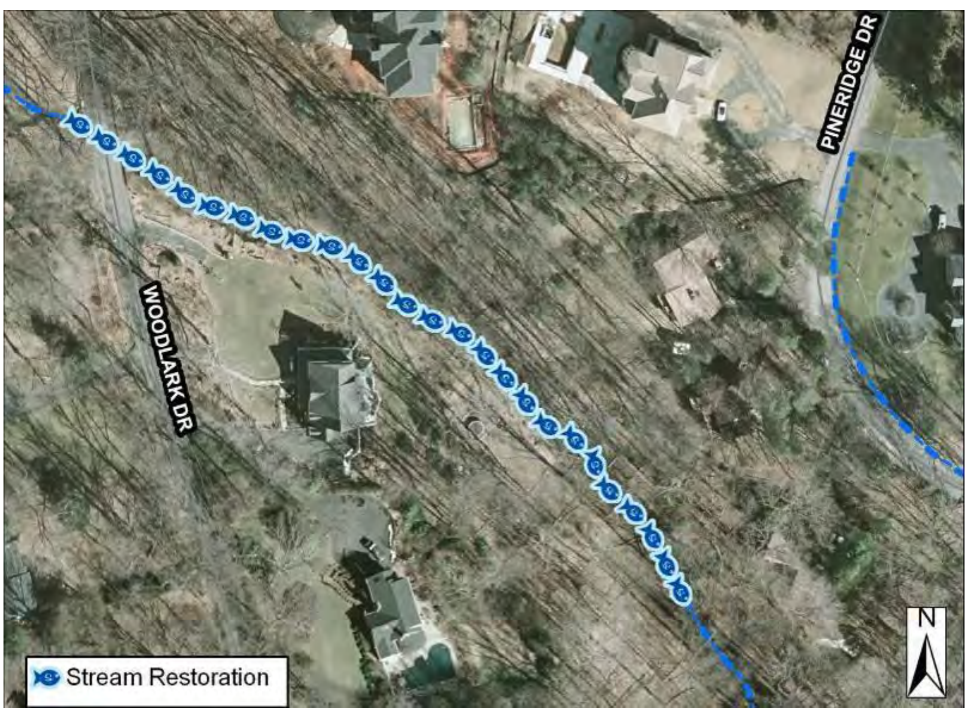
AC9214 - Stream Restoration

Vicinity Map

Address:	4200 block of Woodlark Drive
Location:	Wakefield Park
Land Owner:	County - FCPA
PIN:	0702 02 P
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: The existing stream channel to be restored starts at the stream culvert under Woodlark Drive and extends downstream past two private residential properties. A sanitary sewer utility also parallels the channel. Currently, the Woodlark Drive stream culvert inverts are much higher than the bed elevation of the downstream channel. Moderate to severe erosion is also evident along the channel. Homeowner attempts to stabilize the channel with landscaping and vegetation have not been effective.

Restoring the channel will focus on regrading and stabilizing eroded stream banks with armor-in-place or bioengineering techniques and raising the current bed elevation of the channel up to the elevation of the stream culvert under Woodlark Drive. Stone-toe protection may also be needed to prevent future bank instability, and installing grade controls will help to dissipate stream energy and prevent over-widening.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This restoration will help to protect the existing sanitary sewer and private residential properties adjacent to the channel. Stabilizing the area below the culvert under Woodlark Drive and modifying the channel bed and banks will reduce sediment loads currently discharging to downstream channels. Reducing sediment will provide more stable aquatic habitat along the restored channel and improve overall instream water quality. It is estimated that a total of 124,458 lbs of sediment, 100 lbs of total nitrogen and 39 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Access for this project will need to occur off of Woodlark Drive. Fairfax County property includes the existing stream channel and sanitary sewer utility; however, this property is fairly narrow and coordination with adjacent residential property owners will be necessary for access during construction. One property owner is landscaping areas that may need to be used for access or construction thus requiring additional effort and cost to replace landscaping impacted during construction.

The existing sanitary sewer also poses a design constraint. This project will require environmental permitting as it will inviolve construction and modifications within a perennial stream channel. Minor to moderate tree removal will be necessary for access and construction. Despite some impacts to the forest, experience has shown that restoration benefits will outweigh overall construction impacts over the long run.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	655	LF	$200	$131,000
Clear and Grub	1.50	AC	$10,000	$15,037
Plantings	1.50	AC	$25,000	$37,592
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$283,629
Ancillary Items	1	LS	5% of project	$14,181
Erosion and Sediment Control	1	LS	10% of project	$28,363
			Base Construction Cost	**$326,173**
			Mobilization (5%)	$16,309
			Subtotal 1	$342,482
			Contingency (25%)	$85,621
			Subtotal 2	$428,103
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$192,646
			Estimated Project Cost	**$621,000**


Site Photo: Severe erosion next to sanitary sewer and property owner


Site Photo: Downstream side of culvert under Woodlark Drive

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AC9215 - Stream Restoration

Vicinity Map

Address:	8220 Little River Turnpike
Location:	Mill Creek Park
Land Owner:	Private / State - VDOT
PIN:	0594 02010003
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is located just upstream of the VDOT culvert under Little River Turnpike, adjacent to Calvary Church of the Nazarene. The project involves a short section of an existing stream channel with a ditch that runs along Little River Turnpike and drains runoff from the Church and Turnpike. The stream channel is incised and over-widened with moderate to severe erosion occurring on the outside of meanders. The ditch along the Turnpike is also eroded and is currently incising.

Restoration of this channel will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques. Altering the current stream alignment is recommended to redirect flows away from eroded outside meanders. Stone-toe protection may also be needed on outside meanders to prevent future erosion. Grade controls and armor-in-place techniques could be used to stabilize the ditch. Most of the project is within forested conditions.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Stabilization of this channel and ditch will help to reduce erosion and downstream sediment transport. Restoration will protect the VDOT culvert under Little River Turnpike by redirecting flows away from the side of the concrete headwall structure. Instream water quality and habitat may be improved due to new channel creation and reduced sedimentation.

Project Design Considerations: Drainage associated with this project appears to flow across several properties including those owned by the Calvary Church of the Nazarene, a residential property along Little River Turnpike, and VDOT. The project will require significant coordination with property owners for access and construction. Construction access will need to occur off of Little River Turnpike. Steep slopes may be encountered as well as overhead power lines running along the road embankment. An existing sanitary sewer is also present on the upstream side of the Little River Turnpike which slopes down to the floodplain; however, the sewer line will not impact design or construction. The project will require environmental permitting as construction and modifications to a perennial stream channel are involved. Minor to moderate tree removal will be necessary for access and construction.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	302	LF	$200	$60,400
Clear and Grub	1.04	AC	$10,000	$10,399
Plantings	1.04	AC	$25,000	$25,999
Additional Cost, First 500 LF	302	LF	$200	**$60,400**
			Initial Project Cost	$157,198
Ancillary Items	1	LS	5% of project	$7,860
Erosion and Sediment Control	1	LS	10% of project	$15,720
			Base Construction Cost	**$180,778**
			Mobilization (5%)	$9,039
			Subtotal 1	$189,817
			Contingency (25%)	$47,454
			Subtotal 2	$237,271
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$106,772
			Estimated Project Cost	**$345,000**

Site Photo: Severe erosion on meander bend upstream of Little River Turnpike

Site Photo: Eroded ditch paralleling Little River Turnpike

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AC9216 - Stream Restoration

Vicinity Map

Address:	4300 block of Americana Drive
Location:	Lafayette Forest
Land Owner:	Private - Residential
PIN:	Unknown
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project involves the restoration of two existing stream channels, both located in private apartment complex property between Americana Drive and Donnybrook Court. The main channel starts upstream at the confluence of a tributary channel originating from an existing dry pond (DP0627) and extending downstream to within several hundred feet of the culvert under Americana Drive. Both channels are currently incised and over-widened and eroding on meander bends and straight sections.

Restoration will focus on reducing channel dimensions and raising the bed elevations to reconnect each channel to its floodplain. Installation of grade controls will be necessary to prevent future incision and over-widening. Regrading and stabilization may be needed in areas where the existing banks will be maintained or where peak flows warrant protection, such as the areas around the outfall of DP0627 and where the existing main channel is directed toward the valley wall. Repairing or replacing failing storm drain outfalls should be incorporated into the project.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Restoring this channel by stabiliizing existing banks and establishing improved channel geometry will help to reduce erosion and sediment transported to downstream portions of the watershed. Reconnecting the channels to their original floodplains will also reduce the amount of sediment deposited downstream. This project will also stabilize storm drain outfalls and conveyances as well as protect the sanitary sewer and an existing apartment complex swimming pool located next to the stream. It is estimated that a total of 463,845 lbs of sediment, 371 lbs of total nitrogen and 144 lbs of total phosphorus would be reduced by the restoration.

Project Design Considerations: This project will require environmental permitting as it involves construction and modifications within perennial stream channels. This stream is buffered by forest, so moderate tree loss is expected however, as in similar projects, restoration benefits will likely outweigh overall construction impacts in the long term.

Construction access to the floodplain is good and includes a paved access road that starts at an apartment building parking lot along Americana Drive and leads to the stream channel downstream of DP0627. This paved road is used to access the apartment complex swimming pool. This project will require significant coordination with property owners for access and construction. An existing sanitary sewer manhole is located on the floodplain; however, this utility is not expected to constrain design or construction. Special consideration must be given to the location and activities of the apartment swimming pool when coordinating access, signaling, and construction activity. Construction may need to occur during non-summer months to avoid these concerns. Projects AC9217 and AC9166, which occur upstream of this project, should be completed first to ensure proper design and construction sequencing.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	844	LF	$200	$168,800
Clear and Grub	2.91	AC	$10,000	$29,063
Plantings	2.91	AC	$25,000	$72,658
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$370,521
Ancillary Items	1	LS	5% of project	$18,526
Erosion and Sediment Control	1	LS	10% of project	$37,052
			Base Construction Cost	**$426,099**
			Mobilization (5%)	$21,305
			Subtotal 1	$447,404
			Contingency (25%)	$111,851
			Subtotal 2	$559,255
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$251,665
			Estimated Project Cost	**$811,000**

Site Photo: Severe bank erosion along meanders

Site Photo: Over-widened channel with moderate to severe bank erosion

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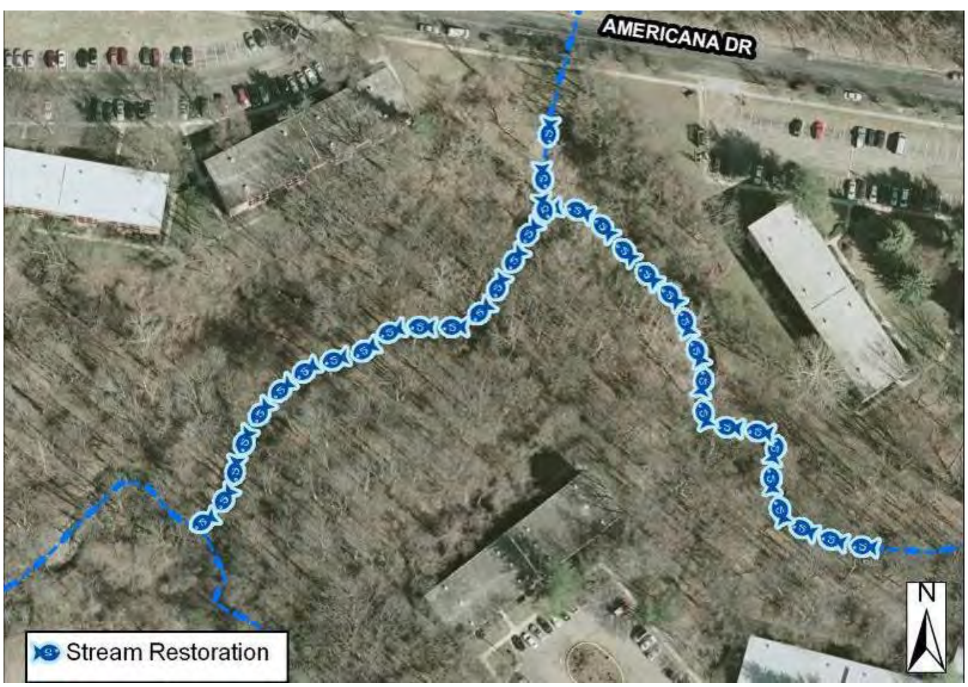
AC9217 - Stream Restoration

Vicinity Map

Address:	4200 block of Americana Drive
Location:	Between Americana Drive and Donnybrook Ct
Land Owner:	Private - Residential
PIN:	Unknown
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is intended to restore a stream channel located between Americana Drive and Donnybrook Court. The proposed restoration extends from the end of Donnybrook Court to the stream's confluence with a tributary which would be restored under project AC9216. Thre project also includes a small section of channel draining a stormwater outfall from Americana Drive. The upstream portion of the project is incised and over-widened while the downstream portion is incised and eroded. Riparian buffers on the right bank facing downstream, are deficient and are currently maintained as mowed lawn.

Channel restoration will focus on reconnecting higher flows with the original floodplain to dissipate energy and encourage the deposition of sediment on the floodplain. Other restoration components include reducing the existing channel dimensions, raising the bed elevation of the channel, installing grade controls to prevent further incision and over-widening and restoring areas of deficient riparian buffers.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementation of this project will reduce the sediment supply to receiving stream channels by reducing bank scour and stream bed incision. Reconnecting this channel to the original floodplain will also reduce the amount of sediment flowing to downstream channels by allowing suspended sediment to be deposited along the floodplain. Enhancement of riparian buffers especially in the upstream portion of this project will also serve to improve the ecological function of this area by filtering overland flow and protecting the stream banks from erosion. It is estimated that a total of 227,985 lbs of sediment, 182 lbs of total nitrogen and 71 lbs of total phosphorus would be reduced by the restoration.

Project Design Considerations: This project is entirely contained within private property and will require significant coordination with property owners for access and construction. Access will most likely occur off of Americana Drive between two apartment building parking lots. Steep slopes would be encountered with this access point. This project will require environmental permitting as it requires construction and modifications within a perennial stream channel and floodplain. The channel is at least partially buffered by forest, so tree loss is expected, however, as with similar projects, restoration benefits often outweigh overall construction impacts. No existing utility impacts are expected during design or construction. This project should be completed before project AC9216, which occurs downstream, to ensure proper design and construction sequencing.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	975	LF	$200	$195,000
Clear and Grub	3.36	AC	$10,000	$33,574
Plantings	3.36	AC	$25,000	$83,936
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$412,510
Ancillary Items	1	LS	5% of project	$20,626
Erosion and Sediment Control	1	LS	10% of project	$41,251
			Base Construction Cost	**$474,387**
			Mobilization (5%)	$23,719
			Subtotal 1	$498,106
			Contingency (25%)	$124,527
			Subtotal 2	$622,633
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$280,185
			Estimated Project Cost	**$903,000**

Site Photo: Upstream end is over-widened with moderate bank erosion

Site Photo: Incised channel with severe bank erosion in downstream portion of project

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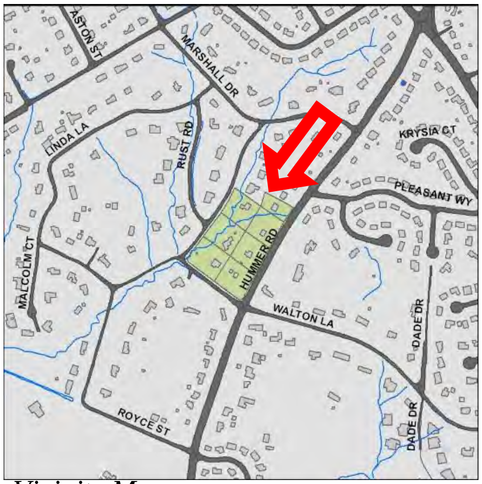
AC9218 - Stream Restoration



Vicinity Map

Address:	3700 block of Hummer Road and Pleasant Ridge Road
Location:	Pleasant Ridge
Land Owner:	Private - Residential
PIN:	0603 02 0024D, 0603 02 0025, 0603 02 0030, 29, 28
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Coon Branch

Description: This project is located between Hummer Road and Pleasant Ridge Road and extends from a culvert under Hummer Road downstream to a culvert under Walton Lane. The existing stream channel parallels several homes along Pleasant Ridge Road and in some cases is located within close proximity to buildings and homes. This channel is actively incising and widening especially on outer meander bends.

Restoring this channel will involve regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, installing grade controls to dissipate energy and prevent further bed incision, and restoring the riparian buffer in areas where vegetation is not present. Reconnecting this channel back to the original floodplain is not advised due to the location of driveway culverts and personal property, including homes and landscaping that may be impacted during storm events.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to receiving stream channels by reducing bank scour and stream bed incision. Overall, stream habitat and water quality will be improved due to stable habitat creation and reductions in available sediment supply. Restoring the existing riparian buffer will also provide additional channel stability and ecological benefits. It is estimated that a total of 70,687 lbs of sediment, 57 lbs of total nitrogen and 22 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: This project is entirely contained within private residential properties and will require significant coordination with property owners for access and construction. In some cases, property owners have landscaped and placed structures within close proximity to the existing channel. Access to this project could occur from the upstream limit at Hummer Road and the downstream limit at Walton Lane. Both of these access points will require some tree removal and will disturb residential lawns. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel. Existing utility impacts are not anticipated with this restoration.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	850	LF	$200	$170,000
Clear and Grub	0.78	AC	$10,000	$7,800
Plantings	0.78	AC	$25,000	$19,500
Additional Cost, First 500 LF	500	LF	$200	$100,000
			Initial Project Cost	**$297,300**
Ancillary Items	1	LS	5% of project	$14,865
Erosion and Sediment Control	1	LS	10% of project	$29,730
			Base Construction Cost	**$341,895**
			Mobilization (5%)	$17,095
			Subtotal 1	$358,990
			Contingency (25%)	$89,748
			Subtotal 2	$448,738
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$201,932
			Estimated Project Cost	**$651,000**


Figure 1: Eroded banks near the intersection of Pleasant Ridge Road and Walton Lane


Figure 2: Channel is actively incising with eroded banks

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AC9219 - Stream Restoration

Vicinity Map

Address:	3401 Woodburn Road
Location:	Pine Ridge Park
Land Owner:	County - FCPA
PIN:	0591 01 0020, 0591 01 0018
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project would restore two existing stream channels and a ditch located within Pine Ridge Park as well as a third stream channel within Accotink Stream Valley Park. The two channels located within Pine Ridge Park drain most of the runoff from the park, a large portion of the hospital property along Gallows Road, and a residential community along Collins Street. All three channels are currently incised and over-widened with moderate to severe erosion occurring on meander bends and along straight sections. There is severe erosion exposing a sanitary sewer line and creating a scour pool.

Restoration will focus on reducing channel dimensions and raising bed elevations to reconnect each channel to its floodplain, which will help to prevent further incision and over-widening. The two areas with severe erosion should be stabilized with using armor-in-place or bioengineering techniques.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will reduce the sediment supply to receiving stream channels by reducing bank scour and stream bed incision. Reconnecting these channels to the original floodplain will also help to dissipate energy within the channel, resulting in suspended sediment being deposited on the floodplain. Restoring and stabilizing these channels will also protect infrastructure, including an exposed sanitary sewer line, several storm drain outfalls, culvert structures, and a park trail near the intersection of Guinevere Drive and Launcelot Way. This project could provide an educational opportunity for residents using park trails.

Project Design Considerations: This project will require environmental permitting as construction and modification within a perennial stream channels is required. All of these channels are buffered by forest, so access and construction for this project will cause a significant amount of tree loss. In similar projects, however, experience has shown that restoration benefits will outweigh construction impacts.

Access to the channels upstream of Chivalry Road can be gained from multiple locations including an access area off of Chivalry Road and Launcelot Way, off of Bannerwood Drive and Collins Street, or off the parking lot of Pine Ridge High School Site Park. Access to the downstream channel can be gained from an access area off of Guinevere Road or at the end of Robey Avenue. An existing sanitary sewer line is currently exposed, but no impacts are expected during design or construction. Changes in the upstream floodplain from Chivalry Road will be analyzed during channel design to determine if modifications will cause any adverse impacts.

The project site is adjacent to and crosses through Native American site 44FX1367, The Sons and Daughters of Liberty, Cemetery #2. In addition, the stream bed contains large boulders of high quality stone, and may have been quarried to make stone tools by Native Americans. An archaeological survey is recommended with subsequent archaeological testing for eligibility for inclusion into the National Register of Historic Places. If sites are found eligible, they would require avoidance or data recovery.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	2060	LF	$200	$412,000
Clear and Grub	7.09	AC	$10,000	$70,937
Plantings	7.09	AC	$25,000	$177,342
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$760,279
Ancillary Items	1	LS	5% of project	$38,014
Erosion and Sediment Control	1	LS	10% of project	$76,028
			Base Construction Cost	**$874,321**
			Mobilization (5%)	$43,716
			Subtotal 1	$918,037
			Contingency (25%)	$229,509
			Subtotal 2	$1,147,546
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$516,396
			Estimated Project Cost	**$1,664,000**

Site Photo: Incising and over-widening channel in Pine Ridge High School Site Park

Site Photo: Severe bank erosion in channel near Collins Street

Site Photo: Eroded downstream channel starts at culvert near Guinevere Drive and Launcelot Way

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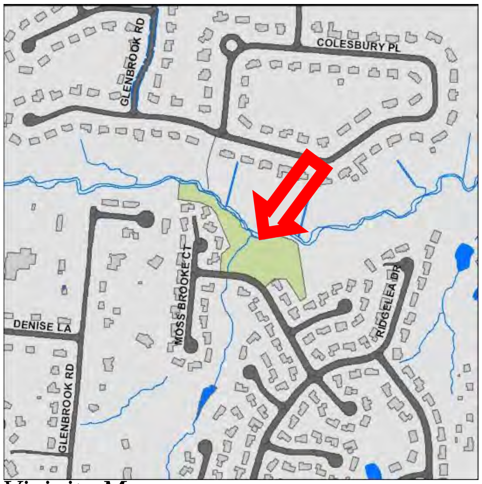
AC9220 - Stream Restoration



Vicinity Map

Address:	3700 Block Moss Brooke Court
Location:	Ridgelea Hills
Land Owner:	Private
PIN:	0584 28 C
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Crook Branch

Description: This project is located between Glade Hill Road and Colesbury Place and extends from the a culvert under Glade Hill Road to the confluence with Crook Branch. The existing stream channel is very incised and over-widened with severe erosion occurring along the downstream portion. The downstream confluence with Crook Branch also corresponds with Project AC9221, which is proposed to restore a portion of the mainstem of Crook Branch. These two projects should be coordinated with Project AC9221 designed and constructed before this project.

Restoring this channel will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, raising the bed elevation to meet the confluence elevation with Project AC9221, and installing grade controls or step pools to dissipate energy and prevent further bed incision.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to receiving stream channels by reducing bank scour and channel bed incision. Additionally, by reducing sedimentation and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. It is estimated that a total of 33,592 lbs of sediment, 27 lbs of total nitrogen and ten lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: This project is entirely contained on private property along Glade Hill Road and will require significant coordination with the property owners for access and construction. Access to this project would need to occur off of Glade Hill Drive and will require some tree removal. This project will require environmental permitting due to construction and modifications to a perennial stream channel. Existing utility impacts are not anticipated with this restoration. This project should be designed and constructed during the implementation of Project AC9221 to ensure proper channel elevations and alignment.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	247	LF	$200	$49,400
Clear and Grub	0.22	AC	$10,000	$2,200
Plantings	0.22	AC	$25,000	$5,500
Additional Cost, First 500 LF	247	LF	$200	$49,400
			Initial Project Cost	**$106,500**
Ancillary Items	1	LS	5% of project	$5,325
Erosion and Sediment Control	1	LS	10% of project	$10,650
			Base Construction Cost	**$122,475**
			Mobilization (5%)	$6,124
			Subtotal 1	$128,599
			Contingency (25%)	$32,150
			Subtotal 2	$160,749
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$72,337
			Estimated Project Cost	**$234,000**


Figure 1: Eroded banks downstream of Glade Hill Drive.


Figure 2: Eroded and incised confluence with Crook Branch

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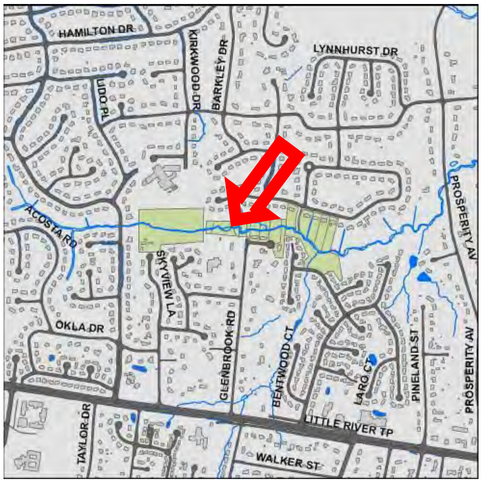
AC9221 - Stream Restoration



Vicinity Map

Address:	Beginning at 3801 Sky View Lane through 8913 Glade Hill Road
Location:	Mantua, Ridgelea Hills
Land Owner:	Private
PIN:	0584 01 0054; 0584 14 0015-0024; 0584 16 0020-0024; 0584 14 E1, F, G, H, J
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Crook Branch

Description: This project involves the restoration of a portion of Crook Branch. flowing west to east along Colesbury Place and extending just downstream of Prince William Drive to a confluence with a channel that originates upstream of Glade Hill Road. A small portion of this confluence channel is also included in this restoration project. Most of the project site is over-widened, unstable, and incised with eroded banks. The upstream portion of the channel has been partially reinforced with concrete debris and there is no riparian buffer. Additionally, several small sections have been armored previously with rip-rap, specifically near a recently installed footbridge at the end of Moss Brooke Court.

Restoring this channel will focus on creating a nested channel, where the floodplain and banks of the current channel will be regraded to allow for a new floodplain at an elevation lower than the current one. Other restoration components include installing grade controls and restoring areas of deficient riparian buffers. The asphalt walking trail behind the houses along Moss Brooke Court is currently being undermined by stream bank erosion and may need to be stabilized. Channels from storm drain outfalls should also be incorporated into this project to provide stability.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Stabilizing existing banks and creating a new channel geometry will result in reduced sediment loads. By reconnecting this channel to its floodplain, erosive flows will dissipate and downstream sediment loads can be reduced as suspended sediment will be deposited on the floodplain. This project will also stabilize storm drain outfalls and conveyances as well as protect walking trails and other infrastructure. Enhancing riparian buffers, especially in the upstream portion of this project, will improve the overall ecological function of this area. It is estimated that a total of 377,726 lbs of sediment, 302 lbs of total nitrogen and 117 lbs of total phosphorus would be reduced by the restoration.

Project Design Considerations: The project lies entirely on private property and will require significant coordination with property owners for access and construction. Structures along Glenbrook Court and Moss Brooke Court are within close proximity to the existing stream channel. Sanitary sewer manholes, pipes, and stream crossings, as well as a walking trail and pedestrian bridge, may constrain design and construction. Access may need to occur from several locations to reach all portions of the channel. Several possible points of access include: the end of Glenbrooke Road or Glenbrooke Court, off of Glade Hill Road, off of Colesbury Place in a road easement between properties, and off of the Mantua Elementary School property. This project will require environmental permitting as construction and modifications within a perennial stream channel and floodplain are needed. Significant tree loss is expected, however, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	2578	LF	$200	$515,600
Clear and Grub	5.92	AC	$10,000	$59,183
Plantings	5.92	AC	$25,000	$147,957
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$822,740
Ancillary Items	1	LS	5% of project	$41,137
Erosion and Sediment Control	1	LS	10% of project	$82,274
			Base Construction Cost	**$946,151**
			Mobilization (5%)	$47,308
			Subtotal 1	$993,459
			Contingency (25%)	$248,365
			Subtotal 2	$1,241,824
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$558,821
			Estimated Project Cost	**$1,801,000**


Site Photo: Downstream end with severe erosion and impacts to walking trail/storm drain inflow


Site Photo: Over-widened channel with severe bank erosion


Site Photo: Upstream end with moderate erosion and no riparian buffer

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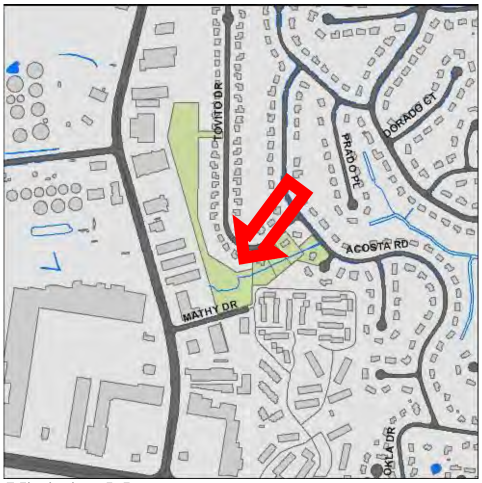
AC9222 - Stream Restoration

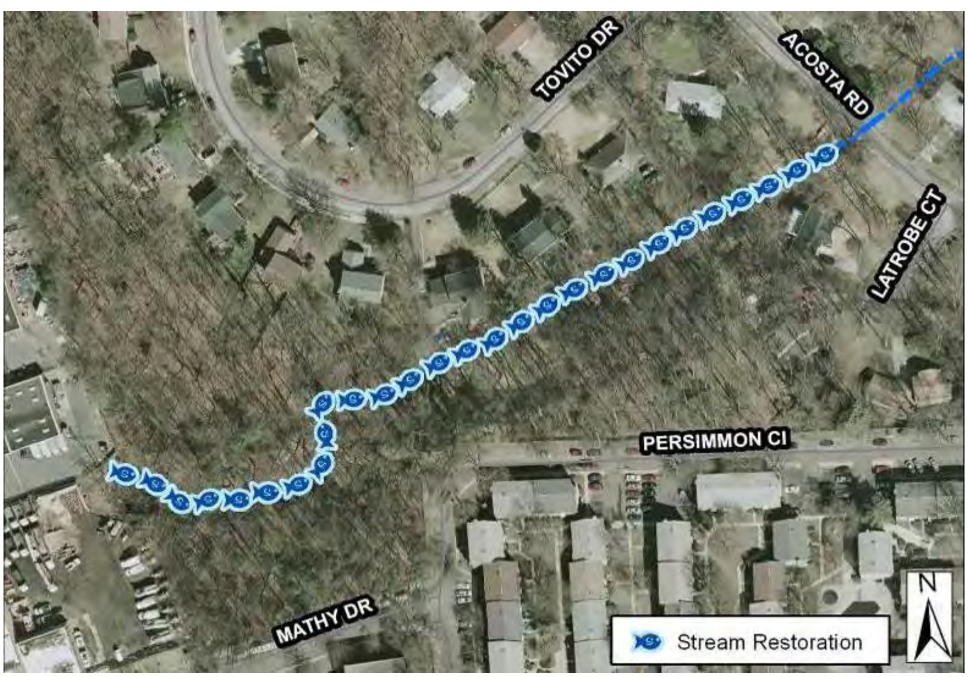


Vicinity Map

Address:	Behind 9300 Block Tovito Drive
Location:	Mantua Hills, Stockbridge
Land Owner:	Private - Residential
PIN:	0584 26 A, 0584 18 0004
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Crook Branch

Description: This project extends from a storm drain outfall behind a commercial area off of Pickett Road to the culvert under Acosta Road. The upstream portion of the project is severely eroded with high, unstable banks. The downstream portion is channelized and contains areas of rip-rap and failing v-shaped concrete channel.

Restoring the upstream portion of this channel will include regrading and stabilizing eroded stream banks with armor-in-place techniques on the outer meander bends and using bioengineering techniques along straight portions to create a stable channel. Restoration will include grade controls to dissipate energy and will require some installation of stone-toe protection to ensure future bank stability. One storm drain outfall that drains to this channel from Persimmon Circle should also be stabilized. Restoring the downstream portion of the channel will include removing the existing rip-rap and concrete channel and replacing it with a natural channel designed to withstand urban peak flows and provide habitat.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will effectively reduce erosion and downstream sediment transport by reducing bank instability, scour, and meander bend migration. Removing concrete and rip rap in the downstream portion and creating stable habitat along restored banks in the upstream portion will also allow for improvements in water quality and instream habitat. Property owners along the downstream portion of this project might welcome the aesthetic changes of the current channel to a natural, restored channel. It is estimated that a total of 146,737 lbs of sediment, 117 lbs of total nitrogen and 46 lbs of total phosphorus would be reduced by the restoration.

Project Design Considerations: This project is entirely contained within private residential properties along Tovito Drive and will require significant coordination with property owners for access and construction. In some cases, property owners along Tovito Drive have landscaped and placed structures close to the existing channel that may constrain new channel design. Access to this project may need to occur from several locations: off of Acosta Road, Persimmon Circle, and from behind the commercial area off of Pickett Road. All of these access points will require tree removal. Access from Acosta Road will also require the use of residential yards. Significant tree loss is expected, however, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts. This project will require environmental permitting as construction and modifications within a perennial stream channel are needed. Existing utility impacts are not anticipated.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	993	LF	$200	$198,600
Clear and Grub	2.28	AC	$10,000	$22,796
Plantings	2.28	AC	$25,000	$56,990
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$378,386
Ancillary Items	1	LS	5% of project	$18,919
Erosion and Sediment Control	1	LS	10% of project	$37,839
			Base Construction Cost	**$435,144**
			Mobilization (5%)	$21,757
			Subtotal 1	$456,901
			Contingency (25%)	$114,225
			Subtotal 2	$571,126
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$257,007
			Estimated Project Cost	**$829,000**

Site Photo: Severe bank erosion in upstream portion

Site Photo: Concrete/rip rap in downstream portion

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AC9223 - Stream Restoration

Vicinity Map

Address:	Behind the 3100/3200 blocks of Highland Lane
Location:	Pine Ridge
Land Owner:	Private-Residential
PIN:	0493 08 0039, 0493 08 0040, 0493 08 0041, 0493 08 0042, 0493 08 0043, 0493 08 0044,0493 08 0039A, 0591 27 F
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project is located between Monarch and Highland Lanes, extending from the outlet of Detention Pond DP0384 to the rear of 3225 Highland Lane. The channel is predominately straight, incised, over-widened, and is lacking a riparian buffer in several areas along the right bank. The dry detention facility has a large, low-flow orifice that may be contributing to the eroded conditions in the receiving channel. Restoring this channel will include regrading and stabilizing eroded stream banks with armor-in-place techniques on outer meander bends and bioengineering techniques on straight portions.

Grade controls will be used to dissipate energy and installing stone toe protection will ensure future bank stability. One storm drain outfall and two ditches that flow to this channel should also be stabilized. Buffer restoration in various locations along the right bank will be necessary to further improve restored areas. Since this restoration is entirely contained within private residential property, raising the bed elevation to reconnect to the floodplain or regrading the floodplain to create a new bench is not desirable.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will help to protect adjacent private properties and structures. Stabilizing the channel will reduce downstream sediment loads by preventing bank scour and channel incision. By reducing sediment transport within the channel and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. Restoring the riparian buffer will also provide future channel stability and ecological benefits. It is estimated that a total of 122,808 lbs of sediment, 98 lbs of total nitrogen and 38 lbs of total phosphorus would be reduced by the restoration.

Project Design Considerations: This project is entirely contained within private residential properties along Highland Lane and will require significant coordination with property owners for access and construction. Access to the project will need to occur from the access road that extends off of Willow Oaks Corporate Drive. This access road appears to be used to access existing ponds DP0374 and DP0384. The access road leads to the upstream end of this project. Moderate tree loss is expected with this restoration, however, in similar projects, experience has shown that restoration benefits and proposed buffer enhancements may outweigh overall construction impacts. This project will require environmental permitting as construction and modifications within a perennial stream channel are needed. Overhead power lines and a sanitary sewer line were noted near the DP0384 facility embankment but existing utilities are not anticipated to impact the design or construction of this restoration.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1204	LF	$200	$240,800
Clear and Grub	2.76	AC	$10,000	$27,640
Plantings	2.76	AC	$25,000	$69,100
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$437,540
Ancillary Items	1	LS	5% of project	$21,877
Erosion and Sediment Control	1	LS	10% of project	$43,754
			Base Construction Cost	**$503,171**
			Mobilization (5%)	$25,159
			Subtotal 1	$528,330
			Contingency (25%)	$132,083
			Subtotal 2	$660,413
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$297,186
			Estimated Project Cost	**$958,000**


Site Photo: Over-widened channel with moderate to severe erosion


Site Photo: Erosion with no riparian buffer

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AC9224 - Stream Restoration

Vicinity Map

Address:	Unknown
Location:	I-66 at Prosperity Ave
Land Owner:	State – VDOT
PIN:	N/A
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Long Branch

Description: This project is located between I-66 and Prosperity Avenue and extends from a culvert under an I-66 access road downstream toward the confluence with Long Branch. This project represents a short section of existing stream channel that parallels I-66 and drains outfalls from I-66, commercial parking lots, and residential areas. The existing stream channel is incised and over-widened with severe erosion occurring on both banks. There is a headcut located downstream of the culvert under the I-66 access road culvert that is migrating upstream toward the culvert.

Restoring this channel will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques. Raising the bed elevation and installing grade controls or step pools may be necessary to dissipate energy and prevent future channel incision.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Stabilizing this channel will help to decrease sediment loads to downstream channels by preventing bank scour and stream bed incision. Restoration will help to protect the VDOT culvert under the access road by preventing future headcut migration. Overall, stream habitat and water quality may be improved due to stable habitat creation and reductions in available sediment supply. It is estimated that a total of 21,165 lbs of sediment, 17 lbs of total nitrogen and seven lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: This project will require significant coordination with VDOT for access and construction. Access to this project could occur from Prosperity Avenue or the I-66 access road and will require significant tree removal and manipulation of steep slopes. Tree loss is expected with this restoration; however, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	249	LF	$200	$49,800
Clear and Grub	0.50	AC	$10,000	$5,000
Plantings	0.50	AC	$25,000	$12,500
Additional Cost, First 500 LF	249	LF	$200	$49,800
			Initial Project Cost	**$117,100**
Ancillary Items	1	LS	5% of project	$5,855
Erosion and Sediment Control	1	LS	10% of project	$11,710
			Base Construction Cost	**$134,665**
			Mobilization (5%)	$6,733
			Subtotal 1	$141,398
			Contingency (25%)	$35,350
			Subtotal 2	$176,748
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$79,537
			Estimated Project Cost	**$257,000**

Figure 1: Severe bank erosion

Figure 2: Incised and eroded stream channel along I-66

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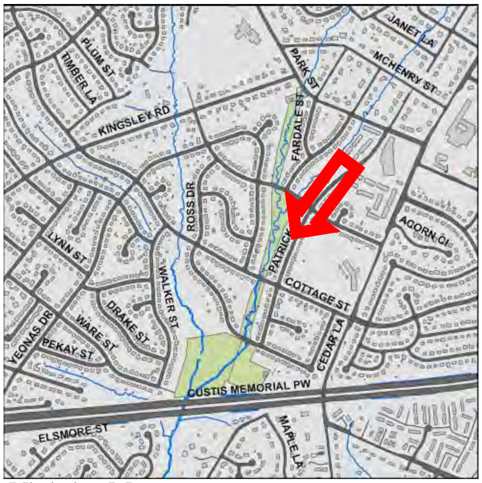
AC9225 - Stream Restoration

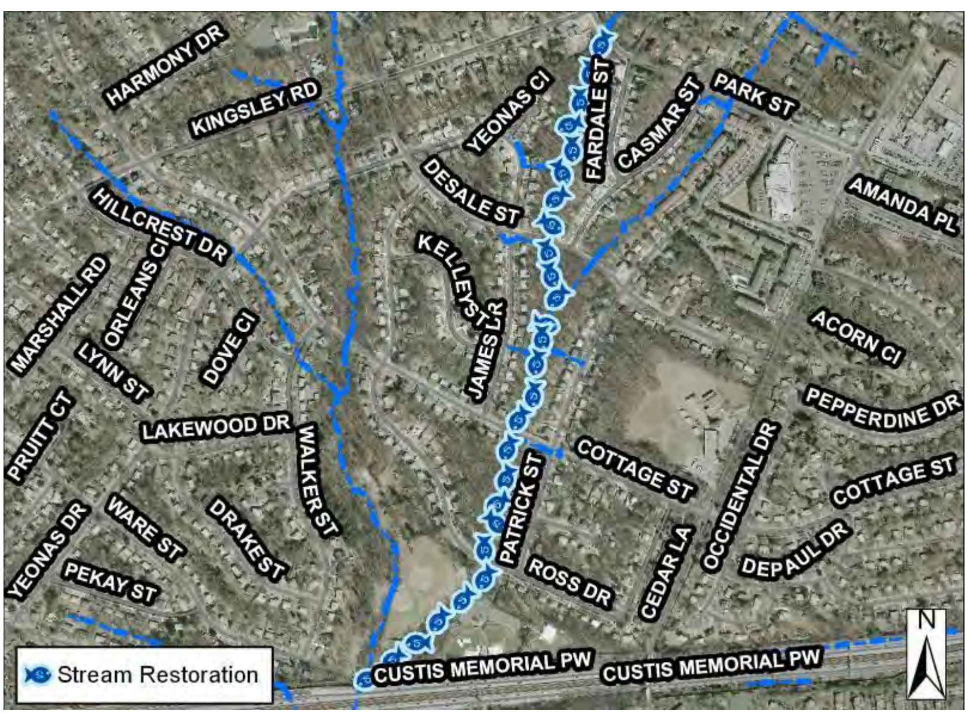


Vicinity Map

Address:	Yeonas Park
Location:	Between Desale and I-66
Land Owner:	Private / Town of Vienna
PIN:	0393 04 0004B, 0482 02 0013B, 0482 03 2360A, 0491 02 0004, 0491 08 2380A, 0491 08 2498P, 0491 08 2513A, 0491 08 2629P
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Bear Branch

Description: This stream restoration project is primarily within Town of Vienna park land, with the upstream limit of this located at Park Street. The downstream limit is located at the culvert under I-66 in South Side Park. Several road crossings including Desale Street, Cottage Street, and Ross Drive and many storm drain outfalls are located along the project length. Most of the existing channel within the project limits is over-widened and incised, with moderate to severe erosion occurring on outside meanders and straight sections. While areas of the channel are sinuous, most of the channel is relatively straight.

Restoring the channel will focus on reducing the current channel dimensions and raising the bed elevation to reconnect the channel to the floodplain. The existing channel in South Side Park is constrained and reconnecting this portion of the channel to the floodplain does not appear to be feasible. In areas such as this, regrading and stabilization may be required using armor-in-place or bioengineering techniques.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will effectively reduce the sediment supply to receiving stream channels by reducing bank scour and stream bed incision. Reconnecting the channel to the floodplain will also reduce the amount of sediment in downstream channels as suspended sediment will be deposited on the floodplain.. Restoring and stabilizing this channel will also help to protect storm drain, road crossing, and utility infrastructure located in the channel and floodplain. This project could provide an educational opportunity for residents using South Side Park. It is estimated that a total of 551,504 lbs of sediment, 441 lbs of total nitrogen and 171 lbs of total phosphorus would be reduced by the restoration.

Project Design Considerations: Coordination with private residential owners will be necessary where the existing channel and floodplain are within close proximity to private properties. Several road crossings, storm drain outfalls and underground utilities may constrain design and construction. Access to the floodplain will need to occur off of Park Street, Desale Street, Cottage Street, and Ross Drive. Since this stream is buffered by forest, access along the channel and grading of the existing channel and floodplain will require significant tree removal. In similar projects, experience has shown that restoration benefits will outweigh overall construction impacts. This project will require environmental permitting as construction and modifications within a perennial stream channel is needed.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	4977	LF	$200	$995,400
Clear and Grub	11.43	AC	$10,000	$114,256
Plantings	11.43	AC	$25,000	$285,640
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$1,495,296
Ancillary Items	1	LS	5% of project	$74,765
Erosion and Sediment Control	1	LS	10% of project	$149,530
			Base Construction Cost	**$1,719,591**
			Mobilization (5%)	$85,980
			Subtotal 1	$1,805,571
			Contingency (25%)	$451,393
			Subtotal 2	$2,256,964
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$1,015,634
			Estimated Project Cost	**$3,273,000**


Site Photo: Over-widened channel with moderate bank erosion


Site Photo: Incised channel with moderate to severe bank erosion

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AC9226 - Stream Restoration

Vicinity Map

Address:	7124 Barry Road
Location:	Windsor Estates
Land Owner:	Private - Residential
PIN:	0902 08 0036, 0902 08 0037, 0904 08 0038, 0904 08 0039, 0904 08 0040, 0904 08 0041, 0904 10 M
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Long Branch

Description: This project is intended to repair an eroding stream at a sewer manhole located within the active channel, restore the actively widening stream, and remove a debris jam. The project is located between Barry Road and the Washington Metropolitan Area Transit Authority (WMATA) metro tracks.

Restoring this channel will include regrading and stabilizing eroded stream banks with armor-in-place and/or bioengineering techniques, removing the debris jam, and adjusting the channel to protect the manhole. This project is located within forested conditions.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will reduce sediment supply to receiving stream channels by reducing erosion related to an existing debris jam. Overall stream habitat and water quality may be improved due to stable habitat creation and reductions in available sediment supply. Restoring and stabilizing the channel will help to protect an exposed utility located within the channel and floodplain. It is estimated that a total load of 29,589 lbs of sediment, 24 lbs of total nitrogen and nine lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: This area is wooded with private residential properties near the access points to the stream. Coordination with these property owners will be necessary for access and construction. The WMATA Metro tracks are located to the west of the stream. Access to the project site could occur through residential properties located on Barry Street. Tree loss is expected with this restoration; however, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel and forest impacts. Existing utility impacts are possible as well as a sewer line parallels the stream.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	765	LF	$200	$153,000
Clear and Grub	0.70	AC	$10,000	$7,000
Plantings	0.70	AC	$25,000	$17,500
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$277,500
Ancillary Items	1	LS	5% of project	$13,875
Erosion and Sediment Control	1	LS	10% of project	$27,750
			Base Construction Cost	**$319,125**
			Mobilization (5%)	$15,956
			Subtotal 1	$335,081
			Contingency (25%)	$83,770
			Subtotal 2	$418,851
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$188,483
			Estimated Project Cost	**$608,000**

Figure 1: Exposed sanitary sewer manhole on streambank

Figure 2: Debris jam and active channel widening

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AC9227 - Stream Restoration

Vicinity Map

Address:	Along 7100 block of Barry Road
Location:	Windsor Estates
Land Owner:	Private - Residential
PIN:	0904 09 G, 0904 08 0043, 44, 45, 46, 47, 48, 49, 50, 51
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Long Branch

Description: This project starts at a large stormdrain outfall located off of Barry Road at the end of Rockshire Court and extends downstream to the end of Rockleigh Way. Currently, the existing stream channel is concrete-lined with several private residential driveway bridges crossing the channel. The riparian buffer is a mix of trees and lawn.

This project is proposed to remove the concrete from the channel and restore it using natural channel design. The alignment of the proposed channel and the existing driveway bridges will likely need to be altered during restoration. Creating a riparian buffer is also proposed along the newly created channel.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Removing the existing concrete channel and creating stable habitat along the restored banks in the upstream portion will allow for improvements in water quality and instream habitat. Property owners along the proposed project might welcome the aesthetic changes of the current channel to a natural, restored channel. There are no estimated pollutant removal benefits at the site, since the project will replace a stable concrete channel with a stable natural channel. The primary benefits of the project will be to extend habitat further upstream.

Project Design Considerations: Since this project is contained within private residential properties, many with driveway bridges over the channel, coordinating with property owners will be necessary for access and construction. Access to this site is good from Barry Road. Impacts to homeowner driveways and property will occur and should be assessed before design and construction. This project will require environmental permitting due to construction and modifications to a perennial stream channel.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	930	LF	$200	$186,000
Clear and Grub	0.64	AC	$10,000	$6,400
Plantings	0.64	AC	$25,000	$16,000
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$308,400
Ancillary Items	1	LS	5% of project	$15,420
Erosion and Sediment Control	1	LS	10% of project	$30,840
			Base Construction Cost	**$354,660**
			Mobilization (5%)	$17,733
			Subtotal 1	$372,393
			Contingency (25%)	$93,098
			Subtotal 2	$465,491
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$209,471
			Estimated Project Cost	**$675,000**

Figure 1: Existing concrete lined stream channel with private driveway bridge

AC9229 - Stream Restoration

Vicinity Map

Address:	Behind 5500 block of Flag Run Drive and behind 7600 block of Dunston St
Location:	Flag Run Park, Lake Accotink Park / I-495
Land Owner:	County - FCPA / State - VDOT
PIN:	0792 01 0001A, 0792 01 0002, 0704 01 0006
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Flag Run

Description: This project is intended to restore an eroded section of Flag Run located between the north side of the Capital beltway (I-495) and the south side of Queensberry Avenue. Currently, this channel is experiencing severe bank and bed erosion. An existing pipeline south of I-495 is exposed and the channel is continuing to degrade threatening the integrity of the pipe. Culverts and storm drains along the reach are also experiencing erosion.

Restoring the channel will include re-grading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques and installing grade controls to dissipate energy. Fill, grading and scour protection will also be necessary for protection of all storm drain outfalls discharging to the stream. Replacing the existing culvert with a bottomless arch culvert would greatly improve hydraulic and hydrologic processes through this stream reach providing a natural stream substrate with grade control structures.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will reduce sediment supply to receiving stream channels by reducing bank scour and stream bed incision. Other benefits include improving fish and aquatic passage and improving overall stream quality by creating stable habitat and reducing sediment supply. Restoring and stabilizing this channel will help to protect storm drain, road crossing, and utility infrastructure located in the channel and on the floodplain. It is estimated that a total of 194,738 lbs of sediment, 156 lbs of total nitrogen and 60 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: Access to the proposed restoration north of I-495 will require use of the easement along the noise wall. This is a narrow and steep slope between the newly constructed noise wall and existing development and forest. Access on the south side of I-495 may be obtained from Queensberry Road. Some tree removal and manipulation of steep slopes may be required. Restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel and forest impacts.

The project is located upstream of culvert retrofit AC9400 and on either side of culvert retrofit AC9401. Design of all three projects should be performed concurrently.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	2291	LF	$200	$458,200
Clear and Grub	2.10	AC	$10,000	$21,000
Plantings	2.10	AC	$25,000	$52,500
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$631,700
Ancillary Items	1	LS	5% of project	$31,585
Erosion and Sediment Control	1	LS	10% of project	$63,170
			Base Construction Cost	**$726,455**
			Mobilization (5%)	$36,323
			Subtotal 1	$762,778
			Contingency (25%)	$190,695
			Subtotal 2	$953,473
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$429,063
			Estimated Project Cost	**$1,383,000**

Figure 1: Severe bank erosion just upstream of I-495

Figure 2: Severe erosion and downcutting at a stormdrain outfall

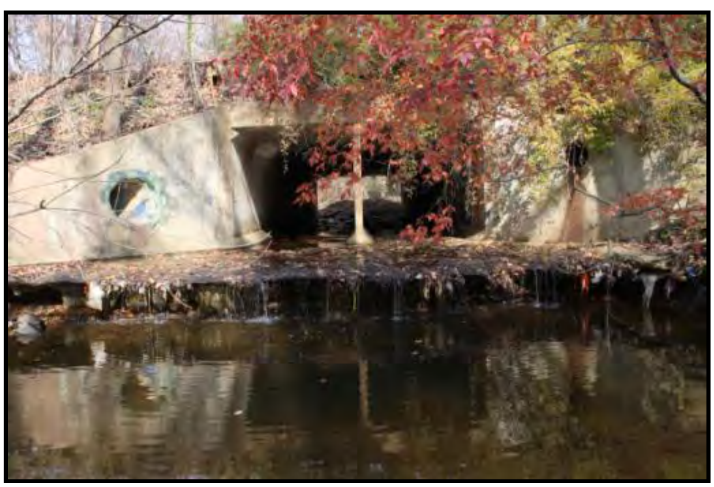

Figure 3: Downcutting and a large scour pool at the Queensberry Avenue culvert

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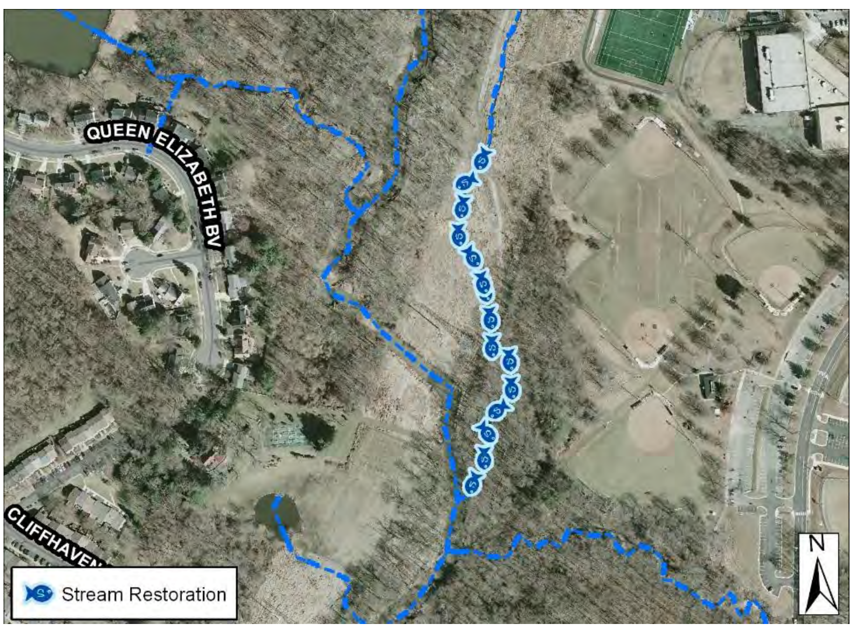
AC9230 - Stream Restoration

Vicinity Map

Address:	Behind 8300 block of Queen Elizabeth Bv
Location:	Wakefield Park
Land Owner:	County - FCPA
PIN:	0704 01 0002
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project entails restoring the existing stream channel located in Wakefield Park between I-495 and Queen Elizabeth Boulevard. The project extends from an overhead power line clearing downstream to the confluence with Accotink Creek. Currently, this channel is deeply incised and experiencing severe bank and bed erosion.

Restoring the channel will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, and installing grade controls to dissipate energy. Since this project is located within a park, the floodplain and project limits are within forested conditions except for an overhead power line utility clearing.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Accotink Creek by reducing bank scour and stream bed incision. Overall, stream habitat and water quality may be improved due to stable habitat creation and reductions in available sediment supply. It is estimated that the project will reduce pollutants by 66,319 lbs of sediment, 53 lbs of nitrogen and 21 lbs of tot phosphorus annually.

Project Design Considerations: Coordination with the appropriate utility agencies will be necessary for access and construction. Access to this project could occur from the utility easement, if permittable. Minor to moderate tree loss is expected with this restoration; however, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel and forest impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1040	LF	$200	$208,000
Clear and Grub	0.96	AC	$10,000	$9,600
Plantings	0.96	AC	$25,000	$24,000
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$341,600
Ancillary Items	1	LS	5% of project	$17,080
Erosion and Sediment Control	1	LS	10% of project	$34,160
			Base Construction Cost	**$392,840**
			Mobilization (5%)	$19,642
			Subtotal 1	$412,482
			Contingency (25%)	$103,121
			Subtotal 2	$515,603
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$232,021
			Estimated Project Cost	**$748,000**

Figure 1: Deeply incised channel with severe erosion

AC9231 - Stream Restoration

Vicinity Map

Address:	Behind 8200 block of Strong Spring Ct
Location:	Wakefield Park
Land Owner:	County - FCPA
PIN:	0704 01 0002
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Accotink Creek

Description: This project entails restoring overflow stream channels located within the eastern floodplain of Accotink Creek between I-495 and Toll House Road. Currently, these channels are deeply incised with bank and bed erosion. Each of the overflow channels convey heavy loads of sand and other sediment to Accotink Creek during large precipitation events.

Restoring these channels will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, and installing grade controls to dissipate energy. The floodplain and project limits are all within forested conditions.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Accotink Creek by reducing bank scour and stream bed incision. Overall, stream habitat and water quality may be improved due to stable habitat creation and reductions in available sediment supply. It is estimated that a total of 39,948 lbs of sediment, 32 lbs of nitrogen and 12 lbs of tol phosphorus would be reduced annually by this project.

Project Design Considerations: A power line easement is within the vicinity of the stream; therefore, coordination with the appropriate utility agencies will be necessary for access and construction. Access to the project site could occur from the utility easement, if permittable, but will require some tree removal. Tree loss is expected with the restoration; however, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel and forest impacts. Other than the overhead power line utility, no other utility conflicts are anticipated with this restoration.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	904	LF	$200	$180,800
Clear and Grub	2.17	AC	$10,000	$21,700
Plantings	2.17	AC	$25,000	$54,250
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$356,750
Ancillary Items	1	LS	5% of project	$17,838
Erosion and Sediment Control	1	LS	10% of project	$35,675
			Base Construction Cost	**$410,263**
			Mobilization (5%)	$20,513
			Subtotal 1	$430,776
			Contingency (25%)	$107,694
			Subtotal 2	$538,470
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$242,312
			Estimated Project Cost	**$781,000**


Figure 1: Overflow channel with erosion and large deposits of sand


Figure 2: Overflow channel with large sand deposits

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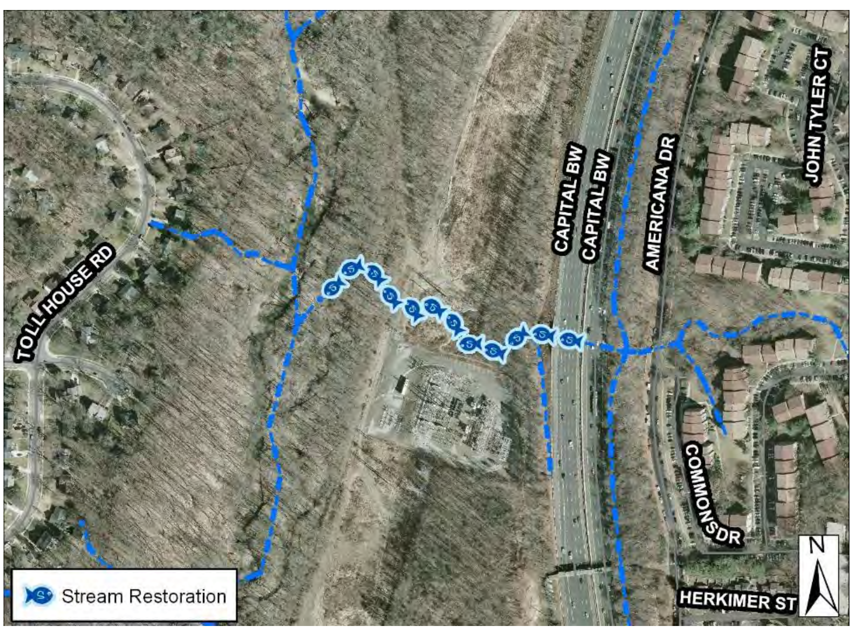
AC9232 - Stream Restoration

Vicinity Map

Address:	Between 8200 block of Toll House Road and I-495 (Capitol Beltway)
Location:	Wakefield Park
Land Owner:	County - FCPA
PIN:	0704 01 0002
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project entails restoring the existing stream channel located within Wakefield Park that is located between I-495 and Toll House Road which extends from the culvert under I-495 downstream to the confluence with Accotink Creek. Currently, this channel is experiencing severe bank and bed erosion and the channel is deeply incised.

Restoration will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, and installing grade controls to dissipate energy. Since this project is located within a park, the floodplain and project limits are all within forested conditions except for an overhead power line utility.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Accotink Creek by reducing bank scour and stream bed incision. Overall, stream habitat and water quality may be improved due to stable habitat creation and reducing the available sediment supply. It is estimated that a total of 147,421 lbs of sediment, 118 lbs of nitrogen and 46 lbs of phosphorus would be reduced annually by this project.

Project Design Considerations: A power line easement is within the vicinity of the stream; therefore, coordination with the appropriate utility agencies will be necessary for access and construction. Access to the project site could occur from the utility easement if permittable, but will require significant tree removal. Although tree loss is expected with this restoration, restoration benefits will outweigh overall construction impacts. Environmental permitting will be required to allow for construction and modifications to a perennial stream channel and for forest impacts. Other than the overhead power line utility, no utility conflicts are anticipated with this restoration.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	940	LF	$200	$188,000
Clear and Grub	0.86	AC	$10,000	$8,600
Plantings	0.86	AC	$25,000	$21,500
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$318,100
Ancillary Items	1	LS	5% of project	$15,905
Erosion and Sediment Control	1	LS	10% of project	$31,810
			Base Construction Cost	**$365,815**
			Mobilization (5%)	$18,291
			Subtotal 1	$384,106
			Contingency (25%)	$96,027
			Subtotal 2	$480,133
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$216,060
			Estimated Project Cost	**$697,000**

Figure 1: Incised channel with severe bank erosion

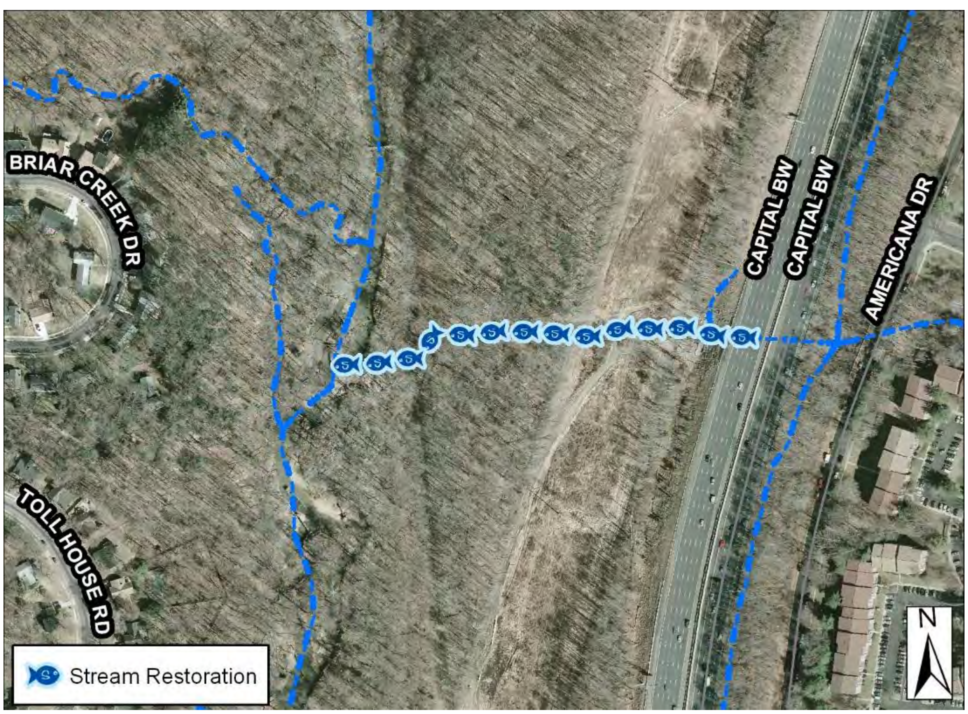
AC9233 - Stream Restoration

Vicinity Map

Address:	Between 8100 Briar Creek Drive and I-495 (Capitol Beltway)
Location:	Wakefield Park
Land Owner:	County - FCPA
PIN:	0704 01 0002
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This project entails restoring an existing stream channel located within Wakefield Park located between I-495 and Briar Creek Drive. The channel extends from the downstream side of the culvert under I-495 downstream to the confluence with Accotink Creek. Currently, this channel is experiencing severe bank and bed erosion and the channel is deeply incised.

Restoring this channel will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, and installing grade controls to dissipate energy. The floodplain and project limits are all within forested conditions except for an overhead power line utility.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will reduce sediment supply to Accotink Creek by reducing bank scour and stream bed incision. Overall, stream habitat and water quality may be improved due to stable habitat creation and reductions in available sediment supply. It is estimated that 35,489 lbs of sediment, 28 lbs of nitrogen and 11 lbs of phosphorus would be reduced annually by this project.

Project Design Considerations: A power line easement is within the vicinity of the stream; therefore, coordination with the appropriate utility agencies will be necessary for access and construction. Access to the project site could occur from the utility easement, if allowed. Access to the proposed restoration will require significant tree removal and manipulation of steep slopes; however, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and forest impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	953	LF	$200	$190,600
Clear and Grub	0.87	AC	$10,000	$8,700
Plantings	0.87	AC	$25,000	$21,750
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$321,050
Ancillary Items	1	LS	5% of project	$16,053
Erosion and Sediment Control	1	LS	10% of project	$32,105
			Base Construction Cost	**$369,208**
			Mobilization (5%)	$18,460
			Subtotal 1	$387,668
			Contingency (25%)	$96,917
			Subtotal 2	$484,585
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$218,063
			Estimated Project Cost	**$703,000**

Figure 1: Incised channel with severe bank erosion

AC9234 - Stream Restoration

Vicinity Map

Address:	Behind 3200 block of Wynford Drive and Amberley Lane, and behind 3300 block of Mantua Drive
Location:	Sutton Place, Mantua Woods
Land Owner:	Private - Residential
PIN:	0591 18 0079, 80, 81, 82, 83, 0591 24 0019, 18, 17, 16, 15, 14, 13, 0591 18 0046, 0591 18 0045
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Long Branch

Description: This project is intended to restore an eroded and over-widened section of Long Branch North located between Wynford Drive, Amberley Lane, and Mantua Drive. Restoring the channel will include raising the bed elevation and reducing channel dimensions to reconnect the channel with the floodplain, installing grade control structures, re-grading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, and stabilizing all stormdrain outfalls and tributary channel connections along the channel. Buffer restoration along re-graded areas and where extensive amounts of invasive vegetation are present will be necessary to promote future stability and to restore ecological function. Coordinating between Project AC9235, which is just upstream of this project, and this project will be necessary during design and construction to ensure compatibility between the two projects. The floodplain and project limits are all forested.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to reduce sediment loads to Long Branch and Accotink Creek. New channel geometry and stabilizing existing banks and eroded connections to this channel will allow for reduced sediment loads to downstream channels. Reconnecting this channel to the floodplain will also reduce downstream sediment loads allowing suspended sediment to deposit on the floodplain. By reducing sedimentation and providing stable habitat along restored banks, overall water quality and habitat may be improved. This project will also remove the invasive bamboo along the stream banks. It is estimated that a total of 185,997 lbs of sediment, 149 lbs of total nitrogen and 58 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: Since private residential properties adjoin the stream, coordination with these property owners will be necessary for access and construction. Access to this project will be difficult and may need to occur from Copeland Pond Court using the existing access to the stormwater pond located adjacent to the stream. Access may also be possible along Wynford Drive using existing utility easements; however, this access would require going through private residences. Access from either of these points will require some tree removal. Although tree loss is expected, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts. Existing utility impacts are possible as a sewer line parallels the stream. This project should be designed and constructed in conjunction with Project AC9235 to ensure proper channel elevations and alignment.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1563	LF	$200	$312,600
Clear and Grub	1.60	AC	$10,000	$16,000
Plantings	1.60	AC	$25,000	$40,000
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$468,600
Ancillary Items	1	LS	5% of project	$23,430
Erosion and Sediment Control	1	LS	10% of project	$46,860
			Base Construction Cost	**$538,890**
			Mobilization (5%)	$26,945
			Subtotal 1	$565,835
			Contingency (25%)	$141,459
			Subtotal 2	$707,294
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$318,282
			Estimated Project Cost	**$1,026,000**

Figure 1: Over-widened channel with severe bank erosion and large depositional features

Figure 2: Over-widened channel with bank erosion and large depositional features

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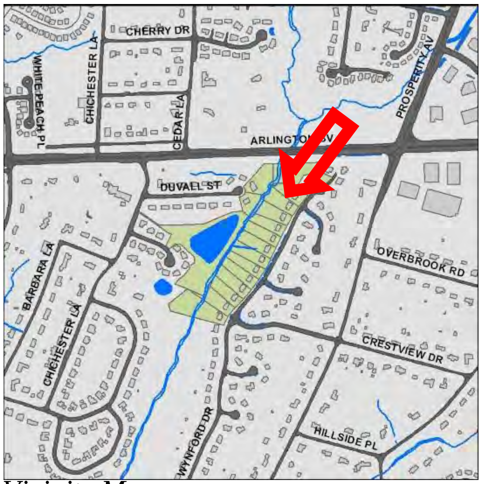
AC9235 - Stream Restoration

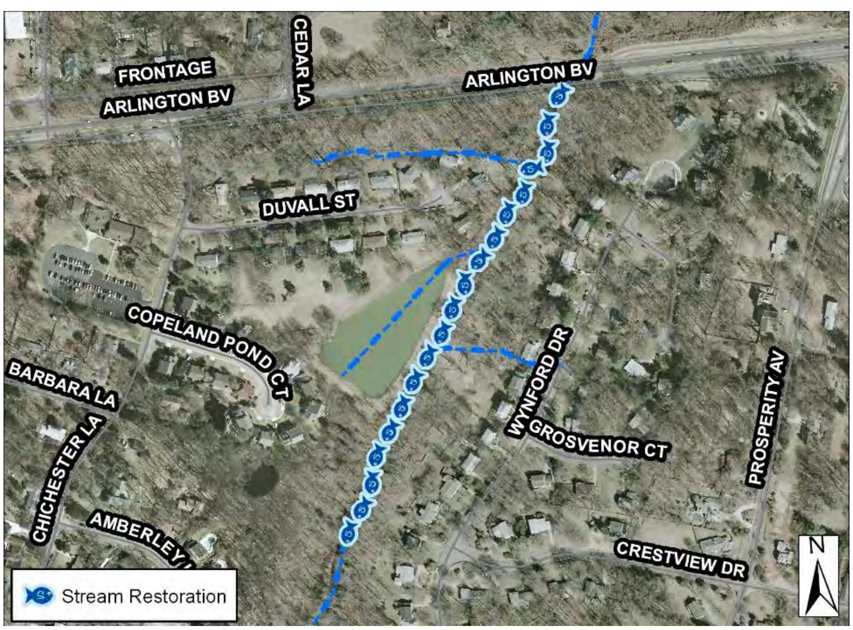


Vicinity Map

Address:	Behind 3100 block of Wynford Drive and behind 8700 block of Duvall St
Location:	Sutton Place, Copeland Pond
Land Owner:	Private - Residential
PIN:	0493 18 0062A, 0493 18 0063, 0493 18 0065, 66, 67, 68, 69, 70, 71, 72, 73, 74, 0493 25 A, 0493 07 0010, 0493 07 0009, 0493 31 A
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Long Branch

Description: This project proposes to restore an eroded and previously stabilized section of Long Branch. The proposed restoration starts downstream of the culvert under Arlington Boulevard to approximately the end of Copeland Pond Court. The upstream portion of this channel has been stabilized with large rip rap around a manhole and a utility. Downstream of this utility there is severe bank erosion and overwidening. The downstream portion parallels a large wet pond and contains gabion baskets within and along the banks as well as grade control structures to control the slope of the existing channel.

Restoration would include re-shaping the channel to provide more protection for the manhole, bank protection measures and channel adjustment, replacing outdated engineered features with natural channel design structures to prevent downstream scouring. Reconnecting this channel to the floodplain in the downstream portion of this restoration may also be possible. Coordination between Project AC9234, which is just downstream of this project, will be necessary during design and construction.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Long Branch and Accotink Creek by reducing bank scour and channel bed incision. By reducing sedimentation within the channel and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. Restoring and stabilizing this channel will also help to protect infrastructure located within the channel and on the floodplain. The riparian buffer will also be improved providing additional channel stability and ecological benefits. It is estimated that a total of 191,233 lbs of sediment, 153 lbs of total nitrogen and 59 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: This project is entirely contained within private residential properties and will require significant coordination with the property owners for access and construction. A portion of this reach parallels a wet pond embankment, where it may not be desirable to remove the existing stabilization measures or promote a riparian buffer. Access to this project could occur from Copeland Pond Court using the existing access to the stormwater pond located adjacent to the stream. Tree loss is expected with this restoration; however, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to the need for construction and modifications to a perennial stream channel and impacting forested area. Existing utility impacts are possible with this restoration as a sewer line parallels the stream. This project should be designed and constructed in conjunction with Project AC9234 to ensure proper channel elevations and alignment.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1607	LF	$200	$321,400
Clear and Grub	1.47	AC	$10,000	$14,700
Plantings	1.47	AC	$25,000	$36,750
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$472,850
Ancillary Items	1	LS	5% of project	$23,643
Erosion and Sediment Control	1	LS	10% of project	$47,285
			Base Construction Cost	**$543,778**
			Mobilization (5%)	$27,189
			Subtotal 1	$570,967
			Contingency (25%)	$142,742
			Subtotal 2	$713,709
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$321,169
			Estimated Project Cost	**$1,035,000**


Figure 1: Severe channel incision and erosion


Figure 2: Existing gabion baskets within the channel


Figure 3: Existing stabilized channel with gabion banks

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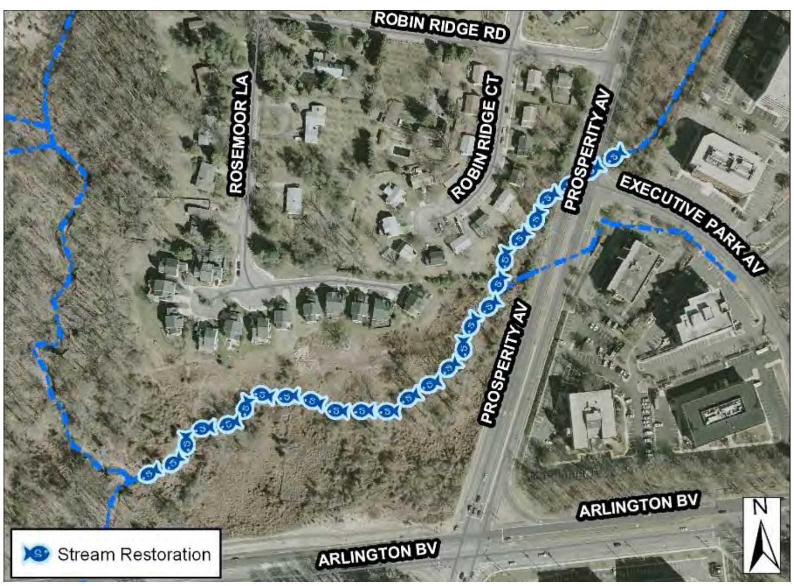
AC9236 - Stream Restoration

Vicinity Map

Address:	Behind 3000 block of Robin Ridge Court and Rosemoor Lane
Location:	Retreat at Sycamore Ridge
Land Owner:	Private - Residential
PIN:	0493 24 A, 0493 30 A
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Unknown Tributary of Long Branch

Description: This project starts at the downstream side of the culvert under Prosperity Avenue and extends downstream to the confluence with Long Branch. Upstream portions of the channel are concrete-lined. The channel downstream of Prosperity Avenue is deeply incised with scoured banks and several stands of invasive bamboo. Restoring this channel will include raising the bed elevation and reducing channel dimensions to reconnect the channel with the floodplain, installing grade control structures, re-grading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, and retrofitting all storm drain outlet structures along the restoration reach. Buffer restoration along re-graded areas and where extensive amounts of invasive vegetation are present will be necessary to promote future stability and to restore ecological function. The floodplain and project limits are all forested.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to decrease sediment loads to downstream portions of the watershed, especially Long Branch. This will be accomplished by creating a new channel geometry and stabilizing existing banks and eroded connections to the channel. Reconnecting the channel to the floodplain will also reduce downstream sediment loads by allowing suspended sediment to deposit on the floodplain. By reducing sedimentation within the channel and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. Restoring the existing riparian buffer will also provide additional channel stability and ecological benefits. It is estimated that a total of 208,510 lbs of sediment, 167 lbs of total nitrogen and 65 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: This project lies entirely within private property and will require significant coordination with property owners for access and construction. Access will need to occur from Prosperity Avenue and will require tree removal and manipulation of slopes. Confluences with other stream channels and storm drain outfalls with their associated conveyances should also be addressed during this restoration. Although tree loss is expected, restoration benefits and proposed buffer enhancements will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and forest impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	1568	LF	$200	$313,600
Clear and Grub	1.44	AC	$10,000	$14,400
Plantings	1.44	AC	$25,000	$36,000
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$464,000
Ancillary Items	1	LS	5% of project	$23,200
Erosion and Sediment Control	1	LS	10% of project	$46,400
			Base Construction Cost	**$533,600**
			Mobilization (5%)	$26,680
			Subtotal 1	$560,280
			Contingency (25%)	$140,070
			Subtotal 2	$700,350
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$315,158
			Estimated Project Cost	**$1,016,000**


Figure 1: Severly eroded banks with invasive bamboo


Figure 2: Severly eroded banks at a confluence

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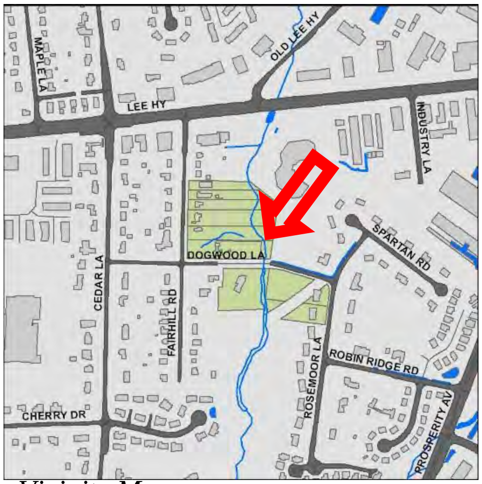
AC9237 - Stream Restoration



Vicinity Map

Address:	Behind 2900 block of Fairhill Road and Rosemoor Lane
Location:	Fairhill on the Boulevard
Land Owner:	Private - Residential
PIN:	0493 06 0023, 24, 25, 26, 28, 29A, 0493 01 0028A, 0493 16 0010
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Long Branch

Description: This project is designed to restore an eroded section of Long Branch that originates north of Cherry Drive and extends to approximately 400 feet south of culvert under Lee Highway. Currently the channel banks are eroding severely, with undercutting, large channel bars, channel bed incision and no access to the floodplain. The channel has also eroded around a sewer manhole. One pedestrian bridge is also present and efforts to protect the bridge abutments and trees within the bridge vicinity are failing.

Restoring this channel will include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, adjusting the channel to protect the sewer manhole, removing concrete and riprap from the pedestrian bridge area and replacing it with bioengineering techniques to preserve the trees. Additionally, grade controls will be installed to dissipate energy and some stone toe protection will be placed to ensure future bank stability. The current floodplain is forested on both sides of the existing channel.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Long Branch and Accotink Creek by reducing bank scour and stream bed incision. By reducing sedimentation within these channels and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. It is estimated that 169,271 lbs of sediment, 135 lbs of nitrogen and 53 lbs of phosphorus would be reduced annually by this project. Restoring and stabilizing this channel will help to protect infrastructure located within the channel and on the floodplain. Restoring the riparian buffer will also provide additional channel stability and ecological benefits.

Project Design Considerations: Since this project is contained within private residential properties, coordination with property owners will be necessary for access and construction. The pedestrian bridge as well as the exposed sanitary sewer may constrain restoration design and construction. Confluences with other stream channels and storm drain outfalls with their associated conveyances should also be addressed during the restoration. Access to this project will need to occur from Dogwood Lane or Cherry Drive which will require tree removal and manipulation of slopes. Although tree loss is expected, restoration benefits and proposed buffer enhancements will outweigh overall construction impacts. This project will also require environmental permitting to allow for construction and modifications to a perennial stream channel and impacts to forests.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	797	LF	$200	$159,400
Clear and Grub	0.73	AC	$10,000	$7,300
Plantings	0.73	AC	$25,000	$18,250
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$284,950
Ancillary Items	1	LS	5% of project	$14,248
Erosion and Sediment Control	1	LS	10% of project	$28,495
			Base Construction Cost	**$327,693**
			Mobilization (5%)	$16,385
			Subtotal 1	$344,078
			Contingency (25%)	$86,020
			Subtotal 2	$430,098
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$193,544
			Estimated Project Cost	**$624,000**

Figure 1: Existing incised and severly eroded channel causing trees to fall

Figure 2: Exposed sanitary sewer manhole along the eroded streambank

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AC9238 - Stream Restoration

Vicinity Map

Address:	Behind 8400 Block Berea Dr
Location:	Dunn Loring Woods, Prosperity Business Campus
Land Owner:	Private
PIN:	0493 05 0001, 0491 15 A1, 0491 19 H, 0491 18 A2, 0491 01 0008, 0491 09K 0069, 68, 67, 66, 65, 62, 61, 60, 52, 51, 50, 49, 48, 39, 38, 37, 36, 35, 32, 31, 30, 0491 09I A
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Long Branch

Description: This project is intended to restore an eroded section of Long Branch that originates north of Cottage Street and extends downstream to Lee Highway. There are several road crossings and many storm drain outfalls along the project length. Currently, this channel is over-widened and incised with scoured banks with many stands of invasive species of bamboo.

Restoring this channel will include raising the bed elevation to address an existing headcut, installing grade control structures, stabilizing eroded stream banks, and moving a utility pole currently in the stream channel. Stone toe protection will also need to be installed to ensure future bank stability. Buffer restoration along re-graded areas and where extensive amounts of invasive vegetation are present is recommended to promote additional stability and to restore ecological function. All tributary and stormdrain conveyances to the restoration reach should also be stabilized as necessary. Due to a constrained floodplain and infrastructure constraints, raising the bed elevation to reconnect it to the floodplain or regrading the floodplain to create a new bench is not desirable.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Long Branch and ultimately Accotink Creek by reducing bank scour and stream bed incision. By reducing sedimentation within these channels and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. It is estimated that a total of 587,423 lbs of sediment, 470 lbs of total nitrogen and 182 lbs of total phosphorus would be reduced annually by this project. Restoring and stabilizing this channel will help to protect storm drain, road crossing, and utility infrastructure located within the channel and floodplain. Restoring the existing riparian buffer along this reach will also provide future channel stability and ecological benefits.

Project Design Considerations: Since this project is contained within private residential and commercial properties, coordination with these property owners will be necessary for access and construction. Several road crossings and storm drain outfalls as well as underground utilities may constrain design and construction. Confluences with other stream channels and storm drain outfalls with their associated conveyances should also be addressed during restoration. Access to the project site will need to occur from either from Cottage Street, Hilltop Road or Lee Highway. Access from these points along the proposed restoration may require tree removal and manipulation of slopes. Although tree loss is expected, restoration benefits and proposed buffer enhancements will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and impacts to forests.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	4953	LF	$200	$990,600
Clear and Grub	4.55	AC	$10,000	$45,500
Plantings	4.55	AC	$25,000	$113,750
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$1,249,850
Ancillary Items	1	LS	5% of project	$62,493
Erosion and Sediment Control	1	LS	10% of project	$124,985
			Base Construction Cost	**$1,437,328**
			Mobilization (5%)	$71,866
			Subtotal 1	$1,509,194
			Contingency (25%)	$377,299
			Subtotal 2	$1,886,493
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$848,922
			Estimated Project Cost	**$2,736,000**

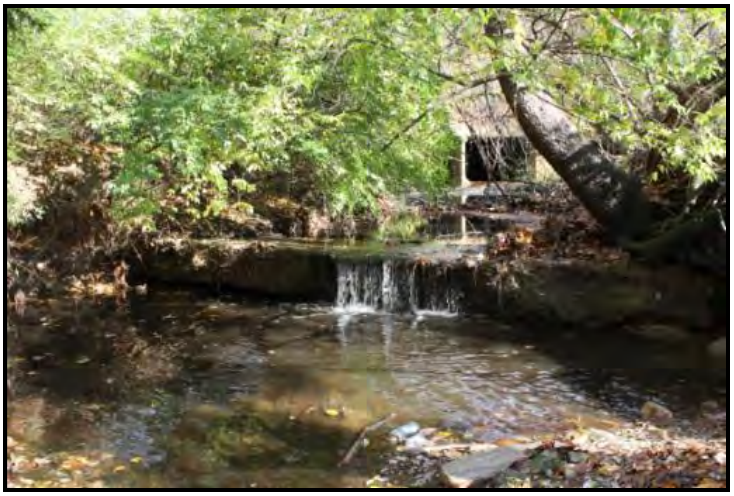
Figure 1: Severe headcut just downstream of the culvert under CottageStreet


Figure 2: Severe bank erosion and channel incision


Figure 3: Severe meander bend erosion with large depositional feature

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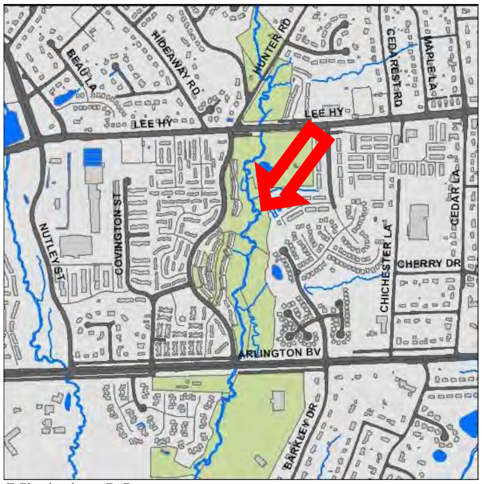
AC9239 - Stream Restoration



Vicinity Map

Address:	Various along Hunter Road and Ellenwood Dr
Location:	Covington / Villa Lee Park, Arrowhead Park
Land Owner:	Private / County - FCPA
PIN:	0484 01 0042A, 0484 18 D, 0484 01 0044, 0484 17 D, 0484 21 E, 0484 21 I, 0484 17 F, 0484 01 0054B, 0484 13 E, 0484 0340 E1, 0482 0744 D
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Bear Branch

Description: This project is intended to restore an eroded section of Bear Branch that originates north of Lee Highway and extends downstream to the end of Readsborough Court. There are several road crossings including Lee Highway and Arlington Boulevard as well as many storm drain outfalls within the project limits. Currently, this channel is experiencing severe bank and bed erosion. Two metal beams are located parallel to the stream north of Lee Highway that are starting to cause downcutting and scour pools in the downstream reach.

Restoring this channel would include stabilizing outfalls, regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, installing grade controls to dissipate energy, removing the metal beams, and reconnecting the stream to the floodplain by raising bed elevations and reducing channel dimensions. All tributary channel connections to this project should also be stabilized as necessary. The floodplain and project limits are all within forested conditions.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Accotink Creek by reducing bank scour and stream bed incision. By reducing sedimentation within these channels and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. It is estimated that a total of 735,368 lbs of sediment, 588 lbs of total nitrogen and 228 lbs of total phosphorus would be reduced annually by this project. Restoring and stabilizing this channel will help to protect storm drain, road crossing, and utility infrastructure located within the channel and floodplain. This project could provide an educational opportunity for residents using parkland for recreation.

Project Design Considerations: Since private residential and commercial properties adjoin the stream, coordination with these property owners will be necessary for access and construction. Several road crossings and storm drain outfalls as well as underground utilities may constrain design and construction. Confluences with other stream channels and storm drain outfalls with their associated conveyances should also be addressed during this restoration. Access to the upstream portion of this project could occur from Hunter Road and access to the downstream portion could occur from Arlington Boulevard. Access from either point along the proposed restoration will require tree removal and manipulation of steep slopes. Tree loss is expected; however, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	5916	LF	$200	$1,183,200
Clear and Grub	5.43	AC	$10,000	$54,300
Plantings	5.43	AC	$25,000	$135,750
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$1,473,250
Ancillary Items	1	LS	5% of project	$73,663
Erosion and Sediment Control	1	LS	10% of project	$147,325
			Base Construction Cost	**$1,694,238**
			Mobilization (5%)	$84,712
			Subtotal 1	$1,778,950
			Contingency (25%)	$444,738
			Subtotal 2	$2,223,688
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$1,000,660
			Estimated Project Cost	**$3,225,000**

Figure 1: Severe bank erosion, exposed roots, and deposition south of Lee Highway

Figure 2: Severe bank erosion and channel incision south of Lee Highway

Figure 3: Channel is over-widened with large depositional features south of Arlington Boulevard

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AC9240 - Stream Restoration

Vicinity Map

Address:	Yeonas Drive
Location:	South Side Park
Land Owner:	Town of Vienna
PIN:	0482 03 2585B, 0482 03 2567A, 0482 03 2350A, 0482 02 0013B, 0482 01 0003, 0482 31 0004, 0482 31 D
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Bear Branch

Description: This stream restoration project along Bear Branch is primarily within Town of Vienna park land. The upstream limit is located at Yeonas Drive and extends to I-66. Several road crossings including Yeonas Drive, Cottage Street, and I-66 as well as many storm drain outfalls exist within the project limits. Currently, this channel is experiencing severe bank and bed erosion. The condition of many of the road culverts are preventing fish passage. Additionally, there are stands of invasive bamboo along the stream channel.

Restoring this channel would include repairing broken outfalls, regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, installing grade controls to dissipate energy, and removing invasive species. Due to a fairly constrained floodplain and close proximity to private residential properties, raising the bed elevation to reconnect it to the floodplain or regrading the floodplain to create a new bench is not desirable. This project should be coordinated with Project AC9225, in which these channels flow together just upstream of the culvert under I-66 in South Side Park.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will decrease sediment supply to Accotink Creek by reducing bank scour and stream bed incision. By reducing sedimentation within these channels and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. It is estimated that a total of 481,365 lbs of sediment, 385 lbs of total nitrogen and 149 lbs of total phosphorus would be reduced annually by this project. Restoring and stabilizing this channel will help to protect storm drain, road crossing, and utility infrastructure located within the channel and floodplain. This project could also provide an educational opportunity for residents using parkland for recreation.

Project Design Considerations: Even though this project is mostly within park land, the existing channel and floodplain is surrounded by residential properties. Coordination with private owners will be necessary where the existing channel is within close proximity to these properties. Several road crossings and storm drain outfalls as well as underground utilities may constrain design and construction. Access to the upstream portion of this project could occur from Cottage Street or from Yeonas Drive and access to the downstream portion could occur from local parks. Access from any of these points along the proposed restoration will require significant tree removal and manipulation of steep slopes. Although tree loss is expected, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts. The project should be coordinated with Culvert Retrofit project AC9408, a 25-year project within the same stream reach.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	3980	LF	$200	$796,000
Clear and Grub	3.65	AC	$10,000	$36,500
Plantings	3.65	AC	$25,000	$91,250
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$1,023,750
Ancillary Items	1	LS	5% of project	$51,188
Erosion and Sediment Control	1	LS	10% of project	$102,375
			Base Construction Cost	**$1,177,313**
			Mobilization (5%)	$58,866
			Subtotal 1	$1,236,179
			Contingency (25%)	$309,045
			Subtotal 2	$1,545,224
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$695,351
			Estimated Project Cost	**$2,241,000**

Figure 1: Eroded and incised channel near Yeonas Drive

Figure 2: Eroded and undermined stormdrain outfall south of Yeonas Drive

Figure 3: Existing concrete utility casing within the channel near the culvert under I-66

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AC9241 - Stream Restoration

Vicinity Map

Address:	Various along Nutley Street, Mantua Park
Location:	Stonehurst / Eakin Community Park
Land Owner:	Private / County - FCPA
PIN:	0484 18 A, 0582 10 A, 0582 01 0012, 0484 01 0010, 0484 01 0049B, 0484 01 0012B, 0484 11 A1, 0484 01 0012C, 0484 11 B
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Hunters Branch

Description: This project is proposed to restore an eroded section of Hunter's Branch that originates at the confluence of Hunter's Branch with Accotink Creek and extends upstream to near the intersection of Bailey Lane and Stonehurst Drive. Most of the downstream portion of this project is within County park property; however, the upstream portion is privately-owned residential and commercial properties. Currently, this channel is experiencing severe bank and bed erosion. Several utility crossings within the stream channel are stabilized with large riprap, which is leading to downstream scour pools and erosion.

Restoring this channel would include removing riprap and creating more stable stream crossings, repairing scour pools, regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques, installing grade controls to dissipate energy, and removing invasive species. Restoration efforts should also focus on reconnecting this channel to the floodplain by reducing channel dimensions and raising bed elevations.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Restoring this channel will help to reduce sediment loads to Accotink Creek by reducing bed scour, bank scour, over-widening, and meander bend migration. Reconnecting the channel to the original floodplain will dissipate high flows that could cause erosion and can reduce downstream sediment loads by allowing suspended sediment to be deposited on the floodplain. This project will also improve instream habitat by limiting the amount of sedimentation due to bank and bed erosion and creating stable habitat within the newly constructed channel. It is estimated that a total of 369,145 lbs of sediment, 295 lbs of total nitrogen and 114 lbs of total phosphorus would be reduced annually by this project. Paved walking paths parallel this project and may be used for access during construction to limit forest impacts and to provide an educational opportunity for residents.

Project Design Considerations: Since private residential and commercial properties adjoin the stream, coordination with these property owners will be necessary for access and construction. Access to the upstream portion of this project could occur from Nutley Street or from adjoining condominium properties and access to the downstream portion could occur from existing paved walking paths that adjoin the stream channel. Access from any of these points along the proposed restoration will require significant tree removal. Although tree loss is expected, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts. Existing utility impacts are also possible as a sewer line parallels the stream and several utility crossings were noted within the existing channel.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	3722	LF	$200	$744,400
Clear and Grub	4.27	AC	$10,000	$42,700
Plantings	4.27	AC	$25,000	$106,750
Additional Cost, First 500 LF	500	LF	$200	**$100,000**
			Initial Project Cost	$993,850
Ancillary Items	1	LS	5% of project	$49,693
Erosion and Sediment Control	1	LS	10% of project	$99,385
			Base Construction Cost	**$1,142,928**
			Mobilization (5%)	$57,146
			Subtotal 1	$1,200,074
			Contingency (25%)	$300,019
			Subtotal 2	$1,500,093
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$675,042
			Estimated Project Cost	**$2,176,000**


Figure 1: Severe bed and bank erosion just downstream of a utility covered by riprap near the confluence with Accotink Creek


Figure 2: Large debris and severely eroded banks south of Arlington Boulevard

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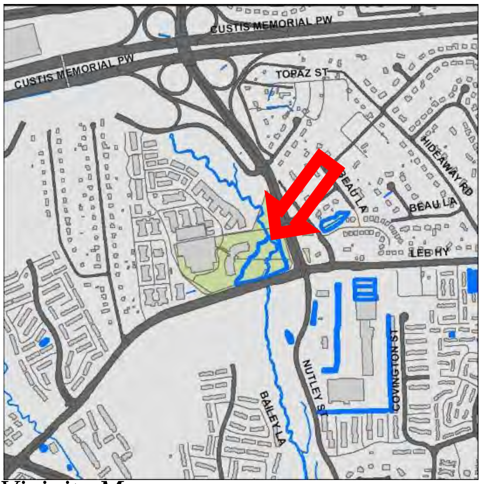
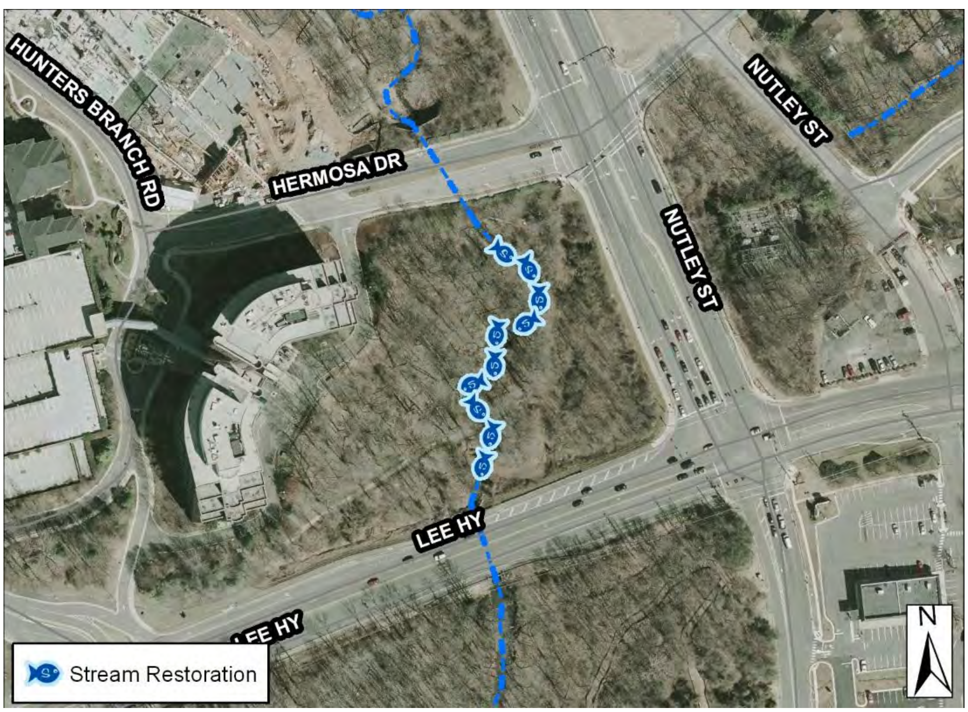
AC9242 - Stream Restoration



Vicinity Map

Address:	9302 Lee Highway
Location:	Lee Hwy and Nutley St
Land Owner:	Private
PIN:	0484 01 0001G, 0484 01 0001E
Control Type	Water Quality
Drainage Area	N/A
Receiving Waters	Hunters Branch

Description: This project is designed to restore an eroded section of Hunter's Branch immediately upstream and downstream of a pedestrian bridge between Hermosa Drive and Lee Highway. The streambank in this location is eroding around the bridge, leading to severe scour at the edges of the bridge and possible future bridge failure. Restoring this channel would include regrading and stabilizing eroded stream banks with armor-in-place and bioengineering techniques and repairing the existing pedestrian bridge.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing this project will stabilize the streambank and improve pedestrian safety as local residents use this bridge and its associated walking paths. This project will address bank instability and scour and overwidening, which all produce excessive sediment loads to downstream channels. Reduced sediment loads and new channel creation with stable habitat along restored banks will all help to improve instream water quality and aquatic habitat. It is estimated that a total of 41,752 lbs of sediment, 33 lbs of total nitrogen and 13 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: Since private residential and commercial properties adjoin the stream, coordination with these property owners will be necessary for access and construction. Access to this project could occur from Nutley Street or from adjoining condominium properties. Access from any of these points along the proposed restoration will require significant tree removal and manipulation of steep slopes. Although tree loss is expected, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts. Existing utility impacts are possible with this restoration as a sewer line parallels the stream.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Construct New Channel	409	LF	$200	$81,800
Clear and Grub	0.40	AC	$10,000	$4,000
Plantings	0.40	AC	$25,000	$10,000
Additional Cost, First 500 LF	409	LF	$200	**$81,800**
			Initial Project Cost	$177,600
Ancillary Items	1	LS	5% of project	$8,880
Erosion and Sediment Control	1	LS	10% of project	$17,760
			Base Construction Cost	**$204,240**
			Mobilization (5%)	$10,212
			Subtotal 1	$214,452
			Contingency (25%)	$53,613
			Subtotal 2	$268,065
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$120,629
			Estimated Project Cost	**$389,000**


Figure 1: Eroded banks and scour at a footbridge near Lee Highway

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AC9300 – Area-Wide Drainage Improvement

Address:	Various
Location:	Pohick Estates
Land Owner:	Private-Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	74 acres
Receiving Waters	Unknown Tributary of Accotink Creek

Description: AC-AC-0080 is a medium density residential area with no stormwater management. The water quality downstream of this subwatershed is impaired with opportunities for retrofits. This area-wide improvement would instead treat the runoff at the inlets, before it enters the conveyance system. This project involves the installation of tree box filters at curb inlets and rain gardens at yard inlets.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration, uptake by vegetation, and infiltration. The amount of nutrients, suspended solids, and other harmful pollutants will be reduced, thus improving in-stream habitat. It is estimated that 5,034 lbs of sediment, 14 lbs of nitrogen and eight lbs of phosphorus would be reduced each year by this project. There may also be some improvement in the peak flow attenuation due to increased infiltration.

Project Design Considerations: Environmental constraints, if any, will be small as the disturbance will only be in the immediate vicinity of the project. Rain gardens would require utility research to ensure there are no conflicts. Some modification of the storm drain system may be required. Projects located on private property need to be coordinated with and approved by the property owner.

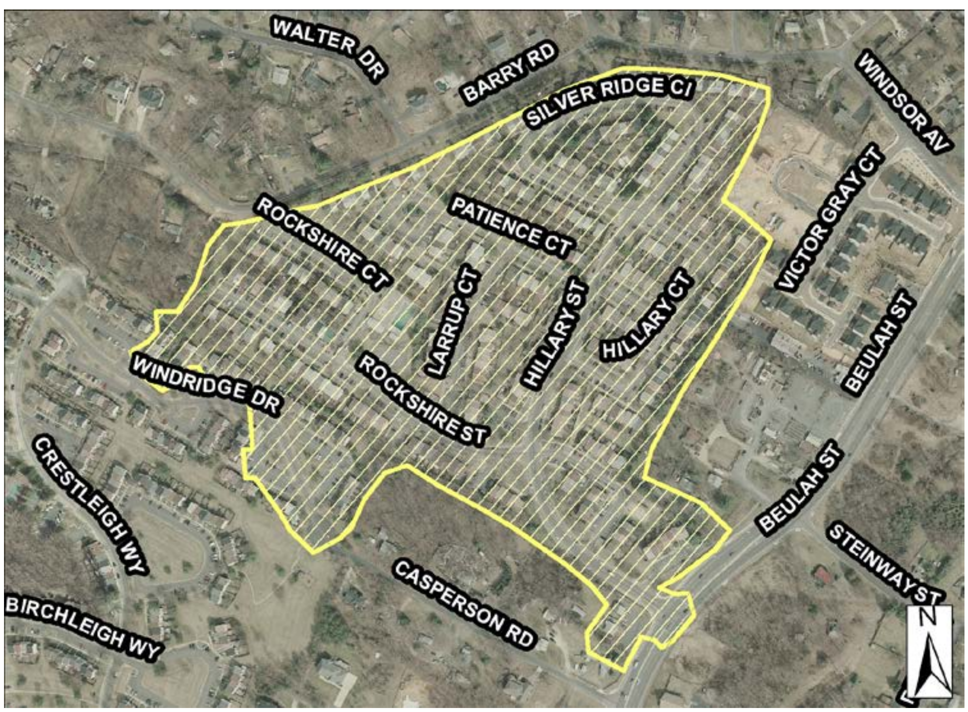
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	32	EA	$10,000.00	$320,000
Rain Garden	595	SY	$50.00	$29,750
			Initial Project Cost	**$349,750**
Plantings	1	LS	5% of project	$17,488
Ancillary Items	1	LS	5% of project	$17,488
Erosion and Sediment Control	1	LS	10% of project	$34,975
			Base Construction Cost	**$419,701**
			Mobilization (5%)	$20,985
			Subtotal 1	$440,686
			Contingency (25%)	$110,172
			Subtotal 2	$550,858
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$247,886
			Estimated Project Cost	**$799,000**

AC9301 – Area-Wide Drainage Improvement

Address:	Various
Location:	Windsor Park
Land Owner:	Private–Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	46 acres
Receiving Waters	Unknown Tributary of Long Branch

Description: AC-LA-0055 is a high density residential area which was developed without stormwater management. The water quality downstream of this subwatershed is impaired with few opportunities for treatment. This area-wide improvement would treat the runoff before it enters the conveyance system, with installation of tree box filters and rain gardens at storm drain inlets.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration, infiltration, and uptake from vegetation. It is estimated that 7,578 lbs of sediment, 89 lbs of nitrogen and 18 lbs of phosphorus would be reduced each year by this project. There will also be some improvement in the peak flow attenuation due to attenuation through filter media and increased infiltration.

Project Design Considerations: Environmental constraints will be minimal as the disturbance will only be in the immediate vicinity of the project. Installation of rain gardens will require utility research to ensure there are no conflicts. Some modification of the storm drain system may be required. Projects located on private property need to be coordinated with and approved by the property owner.

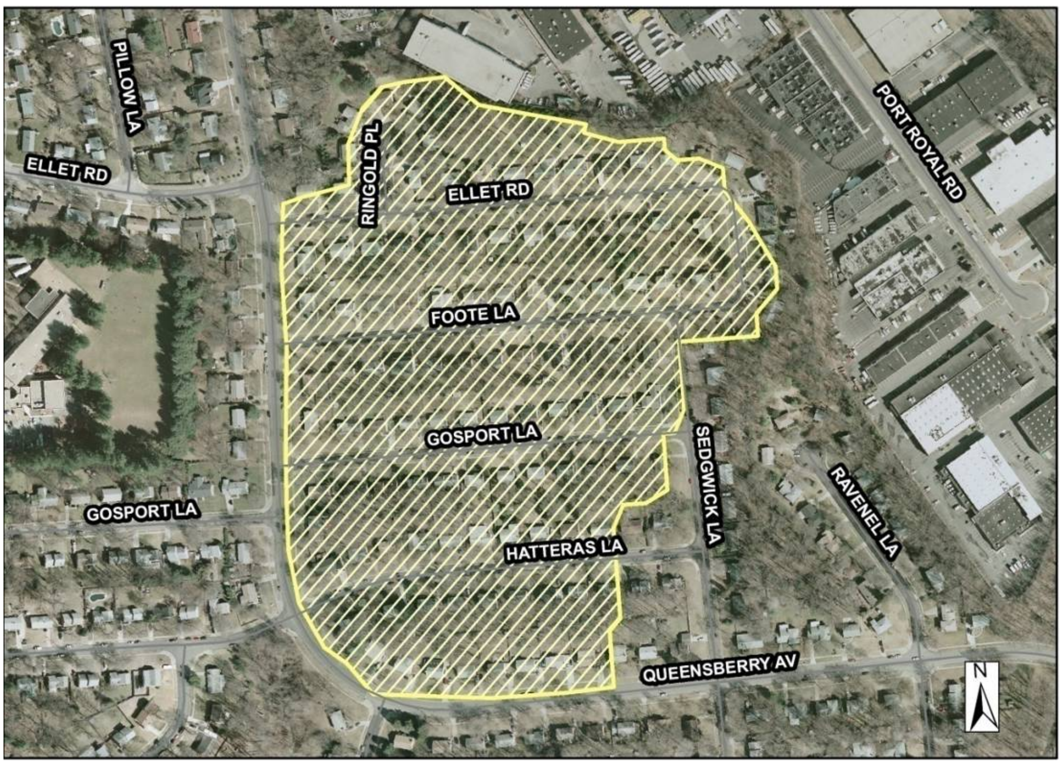
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	42	EA	$10,000.00	$420,000
Rain Garden	702	SY	$50.00	$35,100
			Initial Project Cost	**$455,100**
Plantings	1	LS	5% of project	$22,755
Ancillary Items	1	LS	5% of project	$22,755
Erosion and Sediment Control	1	LS	10% of project	$45,510
			Base Construction Cost	**$546,120**
			Mobilization (5%)	$27,306
			Subtotal 1	$573,426
			Contingency (25%)	$143,357
			Subtotal 2	$716,783
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$322,552
			Estimated Project Cost	**$1,040,000**

AC9302 Area-Wide Drainage Improvement

Address:	Various
Location:	Ravensworth
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	35 acres
Receiving Waters	Unknown tributary of Lake Accotink

Description: This subwatershed, AC-AC-0240, consists of medium density residential land use with no existing stormwater management facilities. This area-wide project is intended to treat runoff in the stormwater conveyance system before it reaches the streams. This project will include installation of tree box filters at curb inlets throughout the neighborhood.



Project Area Map

Project Benefits: This project will provide water quality treatment for stormwater runoff through the removal of pollutants and increased infiltration. This will improve instream water quality and instream habitat. It is estimated that project implementation will reduce annual pollutant loads by approximately 2,976 lbs of sediment, 39 lbs of total nitrogen and seven lbs of total phosphorus.

Project Design Considerations: No other projects are recommended in this subwatershed. No environmental constraints are anticipated since the disturbance would be limited to the area imediately around the projects. Projects located on private property need to be coordinated with the property owner.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	32	EA	$10,000.00	$320,000
			Initial Project Cost	**$320,000**
Plantings	1	LS	5% of project	$16,000
Ancillary Items	1	LS	5% of project	$16,000
Erosion and Sediment Control	1	LS	10% of project	$32,000
			Base Construction Cost	**$384,000**
			Mobilization (5%)	$19,200
			Subtotal 1	$403,200
			Contingency (25%)	$100,800
			Subtotal 2	$504,000
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$226,800
			Estimated Project Cost	**$731,000**

AC9303 – Area-Wide Drainage Improvement

Address:	Various
Location:	Kings Park
Land Owner:	Private–Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	114 acres
Receiving Waters	Unknown Tributary of Accotink Creek

Description: Most of land use in this subwatershed is medium density residential, developed without stormwater management. The water quality downstream of this subwatershed is impaired. This area-wide improvement would treat the runoff before it enters the storm drain system, by installing tree box filters at curb inlets and rain gardens at yard inlets.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration, infiltration and uptake by vegetation. Nutrients, suspended solids, and other pollutants will be reduced, thus improving in-stream habitat. It is estimated that project implementation will reduce annual pollutant loads by approximately 8,679 lbs of sediment, 116 lbs of nitrogen and 21 lbs of phosphorus**.** There will also be some improvement in the peak flow attenuation due to the disconnection of impervious surfaces and increased infiltration.

Project Design Considerations: If there are any environmental constraints, they will be limited as the disturbance will only be in the immediate vicinity of the project. Rain gardens would require utility research to ensure there are no conflicts. Some modification of the storm drain system may be required. Projects located on private property need to be coordinated with and approved by the property owner.

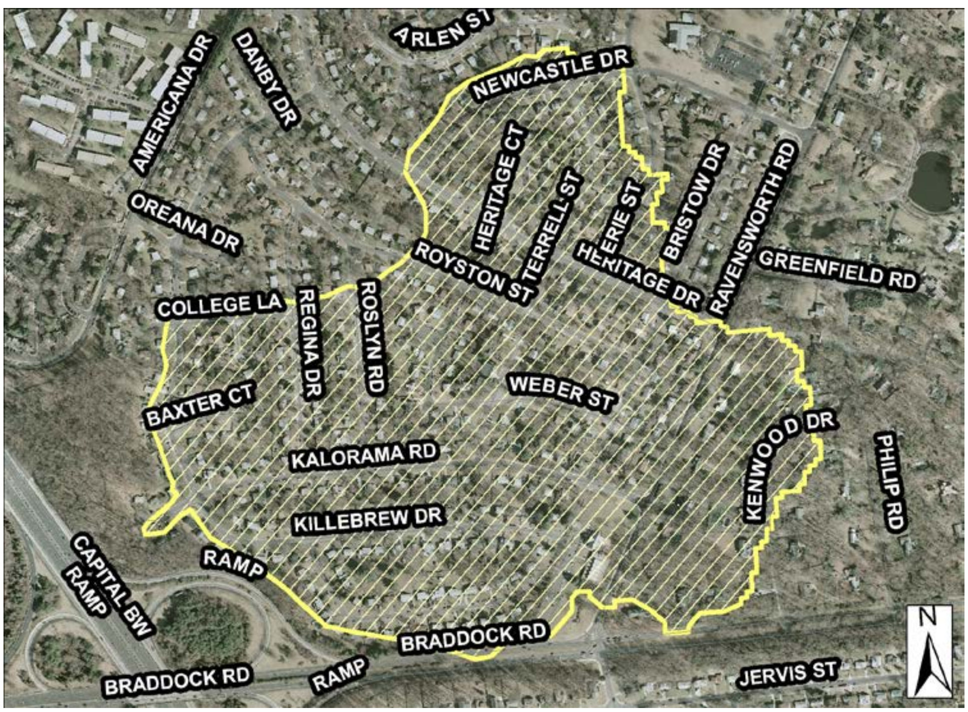
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	59	EA	$10,000.00	$590,000
Rain Garden	1117	SY	$50.00	$55,850
			Initial Project Cost	**$645,850**
Plantings	1	LS	5% of project	$32,293
Ancillary Items	1	LS	5% of project	$32,293
Erosion and Sediment Control	1	LS	10% of project	$64,585
			Base Construction Cost	**$775,021**
			Mobilization (5%)	$38,751
			Subtotal 1	$813,772
			Contingency (25%)	$203,443
			Subtotal 2	$1,017,215
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$457,747
			Estimated Project Cost	**$1,475,000**

AC9304 – Area-Wide Drainage Improvement

Address:	Various
Location:	Ravensworth Park, Bristow,
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	139 acres
Receiving Waters	Unknown Tributary of Accotink Creek

Description: This low and medium density residential area has no stormwater management. This project will cover about half of the subwatershed northeast of the intersection of I-66 and I-495. The water quality downstream of this subwatershed is impaired. This area-wide improvement would treat the runoff at the source, before it enters the conveyance system in three ways: installation of tree box filters at curb inlets, rain gardens at yard inlets, and retrofit of paved ditches as vegetated swales.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration, infiltration, and uptake by vegetation in all three types of improvements. The amount of nutrients and suspended solids will be reduced within the stream, thus improving in-stream habitat. . It is estimated that project implementation will reduce annual pollutant loads by approximately 10,571 lbs of sediment, 137 lbs of nitrogen and 26 lbs of phosphorus. There will also be some peak flow reduction due to increased infiltration and attenuation.

Project Design Considerations: Environmental constraints will be minimal as the disturbance will only be in the immediate vicinity of the project. Utility research may be required to ensure there are no conflicts. Any project located outside of the right-of-way and on private property will need to be coordinated with and approved by the property owner.

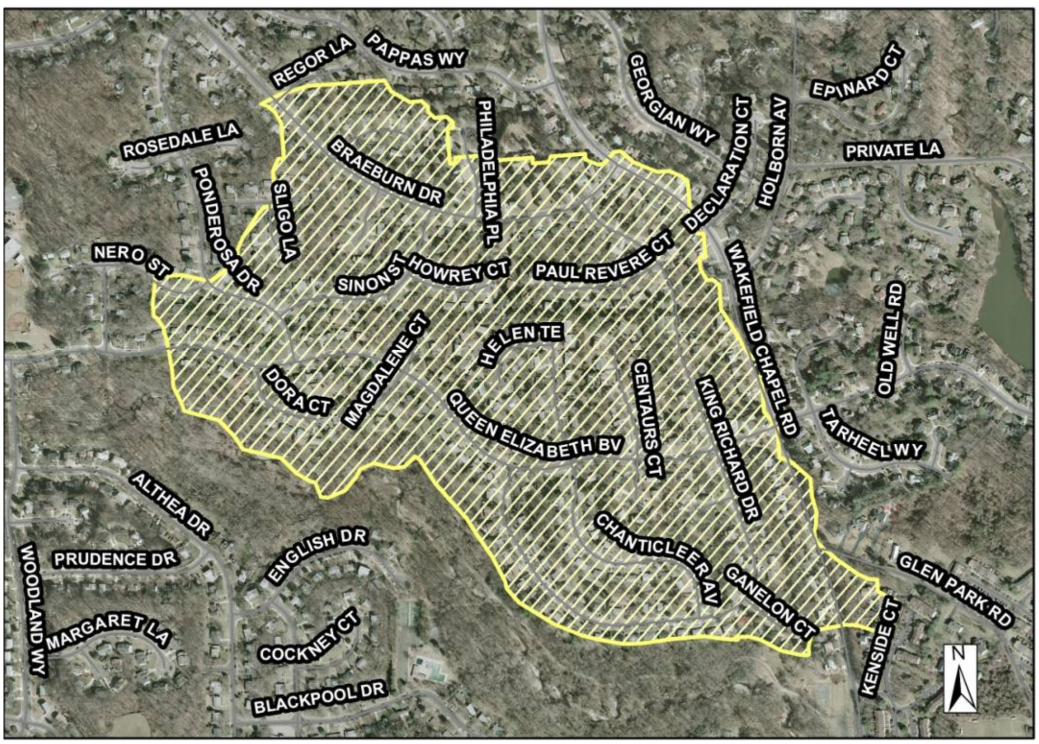
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	67	EA	$10,000.00	$670,000
Vegetated Swale	144	SY	$50.00	$7,200
Rain Garden	1177	SY	$50.00	$58,850
			Initial Project Cost	**$736,050**
Plantings	1	LS	5% of project	$36,803
Ancillary Items	1	LS	5% of project	$36,803
Erosion and Sediment Control	1	LS	10% of project	$73,605
			Base Construction Cost	**$883,261**
			Mobilization (5%)	$44,163
			Subtotal 1	$927,424
			Contingency (25%)	$231,856
			Subtotal 2	$1,159,280
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$521,676
			Estimated Project Cost	**$1,681,000**

AC9305 Area-Wide Drainage Improvement

Address:	Various
Location:	Canterbury Woods
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	138 acres
Receiving Waters	Unknown tributary of Long Branch

Description: The majority of the subwatershed has been developed with medium density residential land use, without stormwater management facilities. The water quality downstream of this subwatershed is impaired with few opportunities for retrofits. This area-wide improvement would treat the stormwater runoff before it enters the conveyance system through installation of tree box filters at curb inlets and rain gardens around yard inlets.



Project Area Map

Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration, infiltration, and uptake by vegetation. The amount of nutrients, suspended solids, and other harmful pollutants will be reduced before reaching stream, thus improving instream habitat. It is estimated that project implementation will reduce annual pollutant loads by approximately 10,368 lbs of sediment, 137 lbs of nitrogen and 25 lbs of phosphorus. There will also be a slight improvement in the peak flow attenuation due to increased infiltration.

Project Design Considerations: Environmental constraints will be minimal as the disturbance will only be in the immediate vicinity of the existing storm drain system. Rain gardens may require utility research to ensure there are no conflicts. Some modification of the storm drainage system may be required. Projects located on private property need to be coordinated with the property owner. Easements would be required for rain gardens on private property.

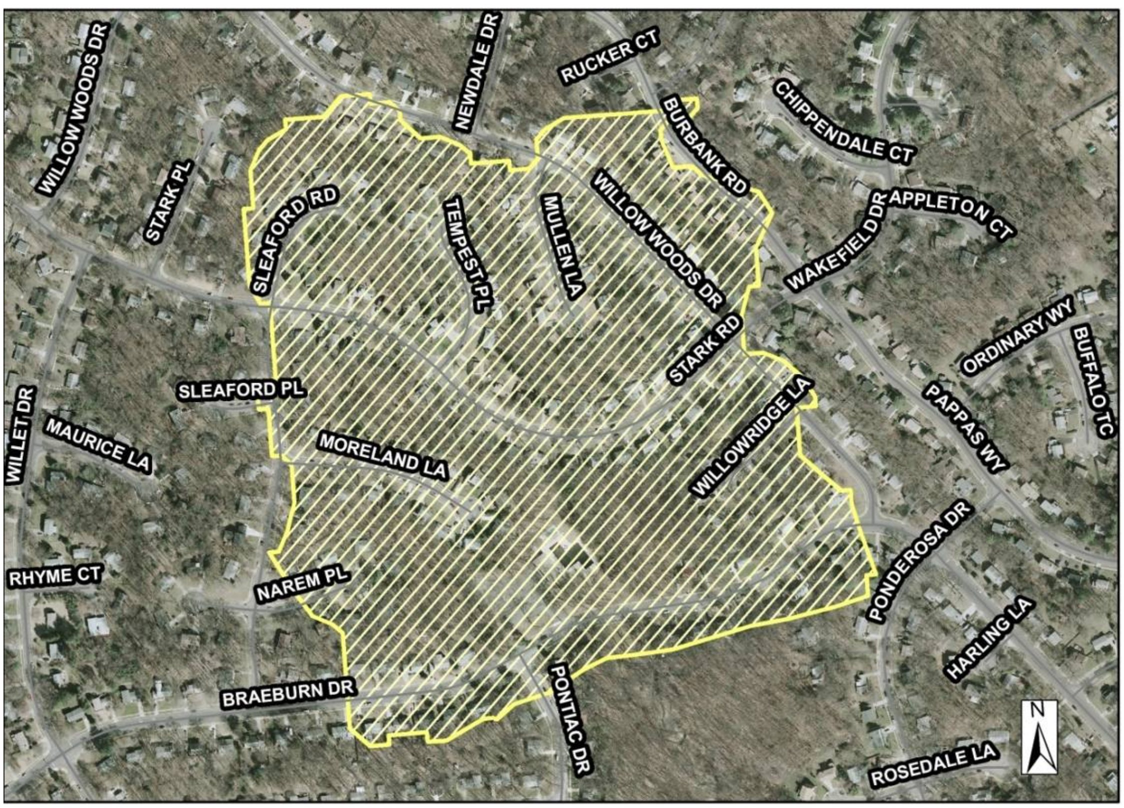
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	65	EA	$10,000.00	$650,000
Rain Garden	1415	SY	$50.00	$70,750
			Initial Project Cost	**$720,750**
Plantings	1	LS	5% of project	$36,038
Ancillary Items	1	LS	5% of project	$36,038
Erosion and Sediment Control	1	LS	10% of project	$72,075
			Base Construction Cost	**$864,901**
			Mobilization (5%)	$43,245
			Subtotal 1	$908,146
			Contingency (25%)	$227,037
			Subtotal 2	$1,135,183
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$510,832
			Estimated Project Cost	**$1,647,000**

AC9306 Area-Wide Drainage Improvement

Address:	Various
Location:	Willow Woods
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	64 acres
Receiving Waters	Unknown tributary of Long Branch Creek

Description: In this medium density residential neighborhood, there are no stormwater management facilities to treat runoff. Water quality downstream of the area is impaired. This project will treat stormwater before it enters the conveyance system. Rain gardens will be placed around yard inlets and tree box filters will be placed at curb inlets throughout the neighborhood.



Project Area Map

Project Benefits: This project will provide water quality treatment of stormwater runoff through infiltration, filtration, and uptake by vegetation. The amount of nutrients, suspended solids, and other harmful pollutants will be reduced before reaching stream, thus improving instream habitat. It is estimated that project implementation will reduce annual pollutant loads by approximately 4,775 lbs of sediment, 64 lbs of nitrogen and 12 lbs of phosphorus. There may also be some improvements in peak flow attenuation due to increased infiltration throughout the subwatershed.

Project Design Considerations: Environmental constraints, if any, are expected to be minor as the disturbance will only be in the immediate vicinity of the existing storm drains. Some sites may require utility research to ensure there are no conflicts or modification of the storm drain system. Projects located on private property need to be coordinated with property owners.

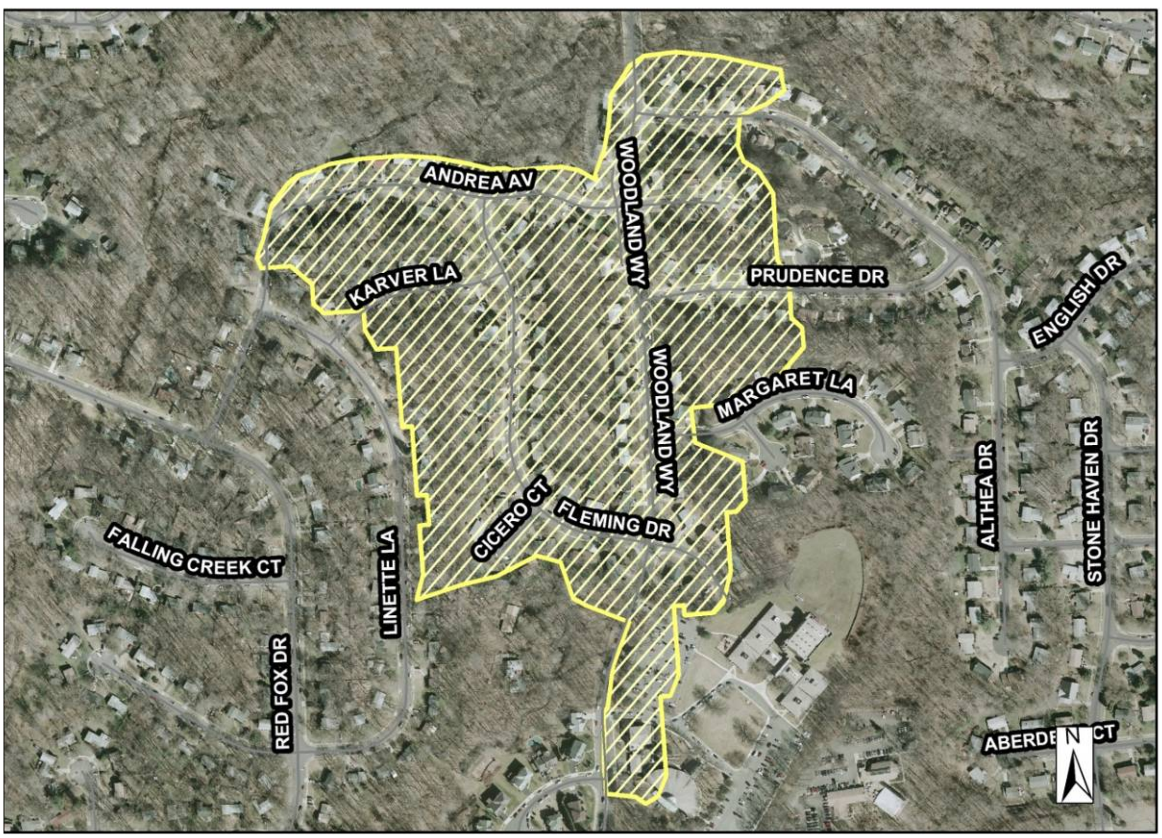
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	30	EA	$10,000.00	$300,000
Rain Garden	626	SY	$50.00	$31,300
			Initial Project Cost	**$331,300**
Plantings	1	LS	5% of project	$16,565
Ancillary Items	1	LS	5% of project	$16,565
Erosion and Sediment Control	1	LS	10% of project	$33,130
			Base Construction Cost	**$397,560**
			Mobilization (5%)	$19,878
			Subtotal 1	$417,438
			Contingency (25%)	$104,360
			Subtotal 2	$521,798
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$234,809
			Estimated Project Cost	**$757,000**

AC9307 Area-Wide Drainage Improvement

Address:	Various
Location:	Woodland Forest
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	41 acres
Receiving Waters	Unknown tributary of Long Branch Creek

Description: This area is a medium density residential neighborhood downstream of instream detention pond 1022DP. This project is located in a headwater subwatershed and would improve the water quality of stormwater runoff before it enters the Long Branch Central tributary. Water quality improvements would consist of tree box filters placed at curb inlets and rain gardens installed adjacent to yard inlets.



Project Area Map

Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration, infiltration, and uptake by vegetation. It is estimated that project implementation will reduce annual pollutant loads by approximately 3,374 lbs of sediment, 44 lbs of nitrogen and eight lbs of phosphorus. There may also be some improvement in peak flow attenuation due to increased infiltration.

Project Design Considerations: There are no environmental constraints as the disturbance will be limited to the area immediately around the existing storm drains. Projects located on private property need to be coordinated with the property owner. For rain gardens located on private property, an easement will be required for installation and maintenance.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	20	EA	$10,000.00	$200,000
Vegetated Swale	157	SY	$50.00	$7,850
Rain Garden	465	SY	$50.00	$23,250
			Initial Project Cost	**$231,100**
Plantings	1	LS	5% of project	$11,555
Ancillary Items	1	LS	5% of project	$11,555
Erosion and Sediment Control	1	LS	10% of project	$23,110
			Base Construction Cost	**$277,320**
			Mobilization (5%)	$13,866
			Subtotal 1	$291,186
			Contingency (25%)	$72,797
			Subtotal 2	$363,983
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$163,792
			Estimated Project Cost	**$528,000**

AC9308 Area-Wide Drainage Improvement

Address:	Various
Location:	Canterbury Woods, Long Branch
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	30 acres
Receiving Waters	Unknown tributary of Long Branch Creek

Description: The subwatershed encompassing the project area is medium density residential area with no stormwater management facilities. The water quality downstream of this subwatershed is impaired. This area-wide improvement would treat runoff at the source, before it enters the stream. This project involves the installation of tree box filters at curb inlets and rain gardens adjacent to yard inlets.

Project Area Map

Project Benefits: This project will provide water quality treatment of stormwater runoff through various methods of treatment. The amount of nutrients, suspended solids, and other harmful pollutants will be reduced before reaching stream, thus improving instream habitat. Project implementation is expected to reduce annual pollutant loads by approximately 3,440 lbs of sediment, 32 lbs of nitrogen and six lbs of phosphorus. There will also be a slight improvement in the peak flow attenuation due to the disconnection of rooftops and increased infiltration.

Project Design Considerations: Environmental constraints will be minor as the disturbance will only be in the immediate vicinity of the existing storm drain system. Rain gardens may require utility research to ensure there are no conflicts. Some modification of the storm drainage system may be required. Projects located on private property need to be coordinated with the property owner.

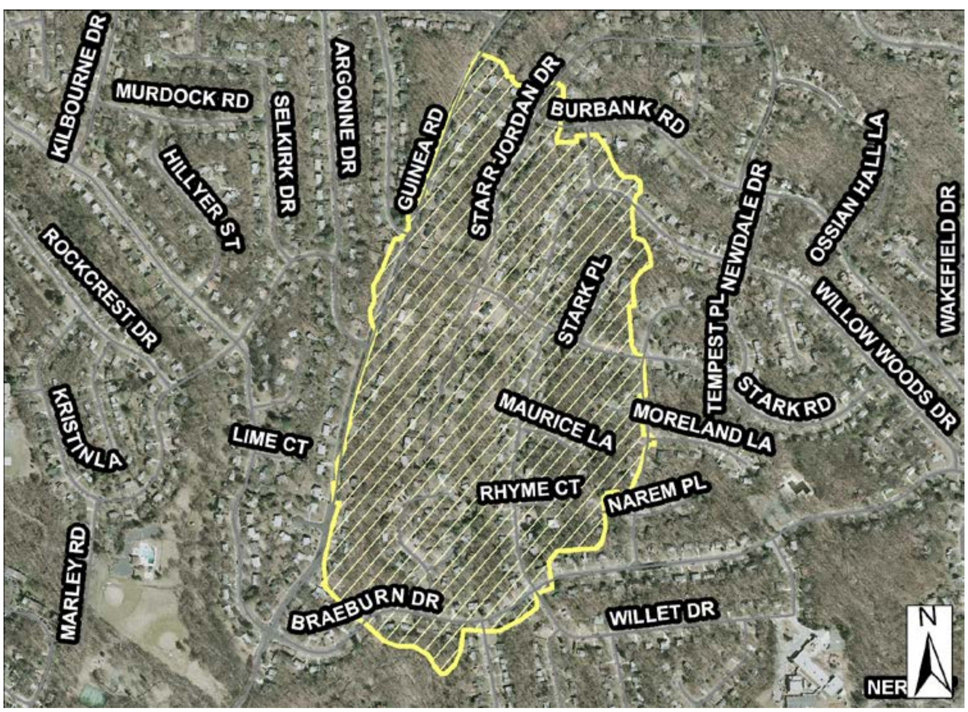
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	14	EA	$10,000.00	$140,000
Rain Garden	329	SY	$50.00	$16,450
			Initial Project Cost	**$156,450**
Plantings	1	LS	5% of project	$7,823
Ancillary Items	1	LS	5% of project	$7,823
Erosion and Sediment Control	1	LS	10% of project	$15,645
			Base Construction Cost	**$187,741**
			Mobilization (5%)	$9,387
			Subtotal 1	$197,128
			Contingency (25%)	$49,282
			Subtotal 2	$246,410
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$110,885
			Estimated Project Cost	**$358,000**

AC9309 – Area-Wide Drainage Improvement

Address:	Various
Location:	Springbook Forest, Willow Woods andWoods of Ilda
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	110 acres
Receiving Waters	Unknown Tributary of Long Branch

Description: This low and medium density residential area was developed without stormwater management. The stream assessment showed impaired conditions downstream of this subwatershed. This area-wide project would treat the runoff before it enters the storm drain system. It would the installation of tree box filters at curb inlets and rain gardens at yard inlets.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment of stormwater runoff through various filtration, infiltration, and uptake by vegetation associated with the tree box filters and rain gardens. It is estimated that project implementation will reduce annual pollutant loads by 7,859 lbs of sediment, 106 lbs of nitrogen and 20 lbs of phosphorus, which would help improve in-stream habitat. There may also be some peak flow reduction due to the disconnection of impervious surfaces and increased infiltration.

Project Design Considerations: Environmental constraints will be minimized as the disturbance will only be in the immediate vicinity of the project. Rain gardens may require utility research to ensure there are no conflicts. Some modification of the storm drain system would be required. Any project located outside of the right-of-way and on private property needs to be coordinated with and approved by the property owner.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	45	EA	$10,000.00	$450,000
Rain Garden	778	SY	$50.00	$38,900
			Initial Project Cost	**$488,900**
Plantings	1	LS	5% of project	$24,445
Ancillary Items	1	LS	5% of project	$24,445
Erosion and Sediment Control	1	LS	10% of project	$48,890
			Base Construction Cost	**$586,680**
			Mobilization (5%)	$29,334
			Subtotal 1	$616,014
			Contingency (25%)	$154,004
			Subtotal 2	$770,018
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$346,508
			Estimated Project Cost	**$1,117,000**

AC9310 – Area-Wide Drainage Improvement

Address:	Various
Location:	Springbook Forest, Rutherford
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	186 acres
Receiving Waters	Unknown Tributary of Long Branch

Description: The entire subwatershed of which this area is a part, was developed in medium density land use with no existing stormwater management facilities. The project is distributed throughout most of the subwatershed and involves treating runoff before it reaches the storm drain system by installing tree box filters at curb inlets and rain gardens adjacent to yard inlets.

Project Area Map: Conceptual plan showing potential project location

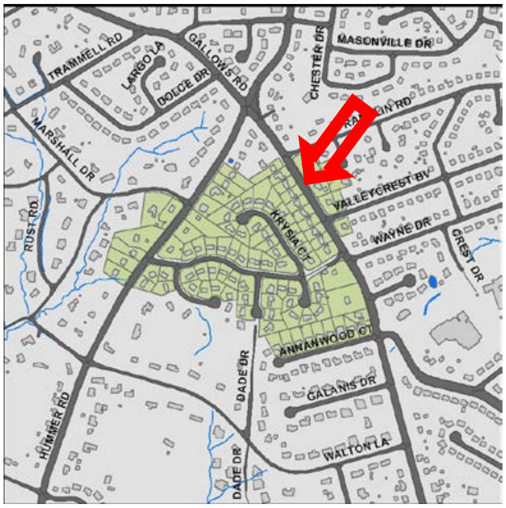
Project Benefits: This project will provide water quality treatment for stormwater runoff through the removal of pollutants and increased infiltration. Project implementation is estimated to reduce annual pollutant loads by approximately 13,774 lbs of sediment, 182 lbs of nitrogen and 34 lbs of phosphorus. This is expected to help improve instream water quality and instream habitat.

Project Design Considerations: No environmental constraints are anticipated as the disturbance would be limited to the area immediately around the projects. Projects located on private property will need to be coordinated with property owners.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	74	EA	$10,000.00	$740,000
Rain Garden	1705	SY	$50.00	$85,250
			Initial Project Cost	**$825,250**
Plantings	1	LS	5% of project	$41,263
Ancillary Items	1	LS	5% of project	$41,263
Erosion and Sediment Control	1	LS	10% of project	$82,525
			Base Construction Cost	**$990,301**
			Mobilization (5%)	$49,515
			Subtotal 1	$1,039,816
			Contingency (25%)	$259,954
			Subtotal 2	$1,299,770
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$584,897
			Estimated Project Cost	**$1,885,000**

AC9311 – Area-Wide Drainage Improvement



Address:	Various
Location:	Ramblewood
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	33 acres
Receiving Waters	Unknown Tributary of Coon Branch

Description: This project is located in a medium density residential area with no stormwater management. Earlier stream assessments showed that the water quality downstream of this subwatershed is impaired. This area-wide improvement would treat the runoff at the source, before it enters the stream. This project involves the installation of tree box filters and rain gardens at storm drain inlets.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration, infiltration, and uptake by vegetation. Nutrients and suspended solids will be reduced within the stream, which will help to improve instream habitat. It is estimated that project implementation will reduce annual pollutant loads by approximately 2,369 lbs of sediment, 33 lbs of nitrogen and six lbs of phosphorus. There will also be some improvement in the peak flow attenuation due increased infiltration.

Project Design Considerations: Environmental constraints, if any, will be limited as the disturbance will only be in the immediate vicinity of the projects. Rain gardens may require utility research to ensure there are no conflicts. Some modification of the storm drain system may be required. Projects located on private property need to be coordinated with and approved by the property owner.

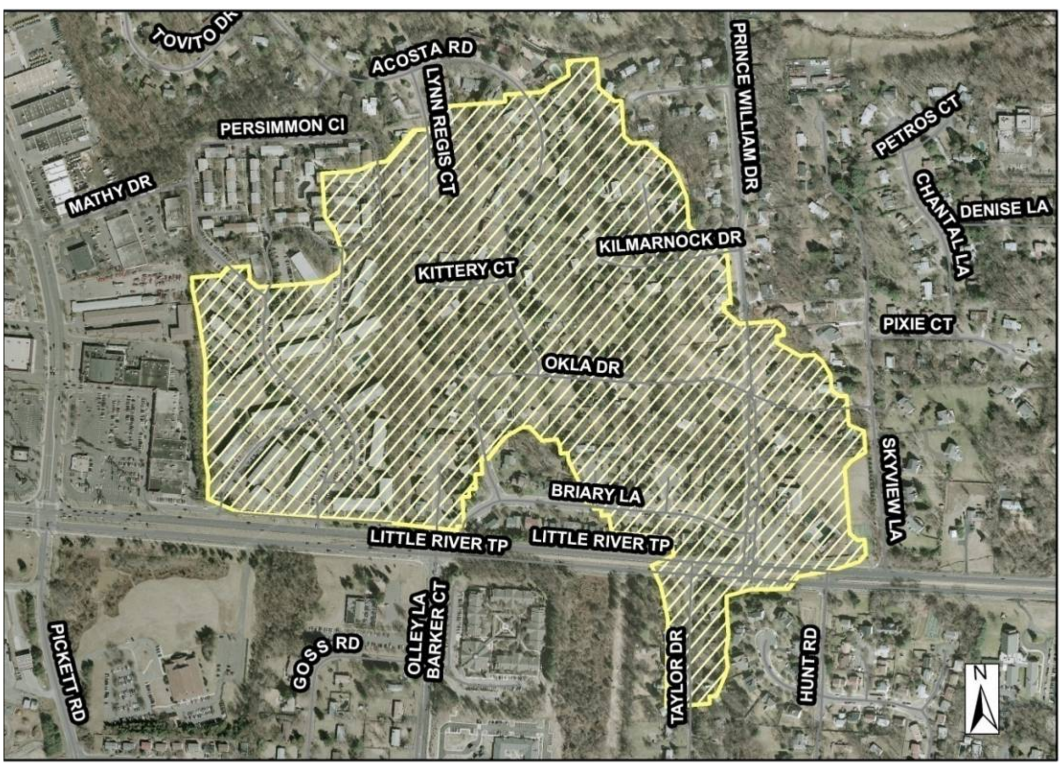
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	17	EA	$10,000.00	$170,000
Rain Garden	295	SY	$50.00	$14,750
			Initial Project Cost	**$184,750**
Plantings	1	LS	5% of project	$9,238
Ancillary Items	1	LS	5% of project	$9,238
Erosion and Sediment Control	1	LS	10% of project	$18,475
			Base Construction Cost	**$221,701**
			Mobilization (5%)	$11,085
			Subtotal 1	$232,786
			Contingency (25%)	$58,197
			Subtotal 2	$290,983
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$130,942
			Estimated Project Cost	**$422,000**

AC9312 Area-Wide Drainage Improvement

Address:	Various
Location:	Westchester, Briars of Westchester
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	85 acres
Receiving Waters	Unknown tributary of Crook Branch

Description: This is a low and medium density residential neighborhood downstream of dry pond 0200DP. This project is located in a headwater subwatershed and would improve the water quality of the runoff after it flows through the dry pond and before it enters the tributary of Crook Branch. Tree box filters will be installed at curb inlets, rain gardens will be installed at yard inlets and vegetated swales will be installed in place of paved ditches.



Project Area Map

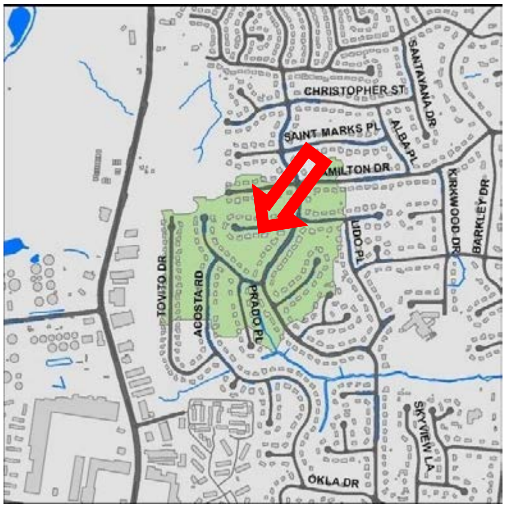
Project Benefits: While there may be some improvement in peak flow attenuation due to increased infiltration and removal of the paved ditches, the project is primarily intended to provide water quality treatment of stormwater runoff. Project implementation is expected to reduce annual pollutant loads by 7,497 lbs of sediment, 96 lbs of nitrogen and 18 lbs of phosphorus.

Project Design Considerations: There are no environmental constraints as the disturbance will be limited to the area immediately around existing storm drains. Projects located on private property need to be coordinated with property owners.

Costs:

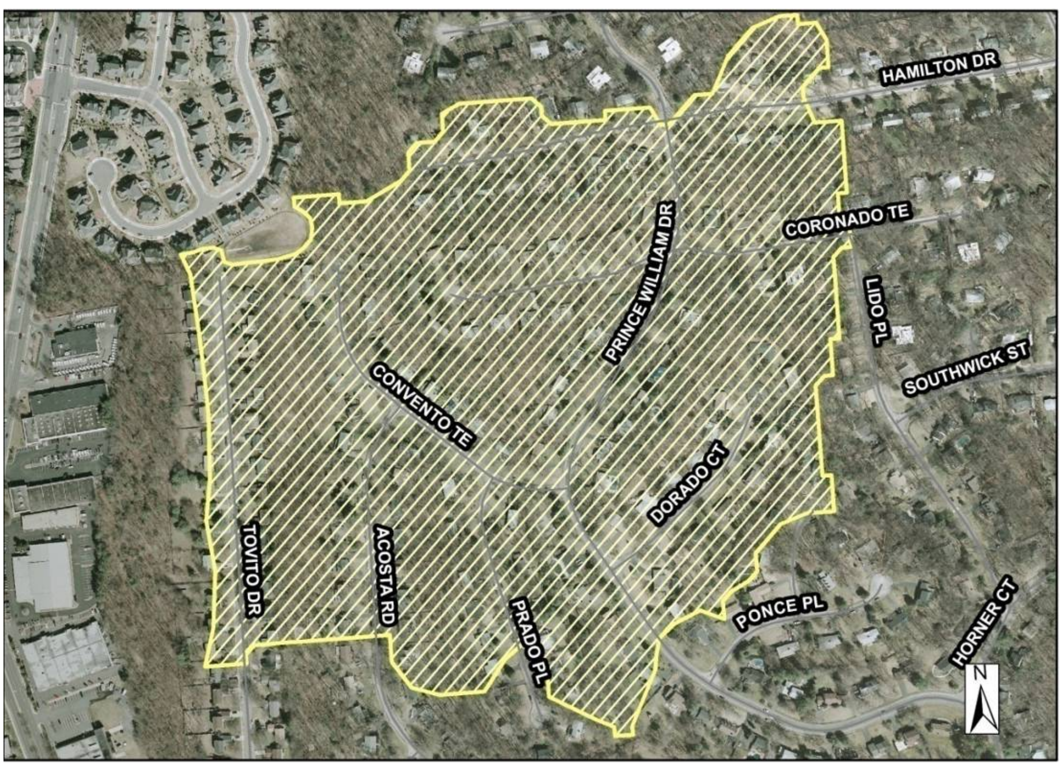
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	48	EA	$10,000.00	$480,000
Rain Garden	823	SY	$50.00	$41,150
			Initial Project Cost	**$521,150**
Plantings	1	LS	5% of project	$26,058
Ancillary Items	1	LS	5% of project	$26,058
Erosion and Sediment Control	1	LS	10% of project	$52,115
			Base Construction Cost	**$625,381**
			Mobilization (5%)	$31,269
			Subtotal 1	$656,650
			Contingency (25%)	$164,163
			Subtotal 2	$820,813
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$369,366
			Estimated Project Cost	**$1,191,000**

AC9313 Area-Wide Drainage Improvement



Address:	Various
Location:	Langhorne Acres
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	80 acres
Receiving Waters	Unknown tributary of Crook Branch

Description: The project area is a low and medium density residential neighborhood which was developed with no stormwater management facilities. It is located in a headwater subwatershed, which is an ideal location to implement runoff treatment to improve water quality before it flows to Crook Branch. Proposed treatment systems include tree box filters installed at various street inlets and rain gardens installed at yard inlets.



Project Area Map

Project Benefits: This project will provide water quality treatment of stormwater runoff. It is estimated that project implementation will reduce annual pollutant loads by 6,315 lbs of sediment, 84 lbs of nitrogen and 16 lbs of phosphorus. There will also be a small amount of improvement in peak flow attenuation due to increased infiltration and removal of the paved ditches.

Project Design Considerations: There are no environmental constraints anticipated as the disturbance will be limited to immediately around the project. Projects located on private property need to be coordinated with property owners. An easement will be required for projects on private property.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	28	EA	$10,000.00	$280,000
Rain Garden	683	SY	$50.00	$34,150
			Initial Project Cost	**$314,150**
Plantings	1	LS	5% of project	$15,708
Ancillary Items	1	LS	5% of project	$15,708
Erosion and Sediment Control	1	LS	10% of project	$31,415
			Base Construction Cost	**$376,981**
			Mobilization (5%)	$18,849
			Subtotal 1	$395,830
			Contingency (25%)	$98,958
			Subtotal 2	$494,788
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$222,655
			Estimated Project Cost	**$718,000**

AC9314 – Area-Wide Drainage Improvement

Address:	Various
Location:	Dunn Loring Village
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	28 acres
Receiving Waters	Unknown Tributary of Long Branch

Description: The project site is located in a high density residential area south of I-66 with no stormwater management. Stream assessments showed that the water quality downstream of this subwatershed is impaired. This project involves the installation of tree box filters and rain gardens to treat the runoff at the source, before it enters the storm drain system.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will provide water quality treatment of stormwater runoff through various filtration, infiltration, and uptake by vegetation. It is estimated that project implementation will reduce pollutant loads by approximately 4,802 lbs of sediment, 56 lbs of nitrogen and 11 lbs of phosphorus each year. There may also be some improvement in the peak flow attenuation due to increased infiltration.

Project Design Considerations: Environmental constraints are not anticipated as the disturbance will only be in the immediate vicinity of the project. Rain gardens would require utility research to ensure there are no conflicts. Some modification of the storm drain system may be required. Projects located on private property need to be coordinated with property owners.

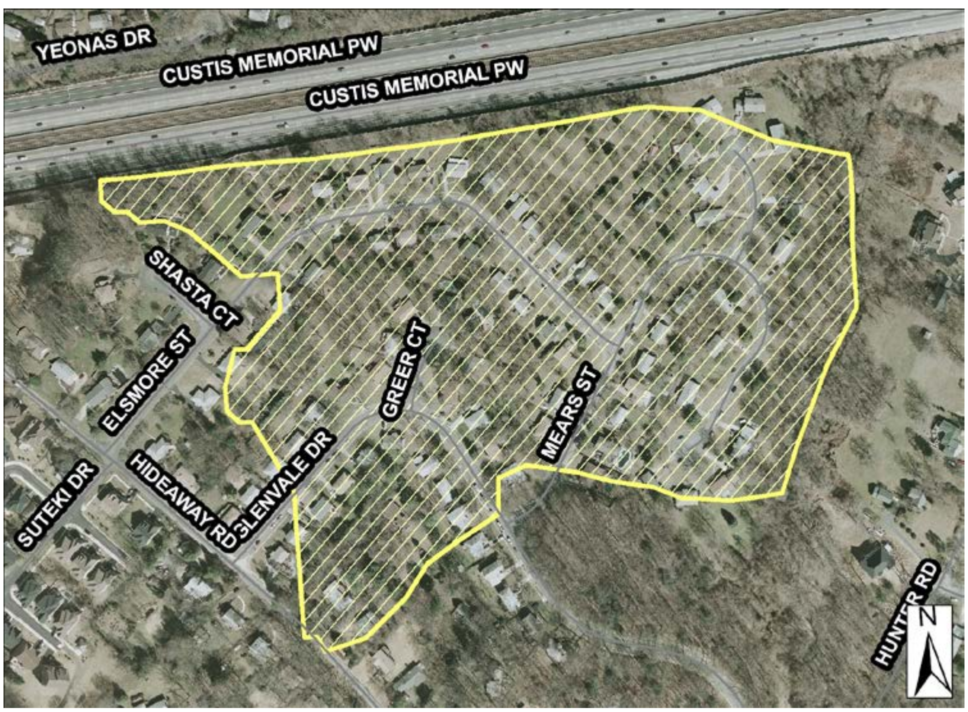
Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	19	EA	$10,000.00	$190,000
Rain Garden	286	SY	$50.00	$14,300
			Initial Project Cost	**$204,300**
Plantings	1	LS	5% of project	$10,215
Ancillary Items	1	LS	5% of project	$10,215
Erosion and Sediment Control	1	LS	10% of project	$20,430
			Base Construction Cost	**$245,160**
			Mobilization (5%)	$12,258
			Subtotal 1	$257,418
			Contingency (25%)	$64,355
			Subtotal 2	$321,773
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$144,798
			Estimated Project Cost	**$467,000**

AC9315 – Area-Wide Drainage Improvement

Address:	Various
Location:	Hideway Park
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	33 acres
Receiving Waters	Bear Branch

Description: The project site lies within a subwatershed which is developed primarily with medium density residential housing with no stormwater management. This project is located south of I-66 and involves the installation of tree box filters and rain gardens at the existing stormwater inlets. The area-wide improvement would treat the runoff as it enters the storm drain system, before it enters the stream.



Project Area Map: Conceptual plan showing potential project location

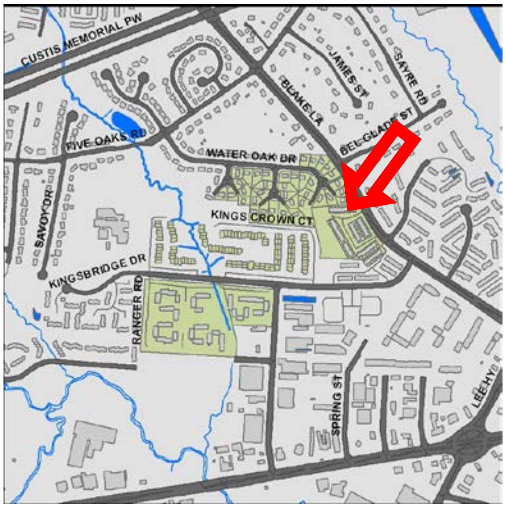
Project Benefits: This project will provide water quality treatment of stormwater runoff through filtration and vegetative uptake. The amount of nutrients and suspended solids will be reduced within the stream, thus improving in-stream habitat. Implementing this project is expected to reduce pollutant loads by approximately 2,368 lbs of sediment, 32 lbs of nitrogen and six lbs of phosphorus annually. There will also be some peak flow reduction due to the increased infiltration.

Project Design Considerations: No environmental constraints are anticipated as the disturbance will only be in the immediate vicinity of the project. Utility research would be required to ensure there are no conflicts. Some modification of the storm drain system would be required. While most of the improvements should be located inside of right-of-way; however, coordination with private property owners will be needed for work done on privately-owned property.

Costs:

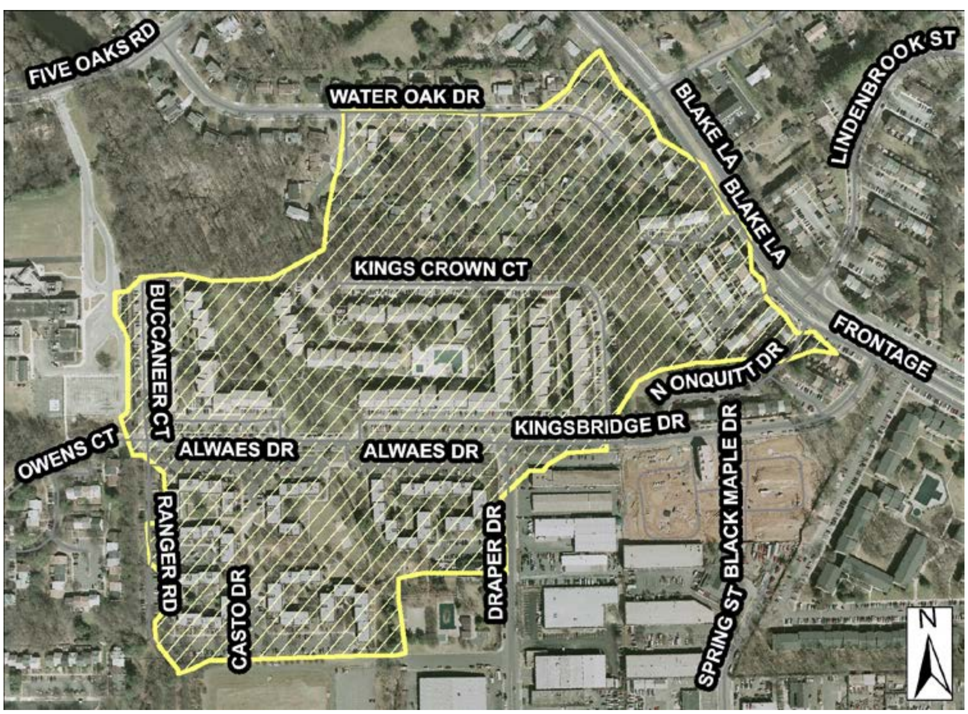
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	11	EA	$10,000.00	$110,000
Rain Garden	271	SY	$50.00	$13,550
			Initial Project Cost	**$123,550**
Plantings	1	LS	5% of project	$6,178
Ancillary Items	1	LS	5% of project	$6,178
Erosion and Sediment Control	1	LS	10% of project	$12,355
			Base Construction Cost	**$148,261**
			Mobilization (5%)	$7,413
			Subtotal 1	$155,674
			Contingency (25%)	$38,919
			Subtotal 2	$194,593
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$87,567
			Estimated Project Cost	**$283,000**

AC9316 – Area-Wide Drainage Improvement



Address:	Various
Location:	Hawthorne Village Apts, Five Oaks Place Cedar Grove Park
Land Owner:	Private - Residential
PIN:	Multiple
Control Type	Water Quality
Drainage Area	49 acres
Receiving Waters	Unknown Tributary of Accotink Creek

Description: The project will be implemented in an area which has been developed as a medium and high density residential neighborhood with no stormwater management. This headwater subwatershed is a location where runoff treatment would improve the water quality before it enters Crook Branch instead of downstream of the impairment. The project consists of retrofitting tree box filters at curb and street inlets, and rain gardens adjacent to yard inlets.



Project Area Map: Conceptual plan showing potential project location

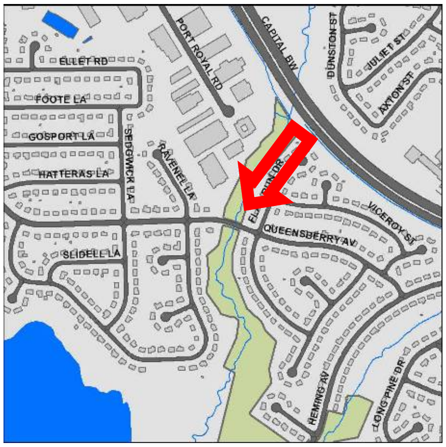
Project Benefits: This project will provide water quality treatment of stormwater runoff. Nutrients, suspended solids, and other harmful pollutants will be removed at the source, and thus within the stream, which will improve in-stream habitat. It is estimated that project implementation will reduce annual pollutant loads by 5,278 lbs of sediment, 62 lbs of nitrogen and 12 lbs of phosphorus. There will also be a small amount of improvement in peak flow attenuation due to increased infiltration.

Project Design Considerations: There are no environmental constraints anticipated as the disturbance will be limited to immediately around the project. Projects located on private property need to be coordinated with the property owner.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	42	EA	$10,000.00	$420,000
Rain Garden	691	SY	$50.00	$34,550
			Initial Project Cost	**$454,550**
Plantings	1	LS	5% of project	$22,728
Ancillary Items	1	LS	5% of project	$22,728
Erosion and Sediment Control	1	LS	10% of project	$45,455
			Base Construction Cost	**$545,461**
			Mobilization (5%)	$27,273
			Subtotal 1	$572,734
			Contingency (25%)	$143,184
			Subtotal 2	$715,918
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$322,163
			Estimated Project Cost	**$1,039,000**

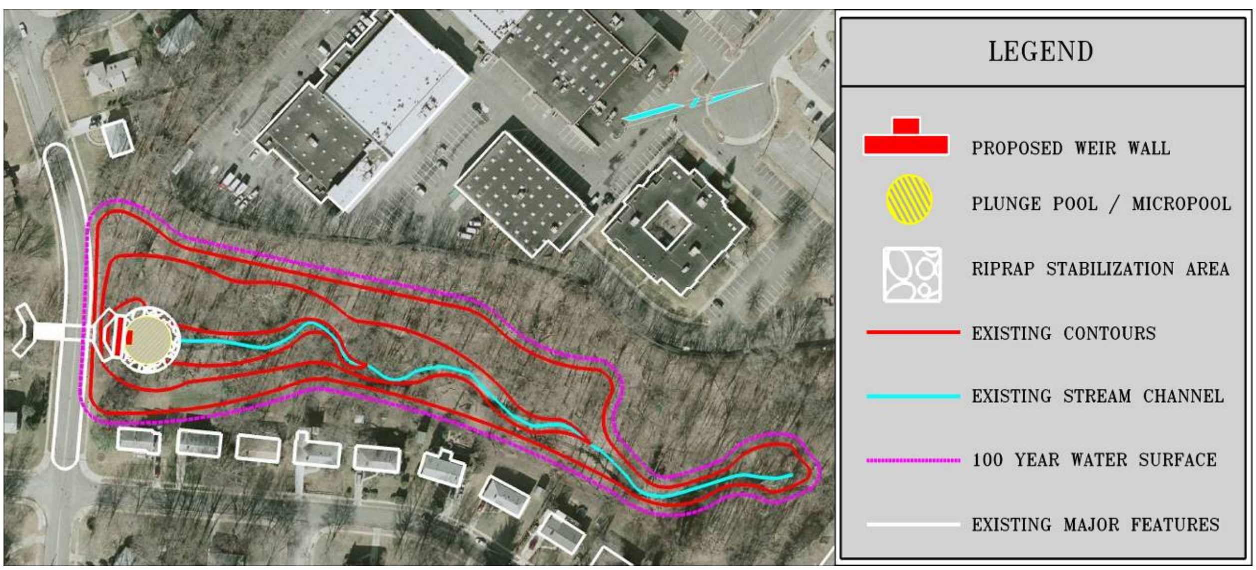
AC9400 - Culvert Retrofit



Address:	Under Queensberry Avenue, near the intersection of Flag Run Drive and Queensberry Avenue
Location:	Lake Accotink Park
Land Owner:	County - FCPA
PIN:	0792 01 0001A
Control Type	Water Quality
Drainage Area	99.86 acres
Receiving Waters	Flag Run

Description: This project is located on the upstream side of Queensberry Avenue between Flag Run Drive and Ravenel Lane. The upstream floodplain is flat and open with possible wetland areas. This culvert retrofit would add a weir wall control structure on the upstream side of the culvert to regulate discharge of smaller, more frequent storm events and provide water quality treatment.

The project is located downstream of stream restoration project AC9229 and culvert retrofit AC9401. Design of all three projects should be performed concurrently.



Project Area Map: Conceptual plan showing potential project location

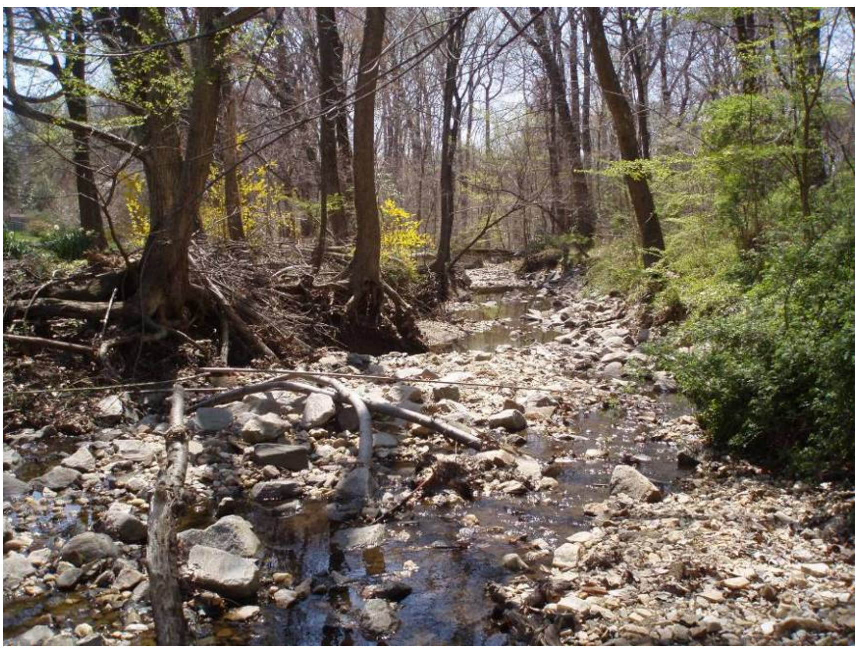
Project Benefits: This project has the potential to manage high frequency smaller storms with the addition of a weir wall as a control structure. The retrofit provides detention that will reduce downstream channel erosion by reducing flow rates back to pre-development conditions. The project will also help remove suspended solids through sedimentation. It is estimated that an annual total of 17,390 lbs of sediment, 126 lbs of nitrogen and 19 lbs of phosphorus would be reduced by this project.

Project Design Considerations: The upstream floodplain is bordered by a commercial / industrial park and several single family homes located adjacent to the stream channel, which should be considered in the design and construction phases. The base flow component of the control structure will require regular maintenance inspection to prevent clogging. All components of the existing embankment and stream channel should be analyzed to ensure that the integrity is not compromised as a result of the change in hydraulics. Retrofitting this culvert must adhere to FEMA regulations if it is located within the 100-year floodplain. Environmental permitting issues are expected due to the in-stream location of this facility. Moderate tree loss is expected for access and during construction. Existing utility conflicts are not anticipated with this retrofit. Access is good off of Queensberry Avenue.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Plungepool / Micropool	1	EA	$400.00	$400
New Control Structure - Weir	1	LS	$12,000.00	$12,000
Rip Rap Stabilization	200	SY	$100.00	$20,000
			Initial Project Costs	**$32,400**
Plantings	1	LS	5% of Project	$1,620
Ancillary Items	1	LS	5% of Project	$1,620
Erosion and Sediment Control	1	LS	10% of Project	$3,240
			Base Construction Costs	**$38,880**
			Mobilization (5%)	$1,944
			Subtotal 1	$40,824
			Contingency (25%)	$10,206
			Subtotal 2	$51,030
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$22,964
			Estimated Project Cost	**$74,000**

Site Photo: Downstream Side of Existing Culvert Crossing



Site Photo: Downstream of Existing Culvert

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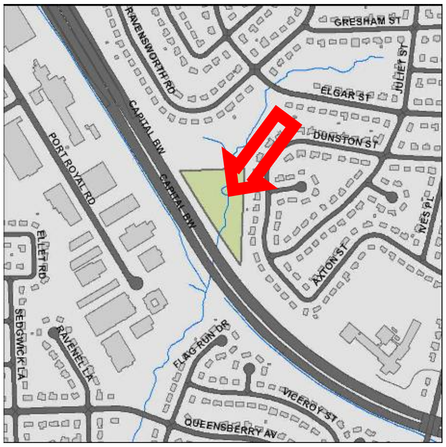
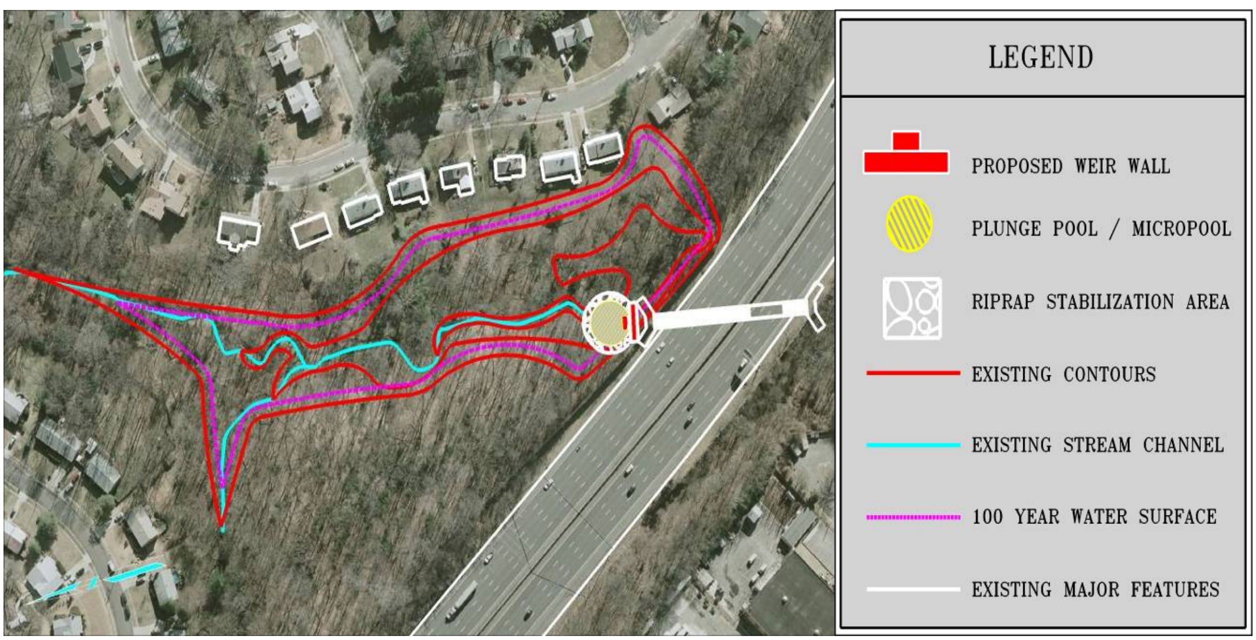
AC9401 - Culvert Retrofit



Address:	Under the Capital Beltway, near the intersection of Dunston Street and Juliet Street
Location:	North Springfield
Land Owner:	State - VDOT
PIN:	0792 01 0002
Control Type	Water Quality
Drainage Area	203.03 acres
Receiving Waters	Flag Run

Description: This project is located on the upstream side of the Capital Beltway (I-495) where Flag Run flows through a culvert under the Beltway. The upstream floodplain is bordered by several single family homes along Dunston and Axton Streets that are relatively close to the stream channel. This culvert retrofit would add a weir wall control structure on the upstream side of the culvert to regulate discharge of smaller high frequency storm events.

The project is located in the middle of two segments of stream restoration project AC9229 and upstream of culvert retrofit AC9400. Design of all three projects should be performed concurrently.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: The installation of a control structure on the upstream side of the existing culvert will provide detention to improve water quality and reduce flow rates and discharge velocities. Both improvements will help to improve the habitat in the downstream channel. Water quality improvements will be obtained through sedimentation during detention and filtering and nutrient uptake by floodplain vegetation. It is estimated that an annual total of 13,983 lbs of sediment, 148 lbs of nitrogen and 27 lbs of phosphorus would be reduced by this project.

Project Design Considerations: The base flow component of the control structure will require regular maintenance inspection to prevent clogging. All components of the existing embankment and stream channel should be analyzed to ensure the integrity of the culvert is not compromised as a result of the hydraulic changes. Retrofitting this culvert must adhere to FEMA regulations if it is located within the 100-year floodplain. Environmental permitting issues are expected due to the in-stream location of this facility. Significant tree loss is expected to obtain access and during construction. Existing utility conflicts are not anticipated with this retrofit. Access to this culvert is difficult and would require the use of an existing storm drain / utility easement off of Dunston Street and the crossing of several hundred feet of forested floodplain to get to the culvert.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Plunge Pool / Micropool	1	EA	$400.00	$400
New Control Structure - Weir	1	LS	$16,000.00	$16,000
Rip Rap Stabilization	200	SY	$100.00	$20,000
			Initial Project Costs	**$36,400**
Plantings	1	LS	5% of Project	$1,820
Ancillary Items	1	LS	5% of Project	$1,820
Erosion and Sediment Control	1	LS	10% of Project	$3,640
			Base Construction Costs	**$43,680**
			Mobilization (5%)	$2,184
			Subtotal 1	$45,864
			Contingency (25%)	$11,466
			Subtotal 2	$57,330
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$25,799
			Estimated Project Cost	**$83,000**


Site Photo: Downstream Side of Existing Culvert Crossing


Site Photo: Downstream of Existing Culvert

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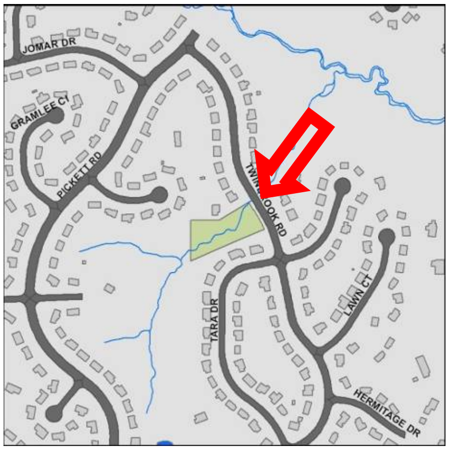
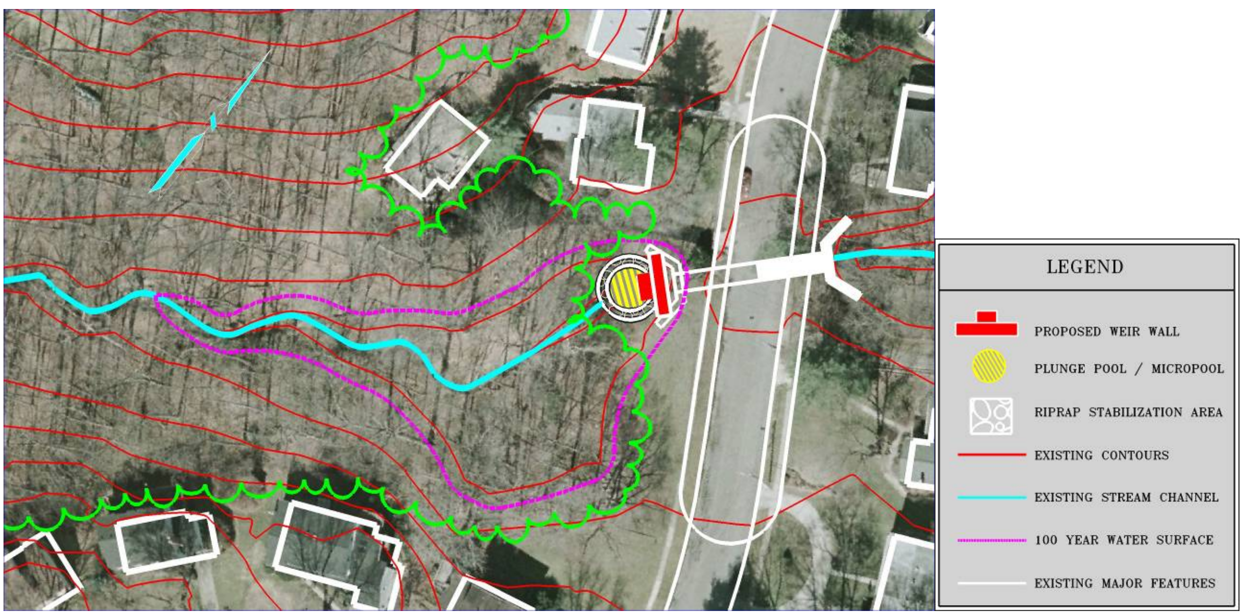
AC9405 - Culvert Retrofit



Address:	4602 Twinbrook Road
Location:	Old Forge Park
Land Owner:	County - FCPA
PIN:	0691 05 D1
Control Type	Water Quality
Drainage Area	59.5 acres
Receiving Waters	Tributary to Long Branch Central

Description: This project is located on the upstream side of Twinbrook Road on a tributary flowing into Long Branch Stream Valley Park. The floodplain at the project site is forested and flat with possible wetland areas. This culvert retrofit would add a weir wall control structure and stabilized micropool to regulate discharge of the smaller, high frequency storm events.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Due to the size of the contributing drainage area and presence of base flow at the culvert, it is unlikely that peak flow management of the 2-year and 10-year design storm can be achieved by this project. The detention that will be provided will treat water quality by allowing sediment to settle out on the floodplain. Nutrient uptake by wetland vegetation will also reduce nitrogen and phosphorus loads. It is estimated that an annual total of 3,933 lbs of sediment, 41 lbs of nitrogen and eight lbs of phosphorus would be reduced by this project.

Project Design Considerations: Adding an in-stream control structure will cause a change in water levels on the upstream side of the embankment, which should be taken into account during the design phase. The base flow component of the control structure will require regular maintenance to prevent clogging. All components of the existing embankment and stream channel should be analyzed to ensure that the integrity of the cross culvert/stream is not compromised as a result of the change in hydraulic characteristics at this site. This project is located within the 100 year floodplain so any adjustments to the characteristics of stream must adhere to FEMA regulations. Environmental permitting measures are expected due to the in-stream location of this facility. Tree clearing is expected to provide access to the culvert and stream channel. Existing utility conflicts are not anticipated. Access is good from Twinbrook Road.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Plungepool / Micropool	1	EA	$600.00	$600
New Control Structure - Weir	1	LS	$12,000.00	$12,000
			Initial Project Costs	**$12,600**
Plantings	1	LS	5% of Project	$630
Ancillary Items	1	LS	5% of Project	$630
Erosion and Sediment Control	1	LS	10% of Project	$1,260
			Base Construction Costs	**$15,120**
			Mobilization (5%)	$756
			Subtotal 1	$15,876
			Contingency (25%)	$3,969
			Subtotal 2	$19,845
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$8,930
			Estimated Project Cost	**$29,000**

Site Photo: Existing Control Structure

Site Photo: Existing Stream Channel

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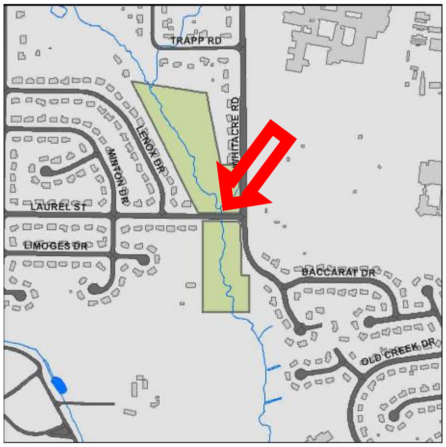
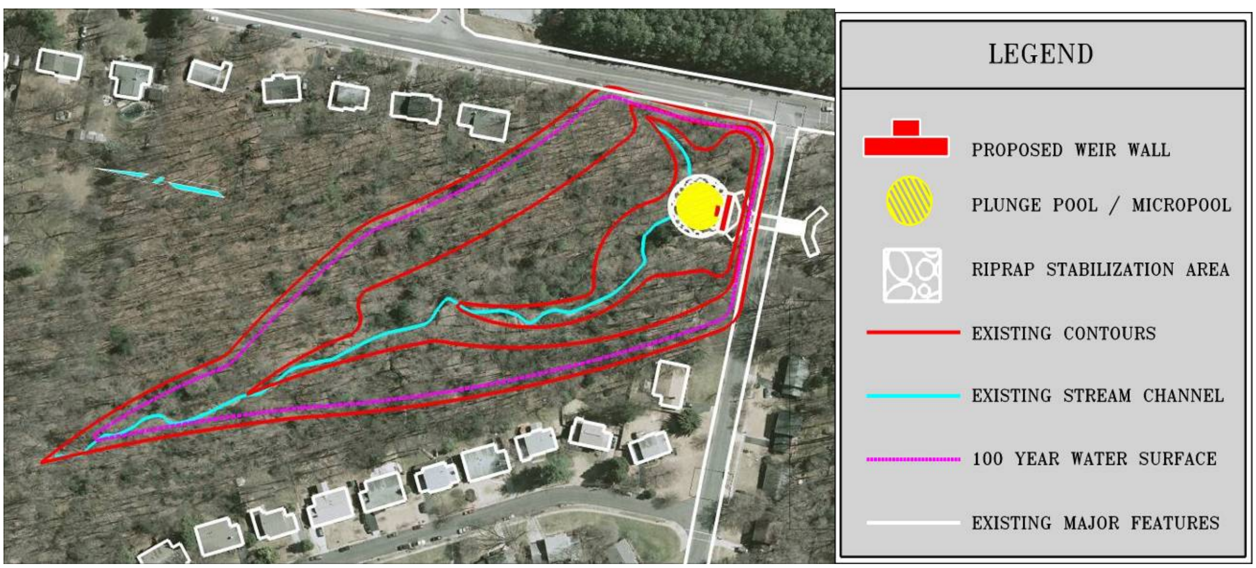
AC9406 - Culvert Retrofit



Address:	Under Laurel Street, near the intersection of Whitacre Road and Laurel Street
Location:	Long Branch Park
Land Owner:	County - FCPA
PIN:	0583 01 0004
Control Type	Water Quality
Drainage Area	161.16 acres
Receiving Waters	Long Branch

Description: This project is located on the upstream side of Laurel Street between Lenox Drive and Whitacre Road. The upstream floodplain is bordered by several single family homes along Lenox Drive, which are located relatively close to the stream channel. This culvert retrofit would add a weir wall control structure on the upstream side of the culvert to regulate discharge of smaller, high frequency storm events.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project has the potential to manage high frequency design storms with the addition of a control structure. Managing these frequent design storms will help to reduce flow rates and discharge velocities back to pre-development conditions. This will prevent further eroded conditions in the downstream channel and improve instream habitat. Installation of a control structure may also improve the health of the downstream channel by allowing suspended solids to settle out, and allow for nutrient uptake and filtering in the floodplain. It is estimated that an annual total of 9,219 lbs of sediment, 88 lbs of nitrogen and 18 lbs of phosphorus would be reduced by this project.

Project Design Considerations: All components of the existing embankment and stream channel should be analyzed to ensure that the integrity of the cross culvert is not compromised with the change in hydraulic characteristics. The base flow component of the control structure will require regular maintenance to inspect for clogging. Retrofitting this culvert must adhere to FEMA regulations if it is located within the 100-year floodplain. Environmental permitting issues are expected due to the instream location of this facility. Moderate tree loss is expected for access along the channel. Existing utility conflicts are not anticipated with this retrofit. Access is good from Laurel Street.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Plunge Pool / Micropool	1	EA	$400.00	$400
New Control Structure - Weir	1	LS	$16,000.00	$16,000
Rip Rap Stabilization	200	SY	$100.00	$20,000
			Initial Project Costs	**$36,400**
Plantings	1	LS	5% of Project	$1,820
Ancillary Items	1	LS	5% of Project	$1,820
Erosion and Sediment Control	1	LS	10% of Project	$3,640
			Base Construction Costs	**$43,680**
			Mobilization (5%)	$2,184
			Subtotal 1	$45,864
			Contingency (25%)	$11,466
			Subtotal 2	$57,330
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$25,799
			Estimated Project Cost	**$83,000**


Site Photo: Downstream Floodplain of Culvert


Site Photo: Existing Culvert

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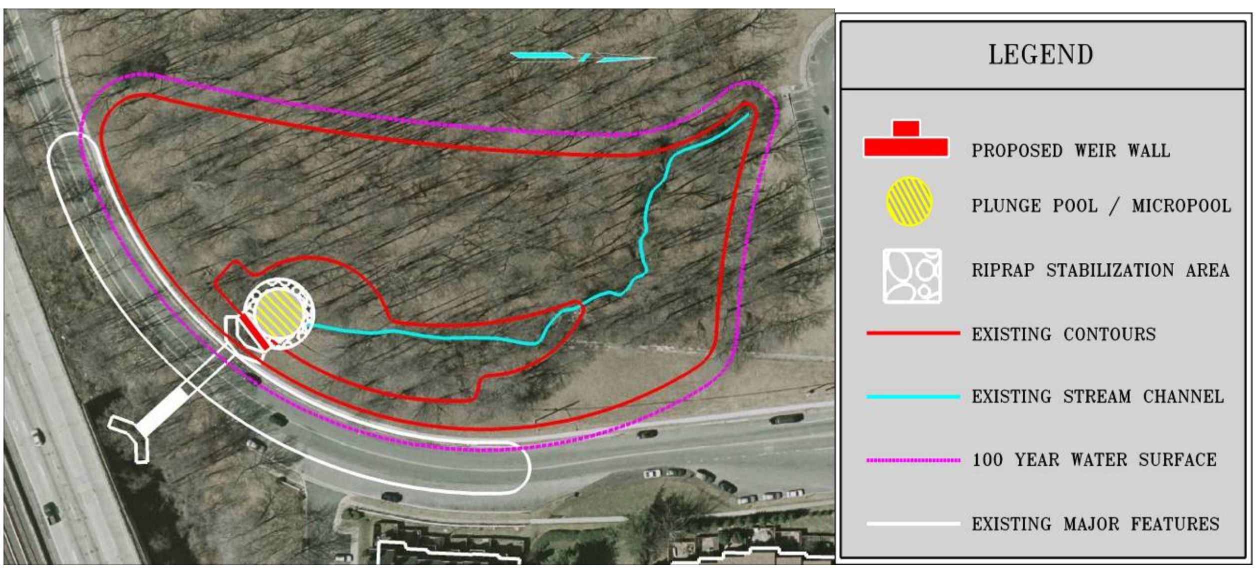
AC9409 - Culvert Retrofit

Address:	Under Sutton Road, near the intersection of Sutton Green Court and Sutton Road
Location:	Oakton High School
Land Owner:	County - FCPS
PIN:	0481 01 0111
Control Type	Water Quality
Drainage Area	42.10 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This project is located on the upstream side of Sutton Road near Oakton High School. The floodplain upstream of Sutton Road is mostly forested in the area of the culvert. This culvert retrofit would add a weir wall control structure on the upstream side of the culvert to regulate discharge of smaller, more frequent storms.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: The newly installed control structure will help prevent future downstream channel erosion by by reducing flow rates from smaller storms back to pre-development conditions. This project will also improve water quality through detention, settling of suspended solids, and filtration and uptake of nutrients by floodplain vegetation. The project would also provide an excellent environmental education or stewardship opportunity for students and parents of Oakton High School. It is estimated that an annual total of 4,183 lbs of sediment, 42 lbs of nitrogen and nine lbs of phosphorus would be reduced by this project.

Project Design Considerations: Moderate tree removal is anticipated in order to obtain access from Sutton Road, to clear the upstream embankment, and for construction around the channel. All components of the existing embankment and stream channel should be analyzed to ensure that the integrity is not compromised. Retrofitting this culvert must adhere to FEMA regulations if it is located within the 100-year floodplain. The base flow component of the control structure will require regular maintenance inspections to prevent clogging. Environmental permitting issues are expected due to the instream location of this facility.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Plunge Pool / Micropool	1	EA	$400.00	$400
New Control Structure - Weir	1	LS	$8,000.00	$8,000
Rip Rap Stabilization	200	SY	$100.00	$20,000
			Initial Project Costs	**$28,400**
Plantings	1	LS	5% of Project	$1,420
Ancillary Items	1	LS	5% of Project	$1,420
Erosion and Sediment Control	1	LS	10% of Project	$2,840
			Base Construction Costs	**$34,080**
			Mobilization (5%)	$1,704
			Subtotal 1	$35,784
			Contingency (25%)	$8,946
			Subtotal 2	$44,730
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$20,129
			Estimated Project Cost	**$65,000**

Site Photo: Erosion in Upstream Channel

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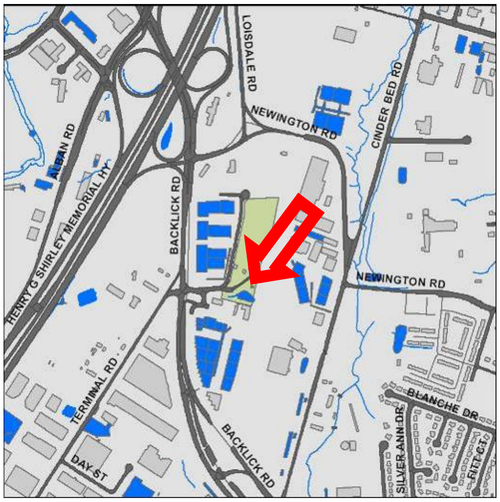
AC9501-BMP/LID



Address:	8201 Terminal Road
Location:	Terminal Drive
Land Owner:	Private - Industrial
PIN:	0993 01 0038
Control Type	Water Quality
Drainage Area	0.98 acres
Receiving Waters	Unknown tributary of Long Branch South

Description: The installation of a vegetated swale is proposed to treat the runoff from an industrial trucking facility on Terminal Drive. This site currently drains untreated runoff via a rip rap channel to a ditch along the railroad tracks. The vegetated swale could be either a dry swale (with underdrain) or a wet swale.

Project Area Map: Conceptual plan showing potential project location

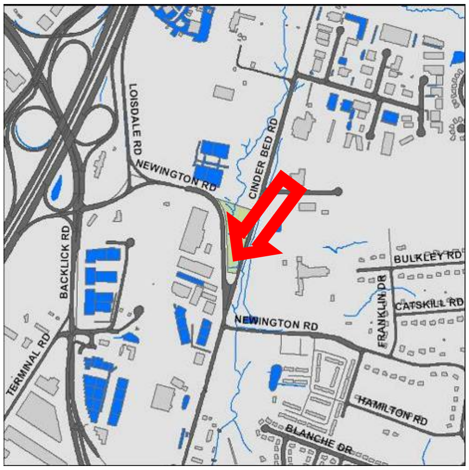
Project Benefits: Given the heavy truck use of this industrial property, the potential for discharge of pollutants such as sediment, heavy metals, nutrients, trash, and oil is relatively high. Implementation of a vegetated swale will provide better water quality treatment for this parking lot during storm events than the existing rip rap channel. The vegetated swale will filter pollutants as it conveys runoff off the property. It is estimated that an annual total of 574 lbs of sediment, five lbs of nitrogen and one lb of phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed site is constrained by a stormwater pond to the north and a large building to the south. The property is privately owned and coordination with the owner will be necessary for this project. No permanent negative impacts to the property are anticipated.

Costs:

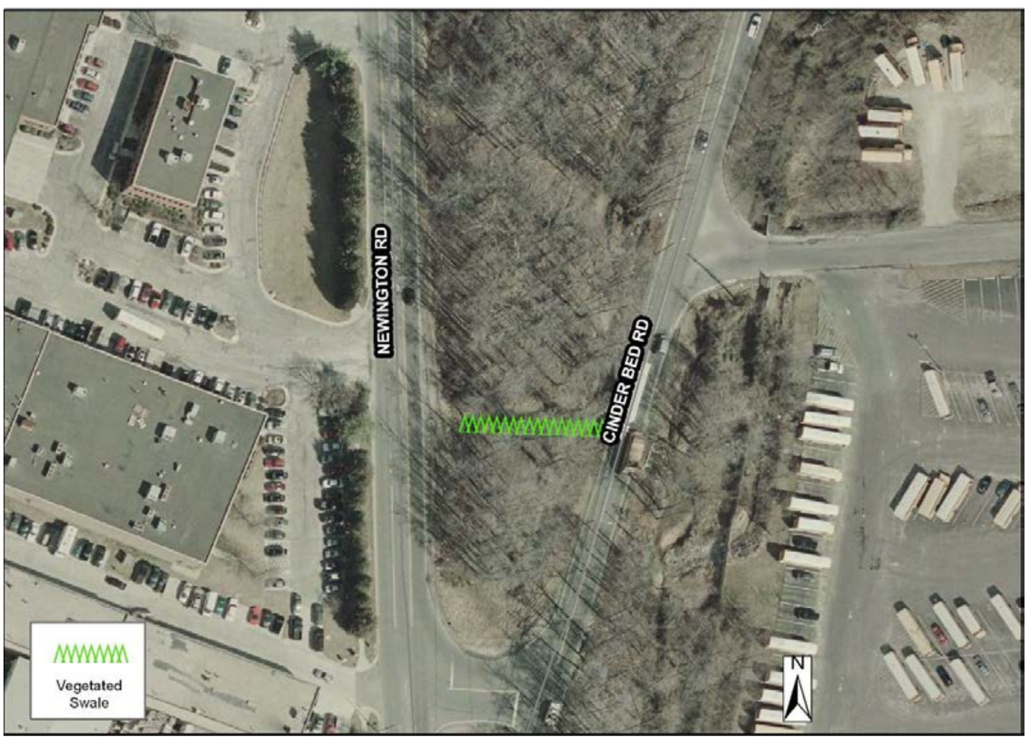
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Vegetated Swale	178	SY	$150.00	$26,700
			Initial Project Cost	**$26,700**
Ancillary Items	1	LS	5% of project	$1,335
Erosion and Sediment Control	1	LS	10% of project	$2,670
			Base Construction Cost	**$30,705**
			Mobilization (5%)	$1,535
			Subtotal 1	**$32,240**
			Contingency (25%)	$8,060
			Subtotal 2	**$40,300**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$18,135
			Estimated Project Cost	**$59,000**

AC9502-BMP/LID



Address:	7002 Newington Dr
Location:	Newington Road
Land Owner:	Private
PIN:	0992 01 0009
Control Type	Water Quality
Drainage Area	2.39 acres
Receiving Waters	Unknown tributary of Long Branch South

Description: Installation of a vegetated swale is proposed to treat the runoff from an industrial facility on Newington Road. Runoff from this site currently drains across Newington Road and into an open channel with heavy sedimentation before discharging to Long Branch South. The channel could be redesigned as a vegetated swale to improve pollutant removal and runoff reduction.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementation of a vegetated swale in this location will essentially serve as a forebay and provide water quality treatment for the storm drainage system and the impervious area it serves. The vegetated swale will remove sediment and other pollutants from the stormwater runoff before it enters Long Branch South. It is estimated that an annual total of 406 lbs of sediment, four lbs of nitrogen and one lb of phosphorus would be reduced by this project.

Project Design Considerations: The project's forested area location may lead to greater permitting issues compared to other retrofits in the watershed. A wetland delineation would need to be performed prior to final design. Access to the proposed site is fair and moderate tree removal may be necessary for construction. The standing water in the existing channel and the potential low head availability may make a wet swale more appropriate here than a dry swale with an underdrain.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Vegetated Swale	310	SY	$150.00	$46,500
			Initial Project Cost	**$46,500**
Ancillary Items	1	LS	5% of project	$2,325
Erosion and Sediment Control	1	LS	10% of project	$4,650
			Base Construction Cost	**$53,475**
			Mobilization (5%)	$2,674
			Subtotal 1	**$56,149**
			Contingency (25%)	$14,037
			Subtotal 2	**$70,186**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$31,584
			Estimated Project Cost	**$102,000**

Site photo: Outlet of storm drainage system on east side of Newington Road.

Site photo: Sediment-filled channel and discharge point to Long Branch South

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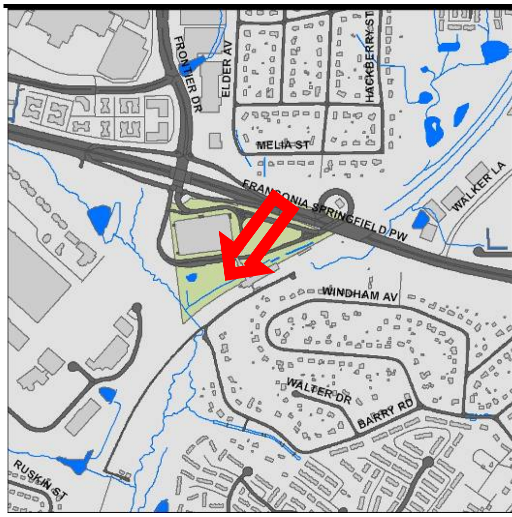
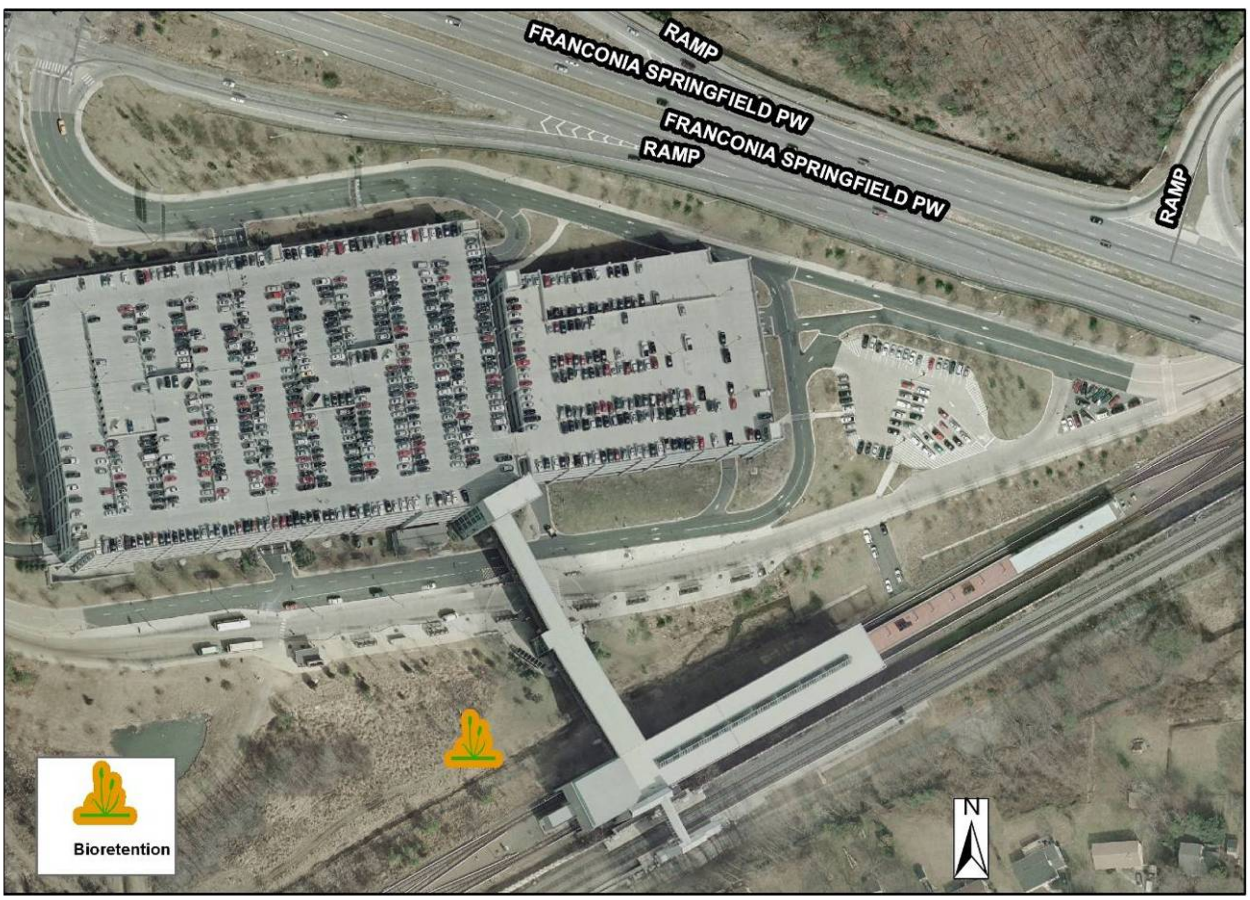
AC9503-BMP/LID



Address:	6775 Frontier Dr
Location:	Franconia/Springfield Metro
Land Owner:	Public - Metro
PIN:	0902 01 0061B
Control Type	Water Quality
Drainage Area	2.64 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: Installation of a bioretention filter is proposed to treat the runoff from one of the stormwater outlets from the Franconia/Springfield Metro. This stormwater outfall conveys runoff from several of the station's parking lots to a ditch along the Metro tracks.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This stormwater outlet receives untreated runoff from a large impervious drainage area, mainly parking lots. Clear evidence of trash, sediment, and other pollutants are visible at the site. Implementation of a bioretention facility would provide water quality treatment for this parking lot during storm events and reduce these pollutants through sedimentation, filtration, and biological processes. In addition, this site is highly visible, and would be a good opportunity for educational signage. It is estimated that an annual total of 3,543 lbs of sediment, 35 lbs of nitrogen and nine lbs of phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed site is excellent, While the property is publicly owned, coordination with the Washington Metropolitan Area Transit Authority will be essential for this project. The grassy area surrounding the proposed bioretention facility would also be a good candidate for reforestation.

Costs:

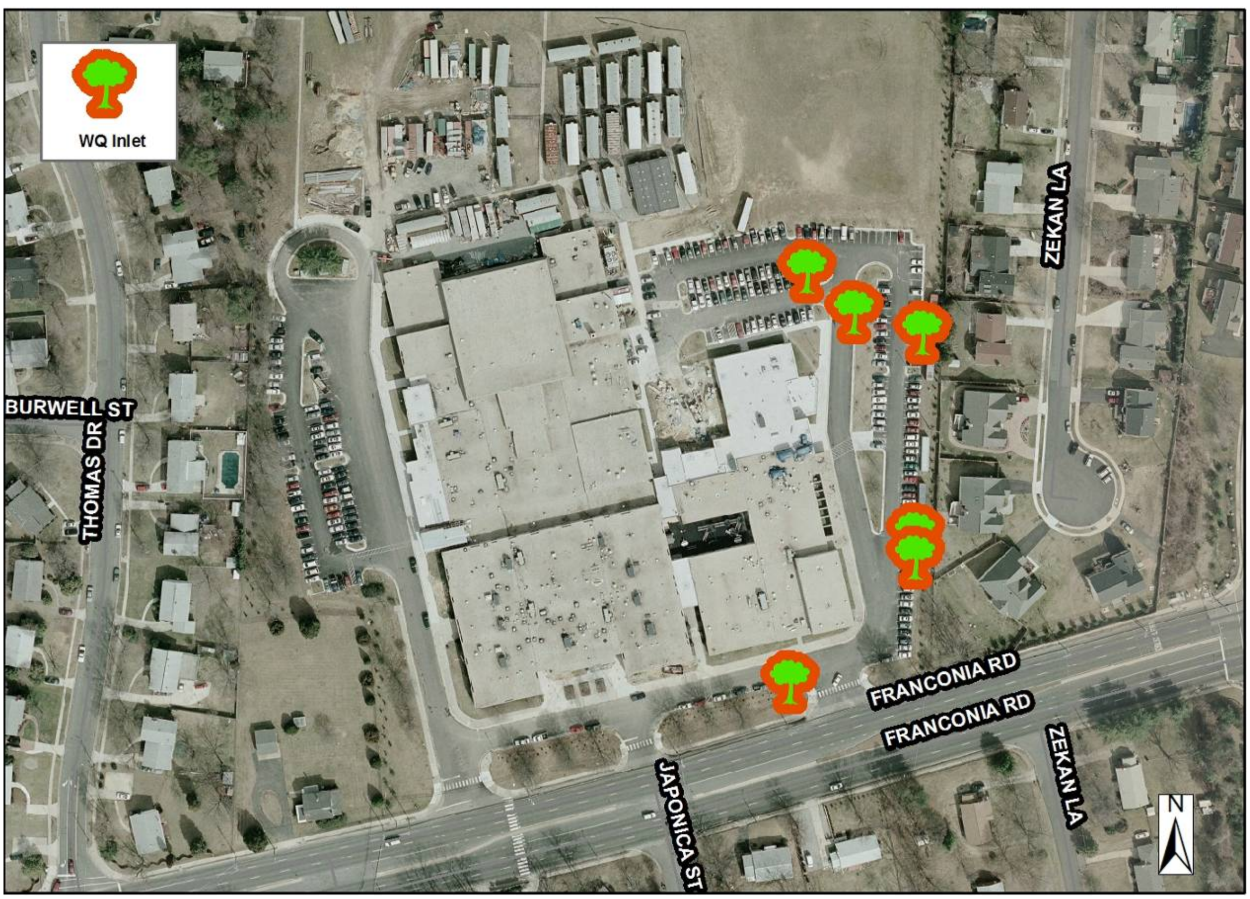
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	304	SY	$150.00	$45,600
			Initial Project Cost	**$45,600**
Ancillary Items	1	LS	5% of project	$2,280
Erosion and Sediment Control	1	LS	10% of project	$4,560
			Base Construction Cost	**$52,440**
			Mobilization (5%)	$2,622
			Subtotal 1	**$55,062**
			Contingency (25%)	$13,766
			Subtotal 2	**$68,828**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$30,973
			Estimated Project Cost	**$100,000**

Site photo: Outfall to be treated by bioretention facility.

AC9505-BMP/LID

Address:	6404 Franconia Road
Location:	Francis Scott Key Middle School
Land Owner:	County - FCPS
PIN:	0813 01 0022B
Control Type	Water Quality
Drainage Area	1.47 acres
Receiving Waters	Unknown tributary of Long Branch South

Description: The installation of Tree Box Filters is proposed to treat the runoff from the parking lot at Francis Scott Key School. The facilities would be located at the existing storm drain inlets and sized to treat the total impervious area. Currently, there are no existing stormwater management practices at the site and runoff flows directly into the storm drain system.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: The impervious surface from the parking lot produces high volumes of runoff and associated pollutants. Implementation of the proposed facilities will provide water quality treatment during storm events, reducing runoff volume, rate of flow, and pollutant loads. In addition, the location of this project on school grounds may provide significant educational benefits. It is estimated that an annual total of 589 lbs of sediment, six lbs of nitrogen and two lbs of phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Underground utilities may be present in the area; however, there should be sufficient space available to avoid them. Access to the proposed sites is excellent from the adjacent parking lot. Coordination with the school district will be necessary for this site and construction during the summer months would be preferred.

Costs:

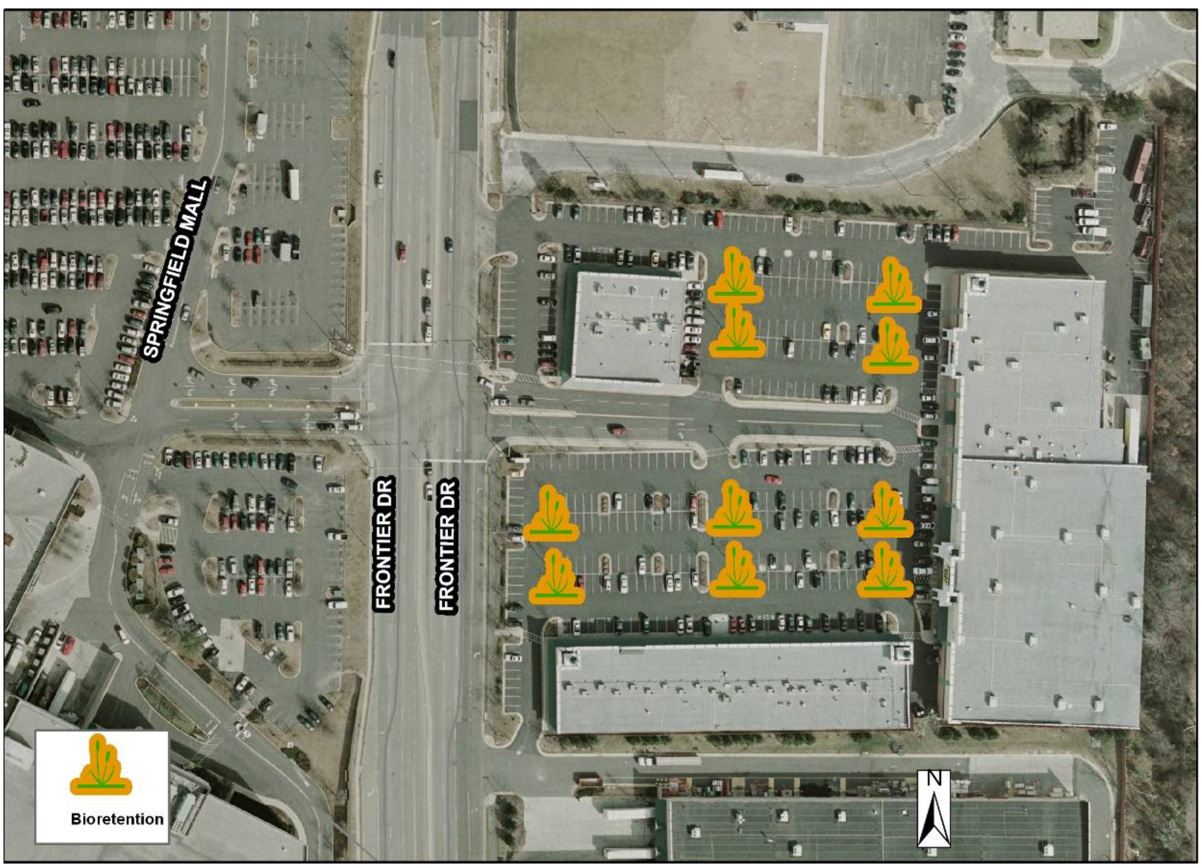
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	6	EA	$10,000.00	$60,000
			Initial Project Cost	**$60,000**
Ancillary Items	1	LS	5% of project	$3,000
Erosion and Sediment Control	1	LS	10% of project	$6,000
			Base Construction Cost	**$69,000**
			Mobilization (5%)	$3,450
			Subtotal 1	$72,450
			Contingency (25%)	$18,113
			Subtotal 2	$90,563
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$40,753
			Estimated Project Cost	**$132,000**

Site photo: Proposed location of one tree box filter adjacent to storm drain inlet in parking median.

AC9506-BMP/LID

Address:	6691 Frontier Dr
Location:	Commercial Parking Lot
Land Owner:	Private - Commercial
PIN:	0902 01 0101A1
Control Type	Water Quality
Drainage Area	2.52 acres
Receiving Waters	Unknown tributary of Long Branch South

Description: The installation of multiple bioretention filters and basins is proposed to treat the runoff from a large commercial parking lot located along Frontier Drive. The parking lot is heavily used at times, but numerous islands in the parking lot could be converted into bioretention facilities. The property appears to have underground detention for control of large storm events, but the detention was not designed for water quality treatment.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementation of bioretention facilities will provide water quality treatment for this parking lot during storm events and treat the sediment, nutrient, and oil pollution common in runoff from commercial parking lots. It is estimated that an annual total of 2,953 lbs of sediment, 27 lbs of nitrogen and five lbs of phosphorus would be reduced by this project.

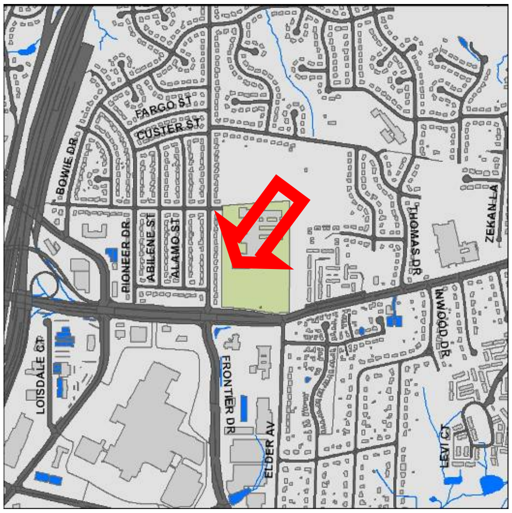
Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from the commercial parking lot. The property is privately owned and coordination with the shopping center will be necessary for these sites.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	345	SY	$150.00	$51,750
			Initial Project Cost	**$51,750**
Ancillary Items	1	LS	5% of project	$2,588
Erosion and Sediment Control	1	LS	10% of project	$5,175
			Base Construction Cost	**$59,513**
			Mobilization (5%)	$2,976
			Subtotal 1	**$62,488**
			Contingency (25%)	$15,622
			Subtotal 2	**$78,110**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$35,150
			Estimated Project Cost	**$114,000**

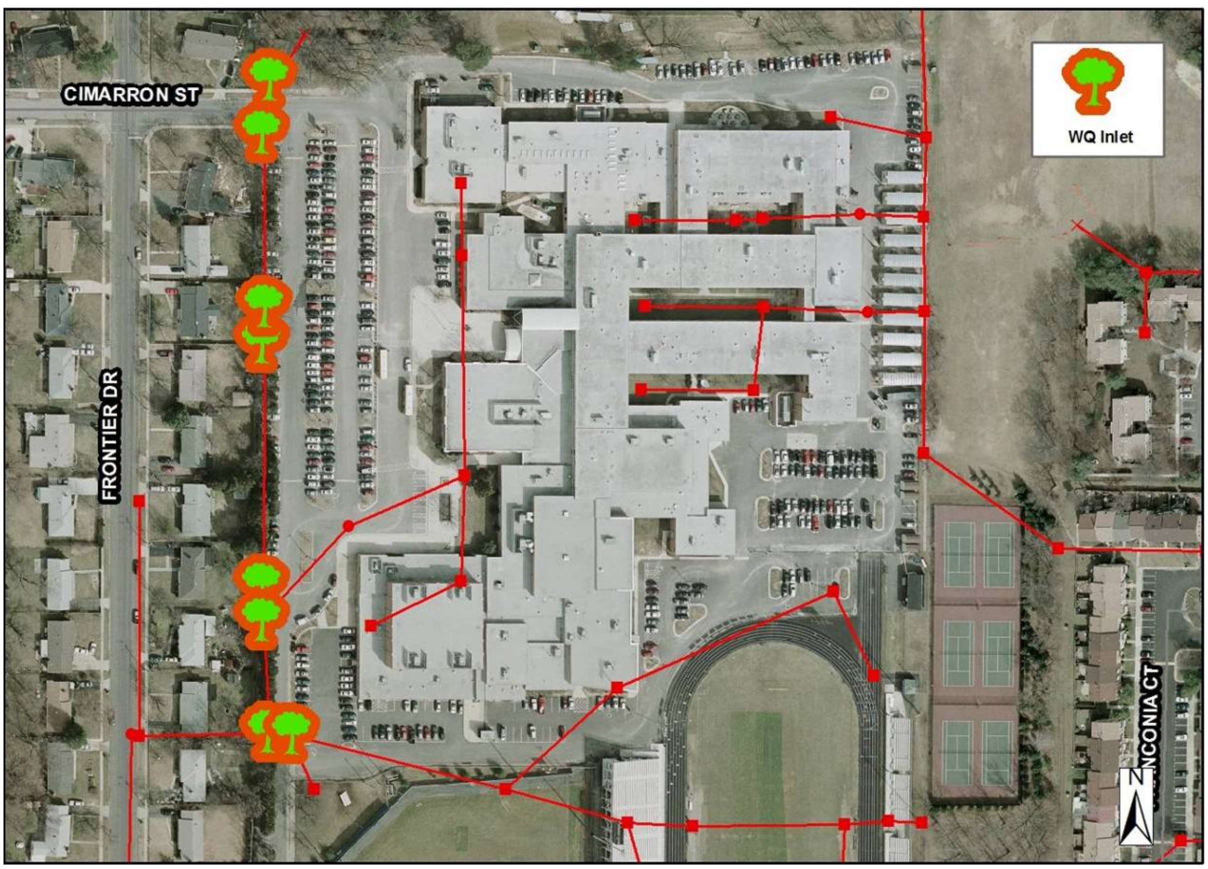
Site photo: Parking lot with multiple islands.

AC9508-BMP/LID



Address:	6540 Franconia Road
Location:	Robert E. Lee High School
Land Owner:	County - FCPS
PIN:	0804 01 0037
Control Type	Water Quality
Drainage Area	3.01 acres
Receiving Waters	Unknown tributary to Long Branch South

Description: The installation of Tree Box Filters is proposed to treat the runoff from the western portion of the parking lot for Robert E. Lee High School. The facilities would be located at the existing storm drain inlets.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This parking lot is likely to exhibit the runoff characteristics typical of heavily used parking lots –high levels of hydrocarbons, trash, sediment and nutrients. Implementation of the Tree Box Filters at the edge of the parking lot will provide water quality treatment for this area during storm events, intercepting and treating the runoff before it enters the storm drain system. It is estimated that an annual total of 486 lbs of sediment, five lbs of nitrogen and one lb of phosphorus would be reduced by this project.

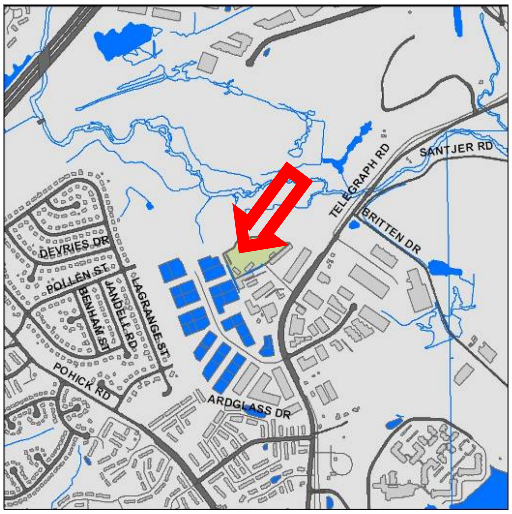
Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from the existing parking lot. Coordination with the school district will be necessary for this site.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	8	SY	$10,000.00	$80,000
			Initial Project Cost	**$80,000**
Ancillary Items	1	LS	5% of project	$4,000
Erosion and Sediment Control	1	LS	10% of project	$8,000
			Base Construction Cost	**$92,000**
			Mobilization (5%)	$4,600
			Subtotal 1	**$96,600**
			Contingency (25%)	$24,150
			Subtotal 2	**$120,750**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$54,338
			Estimated Project Cost	**$176,000**

Site photo: Parking spaces to be removed for bioretention facility.

AC9509-BMP/LID



Address:	7300 Telegraph Square Dr.
Location:	Lockport Industrial Park
Land Owner:	Private - Industrial
PIN:	1081 01 0003D
Control Type	Water Quality
Drainage Area	4.49 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: The installation of a bioretention filter is proposed to treat the runoff from the parking lot of a trucking company located in the Lockport Industrial Park. Currently the parking lot drains untreated via overland flow directly to the floodplain of a small tributary to Accotink Creek.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Given the heavy truck use of this parking lot, its potential for discharge of pollutants, such as sediment, heavy metals, nutrients, trash, and oil is relatively high. Implementation of a bioretention facility will provide water quality treatment for the runoff from this parking lot. The bioretention facility will intercept the overland flow before it reaches the floodplain of the Accotink Creek tributary and remove many of these pollutants. It is estimated that an annual total of 1,770 lbs of sediment, 12 lbs of nitrogen and two lbs of phosphorus would be reduced by this project.

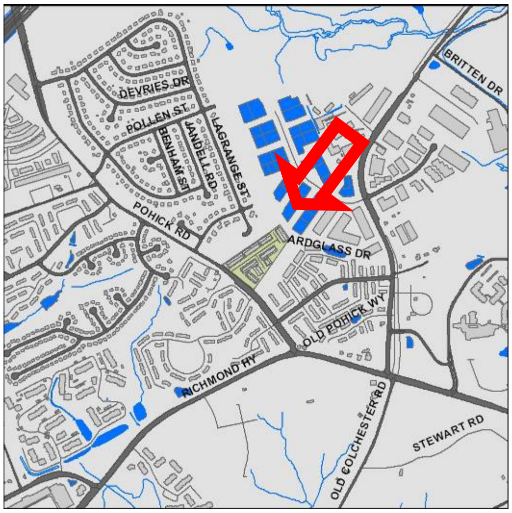
Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is good from the parking lot; however, existing electric lines in the area may require design modifications or specific construction considerations. The property is privately owned and coordination with the Lockport Industrial Park will be necessary. Temporary loss of parking spaces can be expected during construction.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	647	SY	$150.00	$97,050
			Initial Project Cost	**$97,050**
Ancillary Items	1	LS	5% of project	$4,853
Erosion and Sediment Control	1	LS	10% of project	$9,705
			Base Construction Cost	**$111,608**
			Mobilization (5%)	$5,580
			Subtotal 1	**$117,188**
			Contingency (25%)	$29,297
			Subtotal 2	**$146,485**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$65,918
			Estimated Project Cost	**$213,000**

Site photo: Discharge point from parking lot where the bioretention facility could be installed.

AC9510-BMP/LID



Address:	7408 Lockport Pl
Location:	Lockport Industrial Park
Land Owner:	Private - Industrial
PIN:	1081 01 0001M
Control Type	Water Quality
Drainage Area	54.7 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This project would install thirty-three tree box filters at existing inlet locations throughout the Lockport Industrial Park. The site is highly impervious, with very little space available for alternative retrofits. Tree box filters would provide water quality benefits without requiring much additional space.

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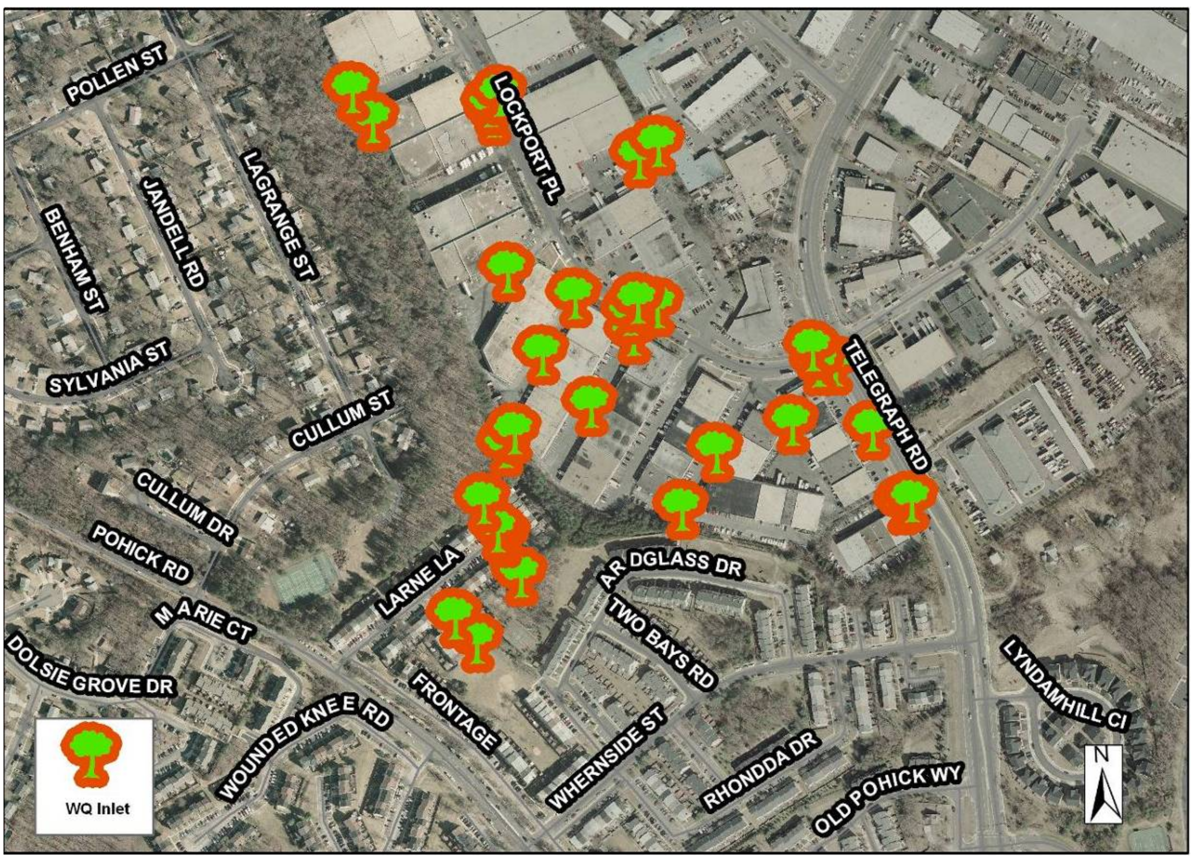


Project Area Map: Conceptual plan showing potential project location

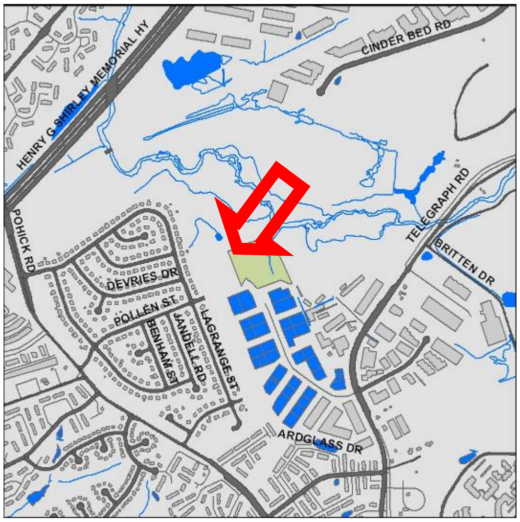
Project Benefits: Tree Box Filters will provide water quality treatment for much of the industrial park. The site exhibits heavy pollutant loads typical of industrial facilities, including trash, oils, grease, and sediment. Tree Box Filters would help remove these pollutants before the runoff enters the storm drain system. It is estimated that an annual total 22,456 lbs of sediment, 222 lbs of nitrogen, and 33 lbs of phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Most of the existing inlets are easily accessible from the parking lots and roads. The property is privately owned and coordination with the industrial park management, as well as the individual businesses, will be necessary for this project. A temporary loss of parking spaces can be expected during construction. As the proposed locations for the tree box filters are based on existing inlet locations, some individual locations may have large drainage areas, and must be designed accordingly.

Costs:

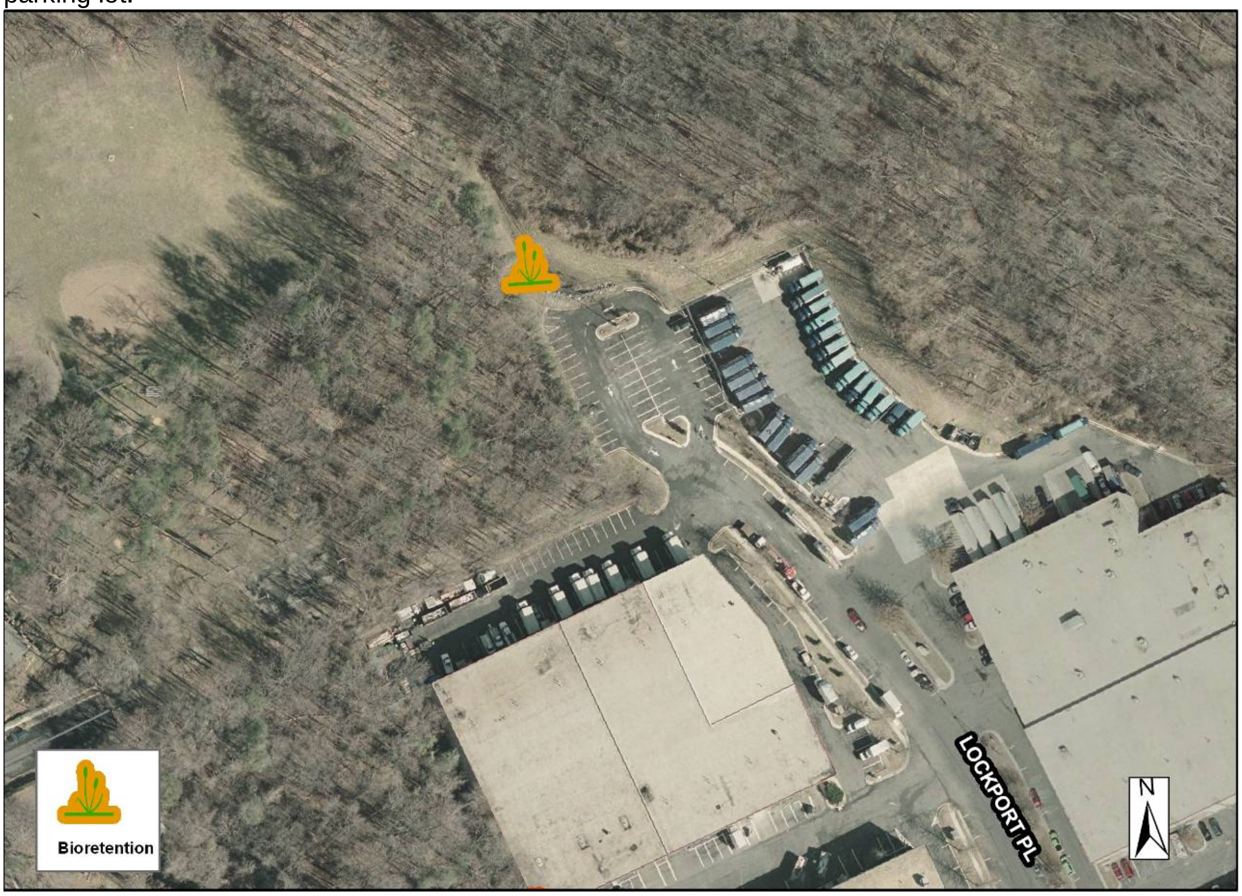
ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	33	EA	$10,000.00	$330,000
			Initial Project Cost	**$330,000**
Ancillary Items	1	LS	5% of project	$16,500
Erosion and Sediment Control	1	LS	10% of project	$33,000
			Base Construction Cost	**$379,500**
			Mobilization (5%)	$18,975
			Subtotal 1	**$398,475**
			Contingency (25%)	$99,619
			Subtotal 2	**$498,094**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$224,142
			Estimated Project Cost	**$723,000**

AC9511-BMP/LID



Address:	7408 Lockport Pl
Location:	Deer Park parking lot
Land Owner:	Private - Industrial
PIN:	1081 01 0001N
Control Type	Water Quality
Drainage Area	1.32 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: The installation of a bioretention filter is proposed to treat the runoff from a parking lot in the Lockport Industrial Park. The proposed facility will be located in a grassy area directly adjacent to the parking lot.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementation of a bioretention filter in this location will provide water quality treatment for the runoff from this parking lot. The bioretention facility will intercept trash, oil, grease, sediments, and nutrients. It is estimated that an annual total of 277 lbs of sediment, one lb of nitrogen and one-third lb of phosphorus would be reduced by this project.

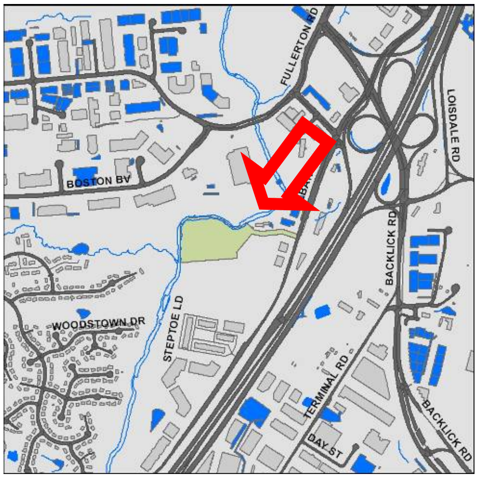
Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed site is excellent from the adjacent parking lot and construction of the facility will cause minimal disruption to the property. The property is privately owned and coordination with the owner/management of the site will be. Due to high trash and sediment loads expected in this location, a forebay and regular maintenance may be necessary.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	190	SY	$150.00	$28,500
			Initial Project Cost	**$28,500**
Ancillary Items	1	LS	5% of project	$1,425
Erosion and Sediment Control	1	LS	10% of project	$2,850
			Base Construction Cost	**$32,775**
			Mobilization (5%)	$1,639
			Subtotal 1	**$34,414**
			Contingency (25%)	$8,603
			Subtotal 2	**$43,017**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$19,358
			Estimated Project Cost	**$63,000**

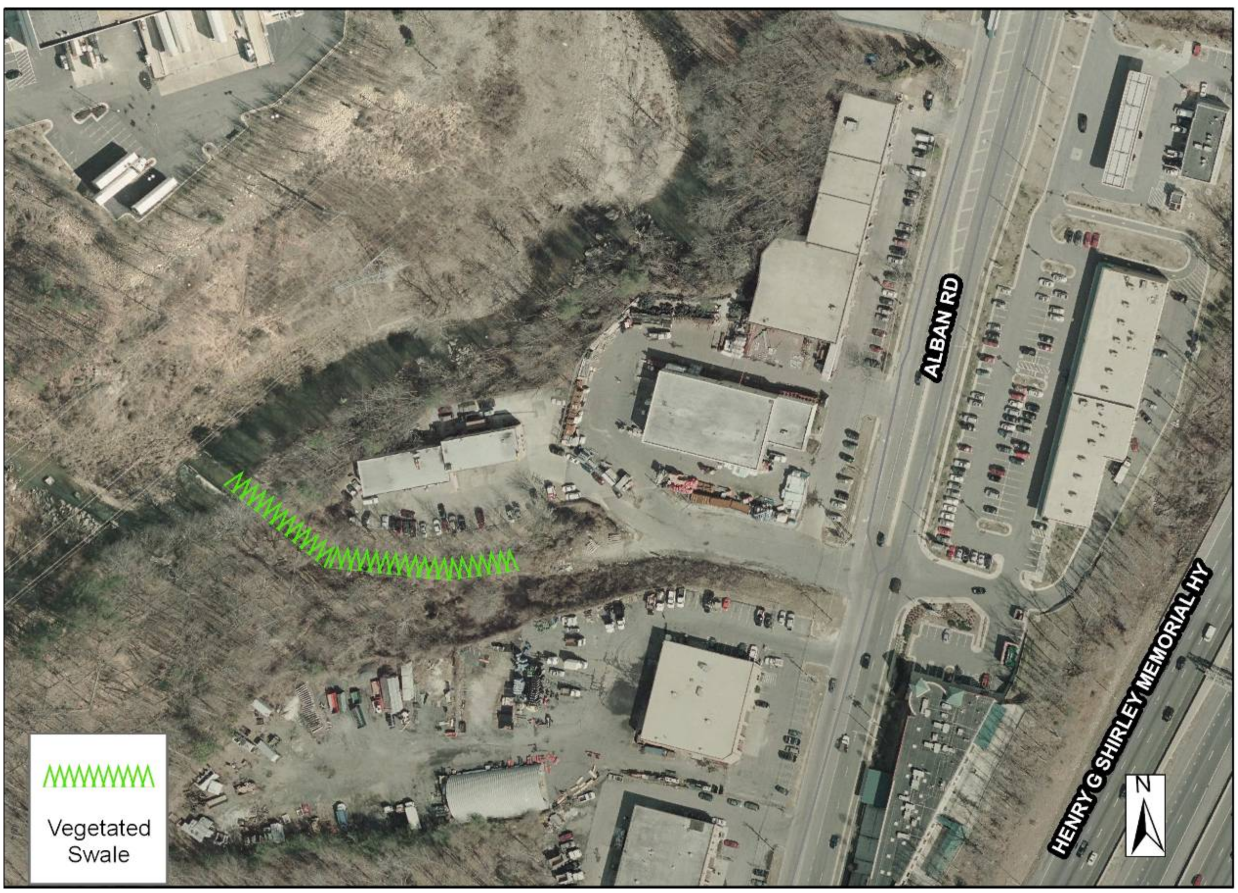
Site photo: Parking lot and bioretention facility location.

AC9512-BMP/LID



Address:	8100A Alban Road
Location:	HRM Automotive
Land Owner:	Private - Industrial
PIN:	0991 01 0003B
Control Type	Water Quality
Drainage Area	26.23 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: The installation of a vegetated swale is proposed to address a severely eroding channel adjacent to the HRM Automotive parking lot. The existing channel discharges directly into Accotink Creek. The proposed project is located next to a recently developed property that includes a detention pond and a stabilized outfall to the eroding channel.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing a vegetated swale in this location will greatly reduce erosion in the channel and sediment loading to Accotink Creek, as well as treating the runoff from the project site through filtration and biological processes. The vegetated swale will stabilize this channel and reduce the chances of property damage due to erosion. It is estimated that an annual total of 1,654 lbs of sediment, 16 lbs of nitrogen, and 2 lbs of phosphorus would be reduced by this project.

Project Design Considerations: Environmental permits may be necessary as the project would be done in a defined channel that is directly connected to Accotink Creek. Access to the site is constrained due to utilities, steep slopes, and a lack of space. These constraints will likely lead to a project design that is not long or wide enough to treat the entire water quality volume, but stabilizing the channel will be a major benefit. The property is privately owned and coordination with the owner/management will be necessary for this project.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Vegetated Swale	321	SY	$150.00	$48,150
			Initial Project Cost	**$48,150**
Ancillary Items	1	LS	5% of project	$2,408
Erosion and Sediment Control	1	LS	10% of project	$4,815
			Base Construction Cost	**$55,373**
			Mobilization (5%)	$2,769
			Subtotal 1	**$58,142**
			Contingency (25%)	$14,536
			Subtotal 2	**$72,678**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$32,705
			Estimated Project Cost	**$106,000**

Site photo: Outfall to existing channel

Site photo: Eroded channel

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AC9514-BMP/LID

Address:	8316-8332 Old Keene Mill
Location:	Cardinal Forest Plaza
Land Owner:	Private - Commercial
PIN:	0793 08 0005D
Control Type	Water Quality
Drainage Area	3.0 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: A bioretention filter is proposed to treat the runoff from from the Cardinal Forest Plaza parking lot located along Old Keene Mill Road. Runoff from the entire parking lot drains south toward Old Keene Mill Road and is discharged off site with no treatment. Based on the topography, it would be possible to intercept this runoff with a bioretention facility and treat the east half of this parking lot.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: This parking lot is likely to exhibit the runoff characteristics typical of heavily used commercial parking lots – high nutrient, oil, and trash discharges, as well as sediment. Implementing a bioretention facility at the downhill end of the parking lot will provide water quality treatment for this parking lot during storm events by intercepting and treating the runoff before it enters the storm drain system. It is estimated that an annual total of 784 lbs of sediment, 9 lbs of nitrogen and 2 lbs of phosphorus would be reduced by this project.

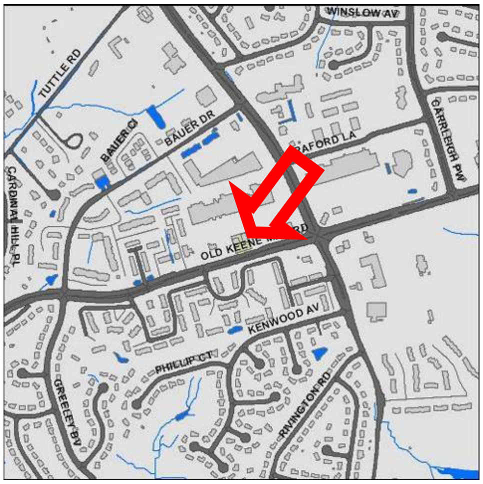
Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from roads and the parking lot. Underground electric lines that service the parking lot lights are likely to present minimal conflicts. As the lot is privately owned, coordination with and cooperation from the shopping center owner and management will be necessary during design.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	432	SY	$150.00	$64,800
			Initial Project Cost	**$64,800**
Ancillary Items	1	LS	5% of project	$3,240
Erosion and Sediment Control	1	LS	10% of project	$6,480
			Base Construction Cost	**$74,520**
			Mobilization (5%)	$3,726
			Subtotal 1	**$78,246**
			Contingency (25%)	$19,562
			Subtotal 2	**$97,808**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$44,014
			Estimated Project Cost	**$142,000**

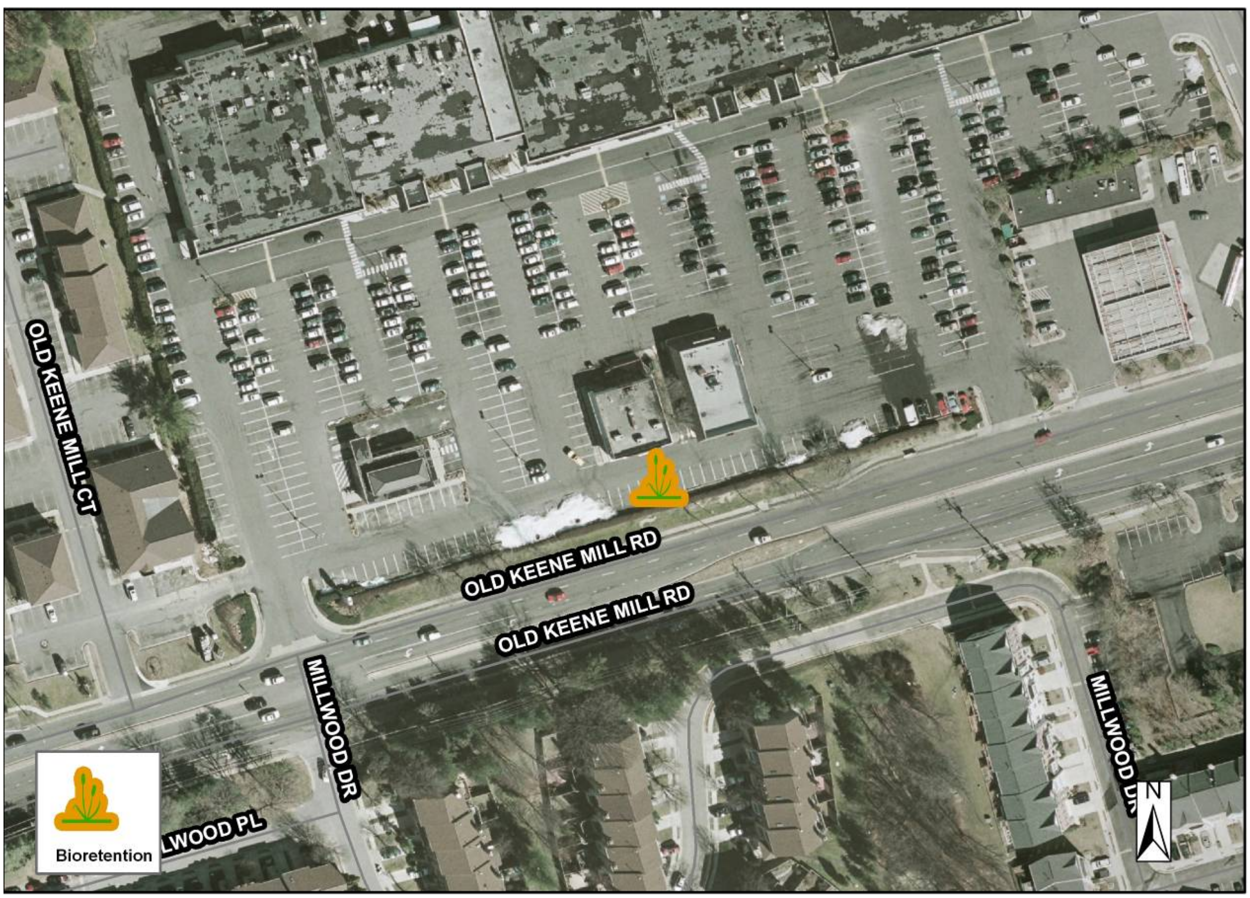
Site photo: Parking lot that could be treated by the bioretention facility.

AC9515-BMP/LID



Address:	8434 Old Keene Mill Road
Location:	Old Keene Mill Shopping Center
Land Owner:	Private - Commercial
PIN:	0793 05 0003A
Control Type	Water Quality
Drainage Area	4.3 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: A bioretention filter is proposed to treat the runoff from the Old Keene Mill Shopping Center parking lot located along Old Keene Mill Road. Runoff from the entire parking lot drains south toward Old Keene Mill Road and is discharged off site with no treatment. The majority of this runoff could be intercepted and treated by a bioretention facility at the south end of the lot.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: The potential for the discharge of pollutants such as sediment, heavy metals, nutrients, trash, and oil, is relatively high in a large parking lot such as this. Implementing a bioretention facility at the downhill end of the parking lot will provide water quality treatment by intercepting and treating the runoff before it enters the storm drain system. It is estimated that an annual total of 1,176 lbs of sediment, 16 lbs of nitrogen and 2 lbs of phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is good from roads and the shopping center parking lot. Underground electric lines that service the parking lot lights and other property uses may present minor conflicts. As the lot is privately owned, coordination with and cooperation from the shopping center owner/management will be necessary for this site.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	619	SY	$150.00	$92,850
			Initial Project Cost	**$92,850**
Ancillary Items	1	LS	5% of project	$4,643
Erosion and Sediment Control	1	LS	10% of project	$9,285
			Base Construction Cost	**$106,778**
			Mobilization (5%)	$5,339
			Subtotal 1	**$112,117**
			Contingency (25%)	$28,029
			Subtotal 2	**$140,146**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$63,066
			Estimated Project Cost	**$204,000**

Site photo: Parking lot runoff could be treated by replacing end parking spaces with a bioretention filter.

AC9529-BMP/LID

Address:	4910 Willet Dr
Location:	Canterbury Woods Elementary School
Land Owner:	County - FCPS
PIN:	0701 01 0005
Control Type	Water Quality
Drainage Area	0.8 acres
Receiving Waters	Unknown tributary of Long Branch Central

Description: This parking lot of this school site drains to several inlets with no stormwater management. While there is limited space in which to implement potential projects, water quality treatment at the inlets is feasible. The proposed project would add two tree box filters in catch basins to the west of the Canterbury Woods Elementary School parking lot to reduce sediment and nutrients in runoff.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing tree box filters will provide water quality benefits, including sediment capture and removal of associated pollutants. The site would also be appropriate for education / outreach signage. It is estimated that an annual total of 187 lbs of sediment, 2 lbs of total nitrogen and one-half lb of total phosphorus would be reduced by this project.

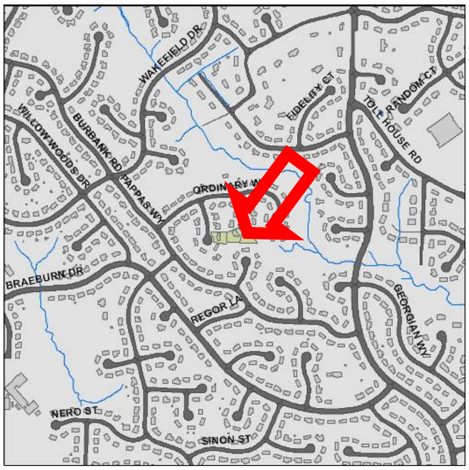
Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from roads and the school's parking lot. Property ownership is public (Fairfax County Public Schools).

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	2	EA	$10,000.00	$20,000
			Initial Project Cost	**$20,000**
Ancillary Items	1	LS	5% of project	$1,000
Erosion and Sediment Control	1	LS	10% of project	$2,000
			Base Construction Cost	**$23,000**
			Mobilization (5%)	$1,150
			Subtotal 1	**$24,150**
			Contingency (25%)	$6,038
			Subtotal 2	**$30,188**
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$13,584
			Estimated Project Cost	**$44,000**

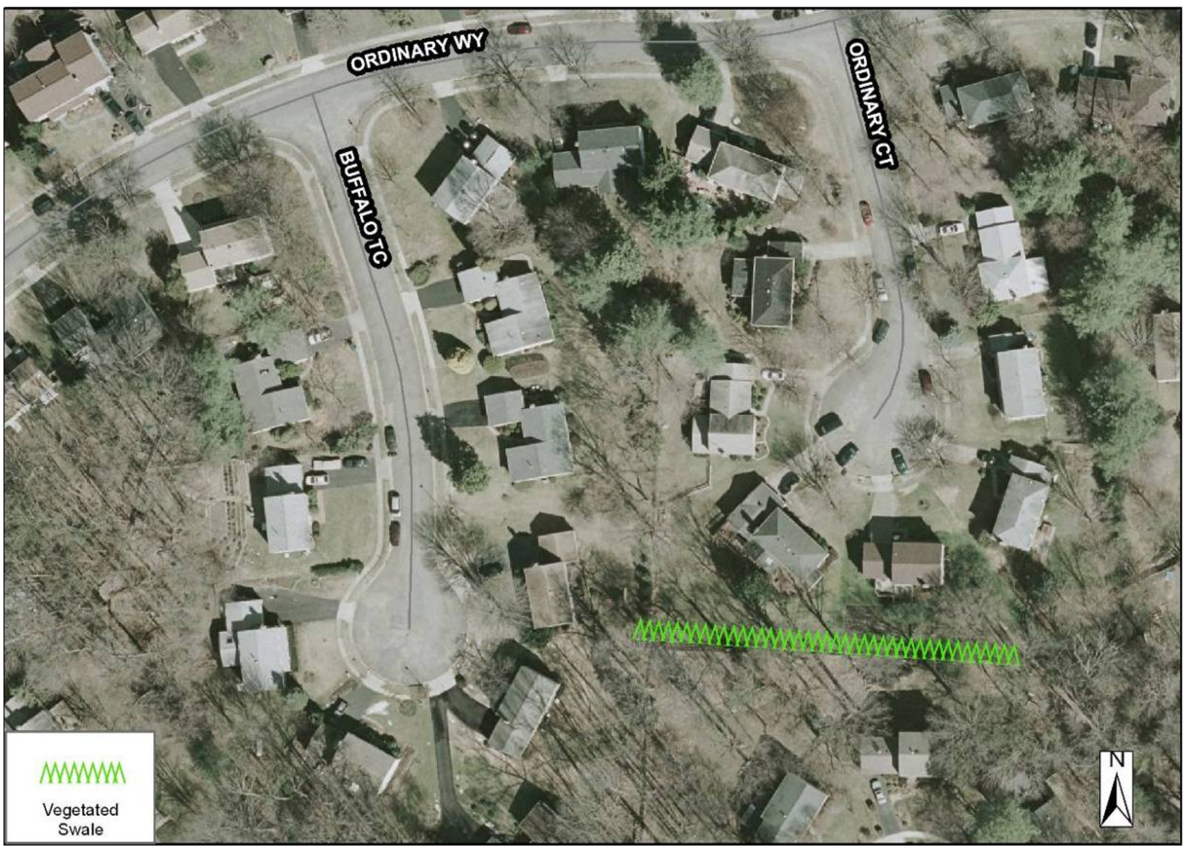
Site photo: Aerial view of inlets to be treated (source: www.bing.com).

AC9535-BMP/LID



Address:	4606 Ordinary Court
Location:	Wakefield Chapel Estates
Land Owner:	Private - Residential
PIN:	0701 21 0022
Control Type	Water Quality
Drainage Area	31.5 acres
Receiving Waters	Unknown tributary of Turkey Run

Description: Installation of a vegetated swale with check dams is proposed to treat runoff flowing behind two residential properties on Ordinary Court. Drainage complaints from the property owners had previously been filed due to backyard flooding. Much of the runoff flowing through the property is from the upstream cul-de-sac. The proposed dry swale will slow and infiltrate runoff and decrease erosion. Further, the upstream drainage area was identified as a target area for individual on-site runoff reduction practices such as homeowner rain gardens or rain barrels.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing the vegetated swale will reduce runoff, decrease erosion, and provide water quality treatment of runoff during storm events. Vegetated swales function similarly to bioretention facilities to remove suspended solids, heavy metals, phosphorus and nitrogen and oil and grease from storm water runoff. It is estimated that an annual total of 2,279 lbs of sediment, 25 lbs of total nitrogen and six lbs of total phosphorus would be reduced by this project.

Project Design Considerations: It is important to note that this project will not eliminate all flooding concerns. In order to address these larger issues, the upstream drainage area must be targeted for the implementation of runoff reduction practices such as the rain barrel outreach program planned for this area (AC9904). No environmental constraints or permitting issues are anticipated. Access to the proposed sites will be challenging since they are located on residential backyards. Property ownership is private and coordination with the homeowners will be necessary. Utilities appear to be present near the proposed project area and should be confirmed prior to final project design.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Vegetated Swale	572	SY	$150.00	$85,800
			Initial Project Cost	**$85,800**
Ancillary Items	1	LS	5% of project	$4,290
Erosion and Sediment Control	1	LS	10% of project	$8,580
			Base Construction Cost	**$98,670**
			Mobilization (5%)	$4,934
			Subtotal 1	**$103,604**
			Contingency (25%)	$25,901
			Subtotal 2	**$129,504**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$58,277
			Estimated Project Cost	**$188,000**

Site photo: Aerial view of site for vegetated swale (source: www.bing.com).

AC9538-BMP/LID

Address:	4001 Wakefield Chapel Road
Location:	Northern Virginia Community College parking lot
Land Owner:	State
PIN:	0593 01 0020
Control Type	Water Quality
Drainage Area	8.2 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This project proposes conversion of three existing dry ponds at Northern Virginia Community College. The dry ponds would be converted to bioretention filters to increase water quality treatment at the site. The bottom of the existing ponds would be excavated and the outlets modified to increase the amount of runoff treatment.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing these bioretention facilities would provide water quality treatment for a portion of the parking lot. Bioretention facilities remove suspended solids, heavy metals, phosphorus and nitrogen and hydrocarbons from storm water; pollutants that are typically found in parking lot runoff. Further, bioretention facilities prevent trash and debris from entering the storm drain system and have the ability to cool down warm runoff before it enters the stream system. In addition, the location of this project on the community college campus may provide significant educational benefits. Signs can be placed nearby to educate students, faculty and visitors about the project and the environmental benefits. It is estimated that an annual total of 1,055 lbs of sediment, 11 lbs of total nitrogen and 3 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated at this site. Access to the proposed sites is excellent through the parking lots. Property ownership is public but coordination with the college will be necessary. Construction during the summer months or during semester breaks would be preferred. Utility constraints are unlikely but the location of all utilities in close proximity to the proposed locations should be confirmed.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	1181	SY	$150.00	$177,150
			Initial Project Cost	**$177,150**
Ancillary Items	1	LS	5% of project	$8,858
Erosion and Sediment Control	1	LS	10% of project	$17,715
			Base Construction Cost	**$203,723**
			Mobilization (5%)	$10,186
			Subtotal 1	$213,909
			Contingency (25%)	$53,477
			Subtotal 2	$267,386
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$120,324
			Estimated Project Cost	**$388,000**

Site photo: Existing dry pond located in a parking island in the site parking lot.

Site photo: Another existing dry pond located in a parking island..

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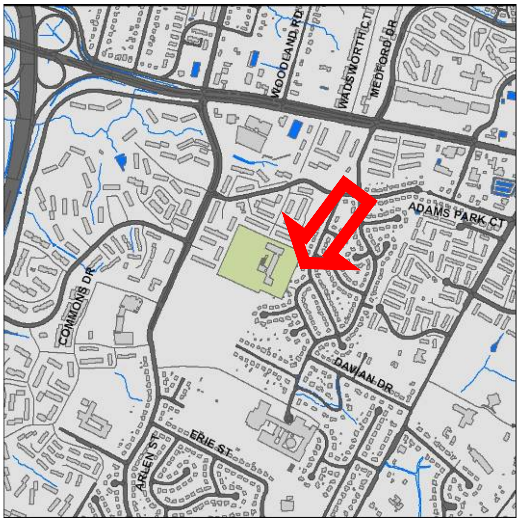
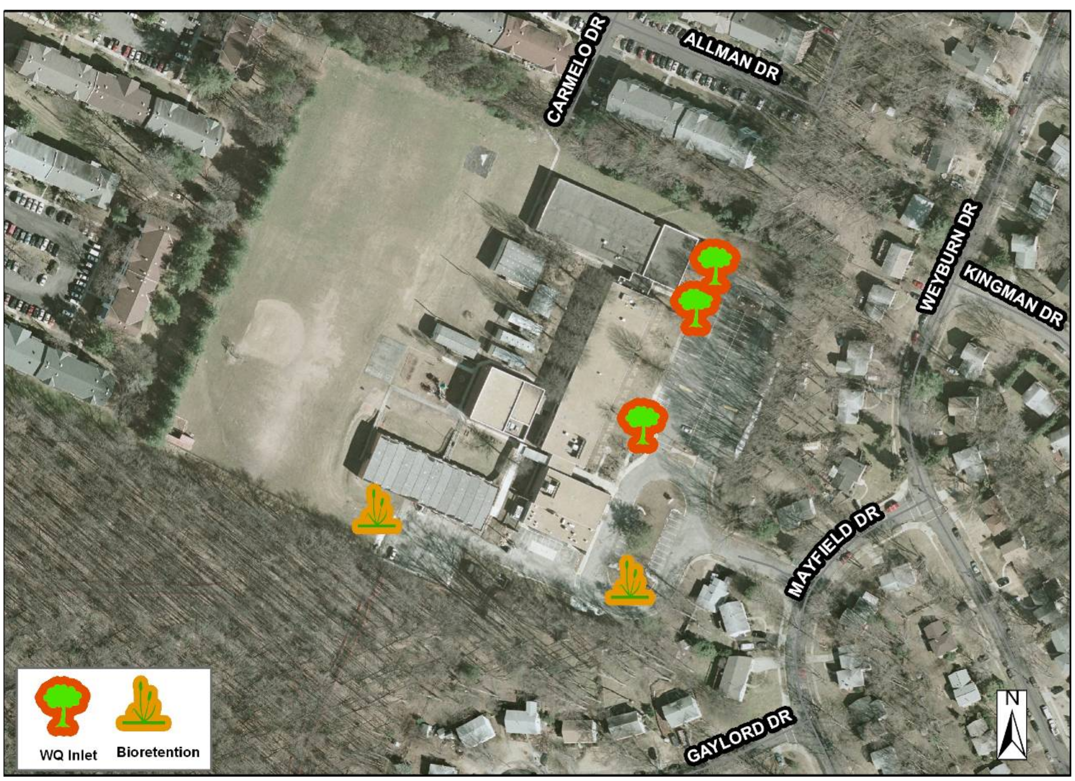
AC9539-BMP/LID



Address:	7604 Herald Street
Location:	Annandale Terrace Elementary School
Land Owner:	County - FCPS
PIN:	0711 01 0072C
Control Type	Water Quality
Drainage Area	1.1 acres (AC9539A) 0.72 acres (AC9539B)
Receiving Waters	Unknown tributary of Accotink Creek

Description: Installation of two bioretention basins for project AC9539A and three tree box filters for project AC9539B are proposed to treat the parking lot runoff from the Annandale Terrace Elementary School. Currently there are no existing stormwater management practices at the site and runoff flows directly into the storm drain system. Sediment deposition in the parking lot was observed.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: The project will provide water quality treatment for the two school parking lots during storm events. Moderate sedimentation was observed from impervious areas at the site and sediment deposition was evident in and around existing storm drain inlets. Bioretention and tree box filter retrofits will help to capture sediment and prevent it from entering the storm drain system. In addition, the location of these projects on school grounds may provide significant educational benefits. Signage can be placed to educate nearby residents on the project and the environmental benefits. It is estimated that an annual total of 223 lbs of sediment, two lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent through the parking lot and around the building. Property ownership is public but coordination with the elementary school will be necessary for this site. Construction during the summer months would be preferred.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	158	SY	$150.00	$23,700
Tree Box Filters	3	EA	$10,000.00	$30,000
			Initial Project Cost	**$53,700**
Ancillary Items	1	LS	5% of project	$2,685
Erosion and Sediment Control	1	LS	10% of project	$5,370
			Base Construction Cost	**$61,755**
			Mobilization (5%)	$3,088
			Subtotal 1	**$64,843**
			Contingency (25%)	$16,211
			Subtotal 2	**$81,053**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$36,474
			Estimated Project Cost	**$118,000**

Site photo: Proposed location for a tree box filter to capture and treat parking lot runoff.

Site photo: Proposed location for a bioretention area to capture and treat parking lot runoff.

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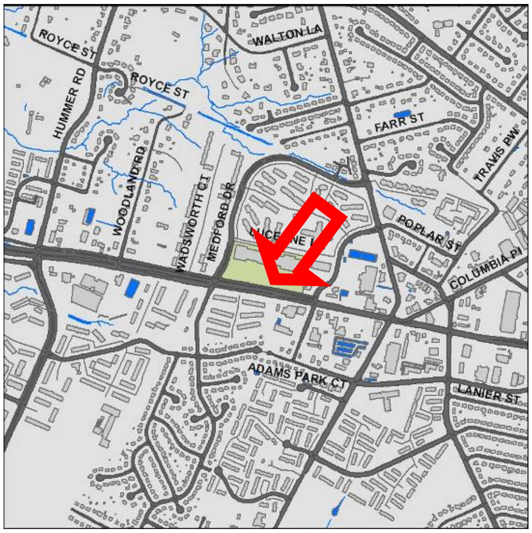
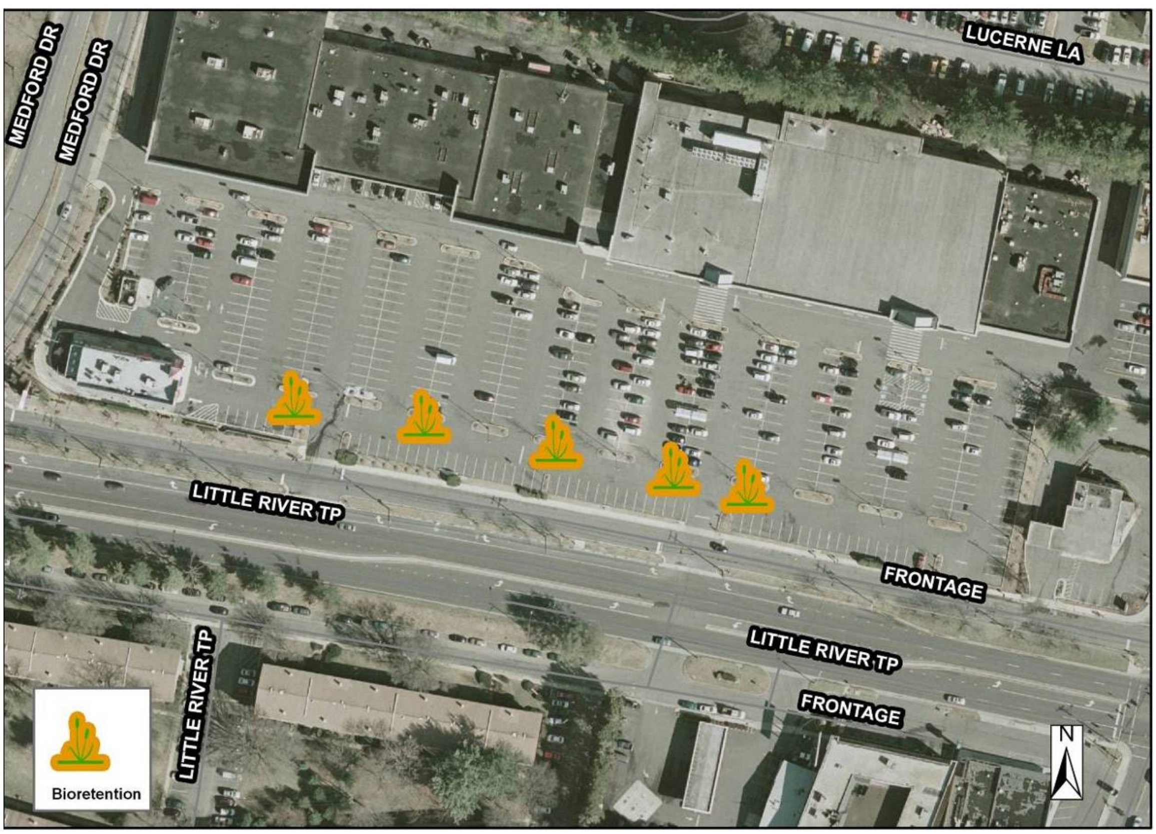
AC9541-BMP/LID



Address:	7450 Little River Turnpike
Location:	Little River Shopping Center
Land Owner:	Private - Commercial
PIN:	0711 20 0006
Control Type	Water Quality
Drainage Area	2.1 ac
Receiving Waters	Unknown tributary of Accotink Creek

Description: Bioretention filters are proposed to treat the runoff from the parking lot of the Little River Shopping Center on Little River Turnpike. The bioretention facilities would be located at the five existing landscaped islands. Underdrains for the facilities would be tied into the existing stormwater infrastructure on the site.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing bioretention facilities will provide water quality treatment for the parking lot during storm events. Bioretention facilities remove suspended solids, heavy metals, phosphorus and nitrogen and hydrocarbons from storm water runoff. These are all pollutants that are typically found in parking lot runoff. Further, bioretention facilities prevent trash and debris from entering the storm drain system and have the ability to cool down warm runoff before it enters the stream system. It is estimated that an annual total of 573 lbs of sediment, eight lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from the parking lot. Property ownership is private and coordination with the shopping center owner/management will be necessary for these sites. Some reduction in parking spaces can be expected with these sites during construction. Utility constraints on the site are unlikely but the location of all utilities in close proximity to the proposed locations should be confirmed.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	303	SY	$150.00	$45,450
			Initial Project Cost	**$45,450**
Ancillary Items	1	LS	5% of project	$2,273
Erosion and Sediment Control	1	LS	10% of project	$4,545
			Base Construction Cost	**$52,268**
			Mobilization (5%)	$2,613
			Subtotal 1	**$54,881**
			Contingency (25%)	$13,720
			Subtotal 2	**$68,601**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$30,870
			Estimated Project Cost	**$100,000**

Site photo: Existing storm drain on site.

Site photo: Business complex located off Heritage Drive.

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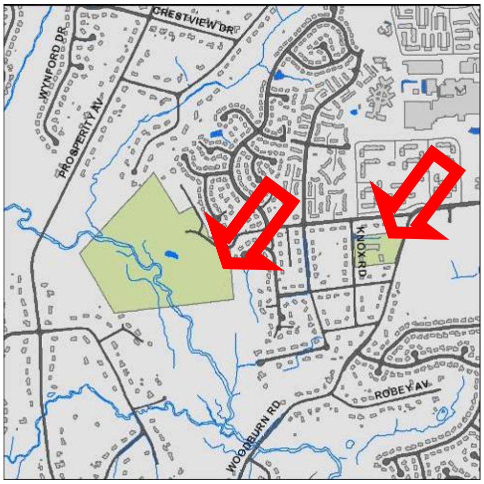
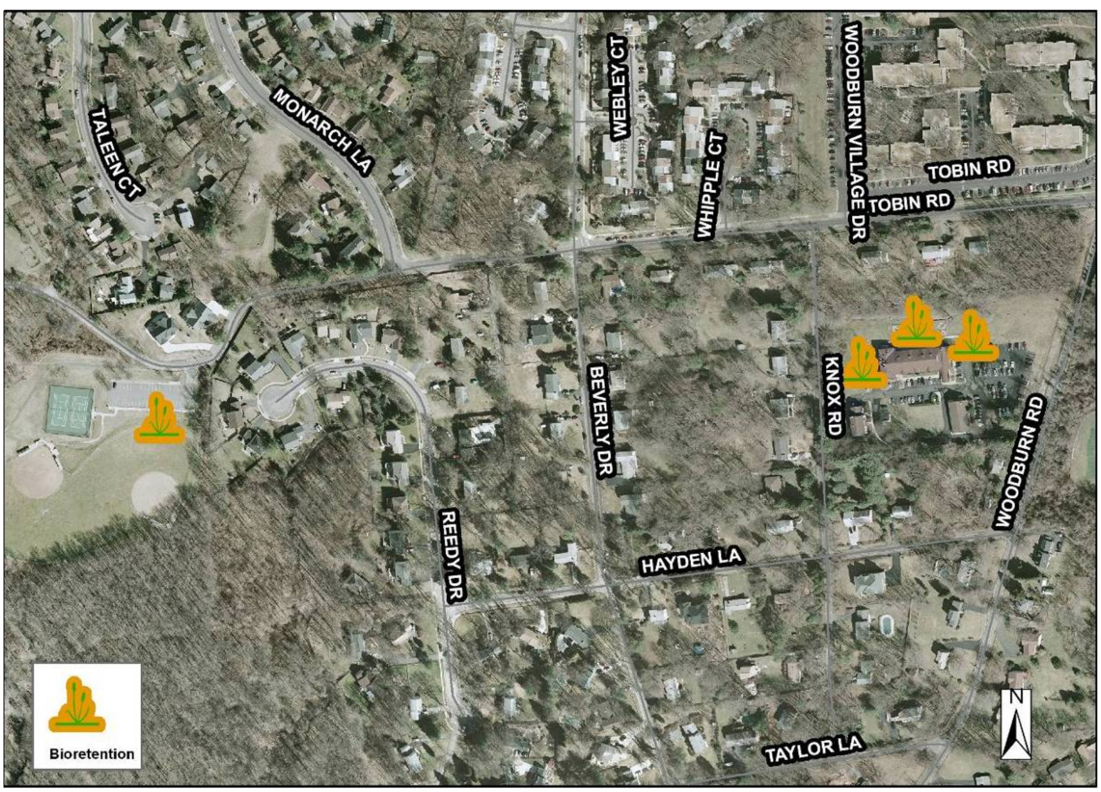
AC9545-BMP/LID



Address:	8515 Tobin Road And 3406 Woodburn Road
Location:	Eakin Park / Church parking lot
Land Owner:	County – FCPA / Private
PIN:	0591 01 0005 0591 01 0021
Control Type	Water Quality
Drainage Area	AC9545A-0.22 acres AC9545B-1.1 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: A bioretention basin is proposed for project AC9545A to treat the runoff from a parking lot in Eakin Park. The bioretention facility would be located between the parking lot and the outfield of a baseball diamond.

Bioretention basins are also proposed for project AC9545B to treat the runoff from a church parking lot located along Woodburn Road. In addition, roof drains from the church currently flow to a ditch and are causing severe erosion; a third bioretention facility is proposed to treat this rooftop runoff



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Implementing the bioretention facility for project AC9545A will provide water quality treatment for this parking lot during storm events, removing pollutants such as sediment, nutrients, and hydrocarbons. This site can also provide public educational opportunities for park users and would be an excellent demonstration project.

Implementing AC9545B will provide water quality treatment for the church parking lot during storm events. Bioretention facilities remove suspended solids, heavy metals, phosphorus and nitrogen, and oil and grease from storm water runoff. Bioretention facilities can also reduce runoff and may alleviate excessive erosion and headcutting in the ditch behind the church. The project also provides public education benefits.

It is estimated that an annual total of 164 lbs of sediment, one lb of total nitrogen and one-third lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated for project AC9545A Access to the proposed sites is excellent from roads and the parking lot. Property ownership is public so coordination should not be a problem. Sewer utilities are present and should be accurately located before the project is initiated. In order to bypass the existing storm drain inlet, curb cuts and trench drains through the existing sidewalk will need to be installed on either side of the inlet to allow stormwater to flow into the practice.

There are also no environmental constraints or permitting issues anticipated for project AC9545B. Access to the proposed sites is excellent from roads and the parking lot. Property ownership is most likely private and coordination with the church management will be necessary for these sites. Utilities are present in the project area and should be accurately located during design..

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	32	SY	$150.00	$35,700
			Initial Project Cost	**$35,700**
Ancillary Items	1	LS	5% of project	$1,785
Erosion and Sediment Control	1	LS	10% of project	$3,570
			Base Construction Cost	**$41,055**
			Mobilization (5%)	$2,053
			Subtotal 1	**$43,108**
			Contingency (25%)	$10,777
			Subtotal 2	**$53,885**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$24,248
			Estimated Project Cost	**$79,000**

Site photo: Bioretention filter project location for AC9545A.

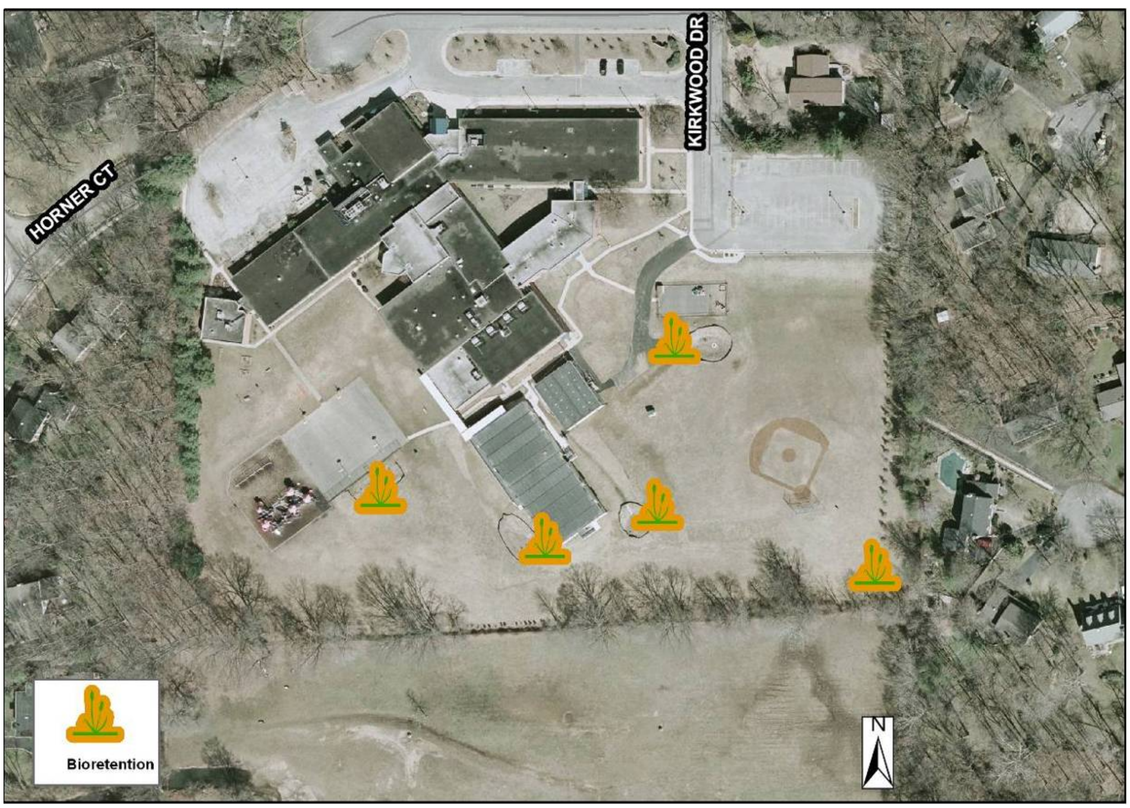
Site photo: Site photo: Bioretention facility project location for project AC9545B.


Site photo: Erosion and headcutting caused by roof drains.

AC9546-BMP/LID

Address:	9107 Horner Court
Location:	Mantua Elementary School
Land Owner:	County - FCPS
PIN:	0582 01 0002
Control Type	Water Quality
Drainage Area	4.5 acres
Receiving Waters	Crook Branch

Description: Four bioretention filters have been installed on the Mantua Elementary School property. These existing facilities are not functioning as optimally as they could due to a lack of vegetative cover and unstable banks. These sites are candidates for additional amendments to bring them to demonstration quality in this public location. As part of the overall project one additional location for a bioretention filter was noted at an outfall on the southeast portion of the property.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Existing bioretention filters at the site are providing some water quality benefit but need vegetation and soil stabilization amendments in order to function more effectively. Bioretention sites will provide greater water quality treatment for several parking lots during storm events by removing suspended solids, heavy metals, nutrients including phosphorus and nitrogen, oil and grease from storm water runoff. The project site has the potential to be a high quality demonstration project and outreach opportunity by upgrading the existing practices. It is estimated that an annual total of 483 lbs of sediment, six lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from existing paved surfaces. Property ownership is public .

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	583	SY	$75.00	$43,725
Organic Compost Soil Amendments	146	CY	$40.00	$5,840
			Initial Project Cost	**$49,565**
Ancillary Items	1	LS	5% of project	$2,478
Erosion and Sediment Control	1	LS	10% of project	$4,957
			Base Construction Cost	**$57,000**
			Mobilization (5%)	$2,850
			Subtotal 1	$59,850
			Contingency (25%)	$14,963
			Subtotal 2	$74,813
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$33,666
			Estimated Project Cost	**$109,000**

Note: Cost for bioretention facilities estimated at 50% of typical costs, since most of the project involves rehabilitation rather than full construction.

Site photo: Existing bioretention filter in need of amendments.

Si

te photo: Existing outfall on project site.

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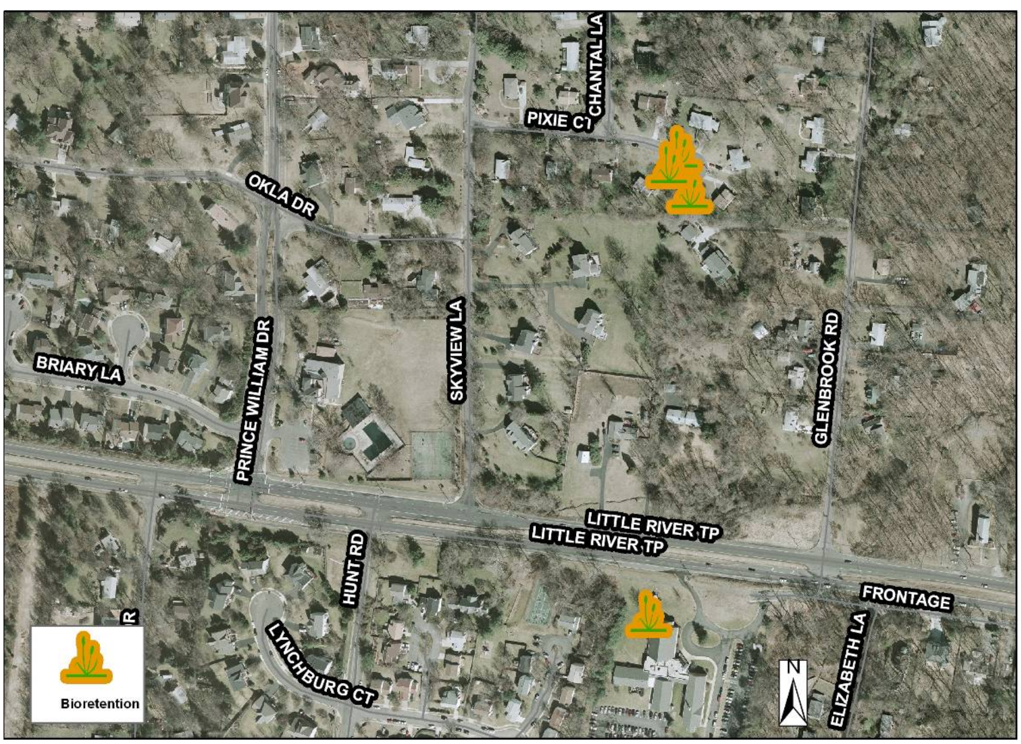
AC9547-BMP/LID

Address:	9019 Little River Turnpike / Pixie Court
Location:	Providence Presbyterian Church / Pixie Court
Land Owner:	Private / State - VDOT
PIN:	0584 01 0001 0584 17 0005
Control Type	Water Quality
Drainage Area	AC9547A-0.61 acres AC9547B-1.7 acres
Receiving Waters	Unknown tributary of Crook Branch

Description: This project would add bioretention facilities to two separate sites; one along Little River Turnpike and the second at the Pixie Court cul-de-sac. Installing a bioretention filter with associated disconnection of downspouts is proposed to treat stormwater runoff at Providence Presbyterian Church for project AC9547A.

Curb extension bioretention filters and basins are proposed for installation in the Pixie Court cul-de-sac for project AC9547B. Runoff from Pixie Court currently flows through the cul-de-sac and into a storm drain inlet. The runoff is eventually discharged to a small eroded creek. No real opportunity for stormwater retrofitting exists at the outlet of the pipe. Instead, the best opportunity is to treat the runoff before it enters the inlet with three bioretention facilities at the curb.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: For Project AC9547A at the Providence Presbyterian Church disconnecting downspouts and implementing a bioretention facility to receive runoff from the disconnected downspouts will provide water quality treatment for a portion of the church property, removing pollutants and reducing runoff volumes. The project's location at a church may also provide educational opportunities at the site.

For project AC9547B, implementing bioretention facilities will provide water quality treatment for Pixie Ct. during storm events, removing pollutants such as sediment, nutrients, and oils. In addition, by collecting and treating this runoff before it is discharged to the stream, erosive forces on the stream may be reduced. It is estimated that an annual total of 836 lbs of sediment, ten lbs of total nitrogen and two lbs of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated for project AC9547A. Access to the proposed site is good, although recent construction at the church will need to be avoided and may affect placement of the facility. As the property is privately owned, cooperation with Providence Presbyterian Church will be necessary.

There are also no environmental constraints or permitting issues anticipated for project AC9547B. Access to the proposed site is excellent from Pixie Court. The area to be disturbed by construction of the bioretention facilities is in the street itself, so property ownership will not be an issue, however, consultation with the adjacent homeowners would be beneficial. Pavement cuts beyond the footprint of the facilities will be necessary to connect the underdrain to the storm drain system. Utility conflicts, including house connections for sanitary sewer, water, and gas services, are likely to be present and may constrain the design of these facilities.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	44	SY	$150.00	$43,350
			Initial Project Cost	**$43,350**
Ancillary Items	1	LS	5% of project	$2,168
Erosion and Sediment Control	1	LS	10% of project	$4,335
			Base Construction Cost	**$49,853**
			Mobilization (5%)	$2,493
			Subtotal 1	**$52,345**
			Contingency (25%)	$13,086
			Subtotal 2	**$65,431**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$29,444
			Estimated Project Cost	**$95,000**


Site photo: Connected downspouts at the church for project AC9547A


Site photo: Cul-de-sac with space for curb extension at site AC9547B

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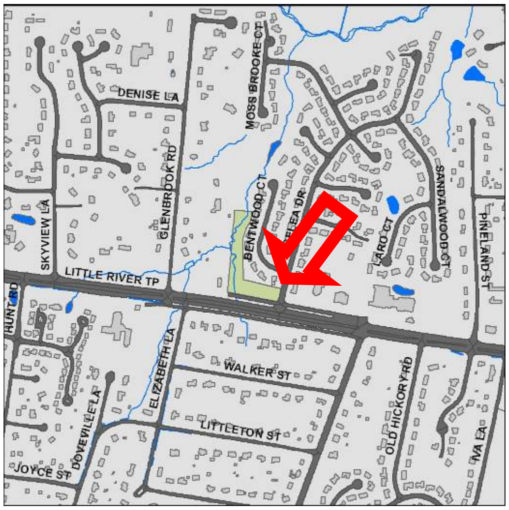
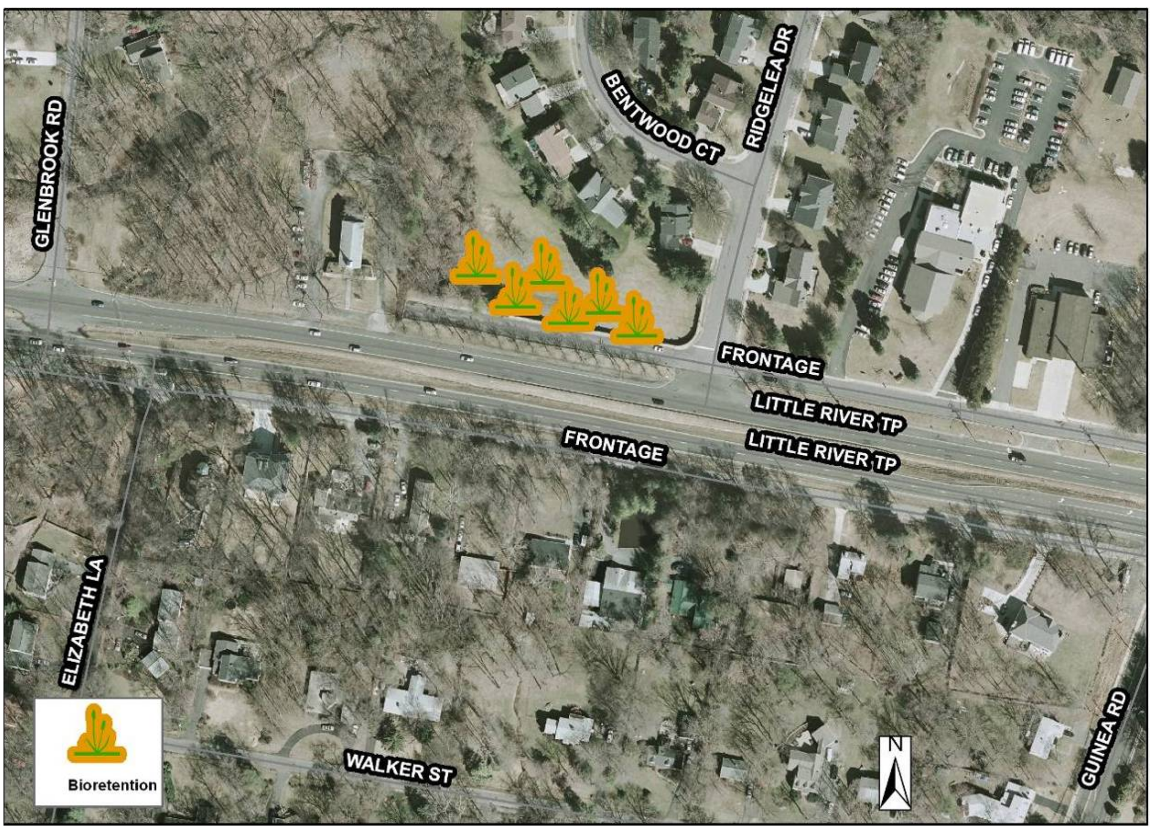
AC9548-BMP/LID



Address:	8930 Little River Turnpike
Location:	Frontage Road
Land Owner:	Private
PIN:	0584 28 E
Control Type	Water Quality
Drainage Area	28.0 acres
Receiving Waters	Unknown tributary of Crook Branch

Description: Bioretention filters are proposed to treat runoff from Little River Turnpike and the adjacent Frontage Road near Ridgelea Drive. Given the large drainage area, this project will require a flow splitter to divert water from the main channel to the proposed bioretention cells. The project will be sited in open space next to Frontage Road on property owned by a homeowner association. The drainage area currently collects stormwater from residential, commercial and roadway runoff from Little River Turnpike.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Bioretention filters will provide water quality treatment for neighborhood, commercial sites and roadway runoff during storm events. Use of the flow splitter will create an offline bioretention system to remove pollutants including suspended solids, heavy metals, nutrients, and oil and grease. Larger flows will bypass the facilities entirely in the existing channel, reducing the chance for failure or damage. It is estimated that an annual total of 1,643 lbs of sediment, 18 lbs of total nitrogen and three lbs of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from paved surfaces. Property ownership is private through the local homeowner association and coordination with the owner / management will be necessary. Minimal tree removal at the periphery of the site may be required. Infiltration capacity of the soils should be further assessed and utilities should be identified as part of the design process.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	1210	SY	$150.00	$181,500
			Initial Project Cost	**$181,500**
Ancillary Items	1	LS	5% of project	$9,075
Erosion and Sediment Control	1	LS	10% of project	$18,150
			Base Construction Cost	**$208,725**
			Mobilization (5%)	$10,436
			Subtotal 1	**$219,161**
			Contingency (25%)	$54,790
			Subtotal 2	**$273,952**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$123,278
			Estimated Project Cost	**$398,000**

Site photo: Outfall to project area

Site photo: Project area viewed from Frontage Road.

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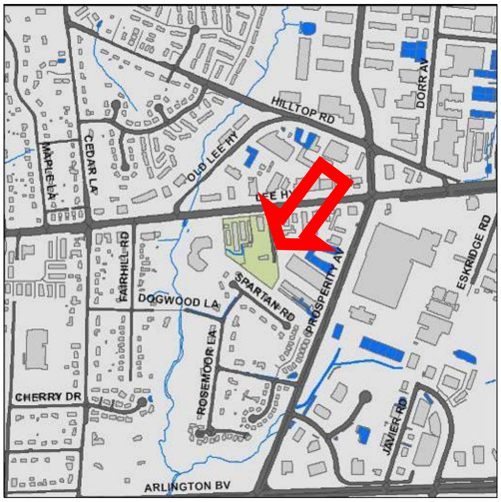
AC9550-BMP/LID



Address:	8505 Lee Highway
Location:	Industry Lane and Lee Highway
Land Owner:	Private - Industrial
PIN:	0493 01 0050A
Control Type	Water Quality
Drainage Area	AC9550A: 1.7 acres AC9550B: 2.1 acres
Receiving Waters	Long Branch North

Description: Multiple practices are proposed on these industrial properties adjacent to Lee Highway. Installation of two tree box filters and a sand filter is proposed at site AC9550A. A vegetated swale that would replace the existing concrete swale is proposed at site AC9550B.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: Adding tree box filters and a sand filter will provide water quality treatment for site AC9550A, removing sediment, heavy metals, nutrients and oils from the site, which is a likely hotspot for these pollutants. A vegetated swale will provide significant water quality improvements over the existing concrete channel at site AC9550B. It is estimated that an annual total of 1,134 lbs of sediment, seven lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites will be constrained, due to tight spaces on the properties. As the properties are privately owned, consultation and cooperation with the property owners will be necessary. The depth of the existing storm drain system may affect how well the sand filter and vegetated swale can be implemented.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Tree Box Filters	2	EA	$10,000.00	$20,000
Sand Filter	1634	CF*	$65.00	$106,210
Vegetated Swale	267	SY	$150.00	$40,050
			Initial Project Cost	**$166,260**
Ancillary Items	1	LS	5% of project	$8,313
Erosion and Sediment Control	1	LS	10% of project	$16,626
			Base Construction Cost	**$191,199**
			Mobilization (5%)	$9,560
			Subtotal 1	**$200,759**
			Contingency (25%)	$50,190
			Subtotal 2	**$250,949**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$112,927
			Estimated Project Cost	**$364,000**

*Note: Sand Filter line item is given based on $65/cf of runoff treated, rather than the actual size of the project installation.

Site photo: AC9550A, near location of proposed sand filter.

Site photo: AC9550B, concrete channel to be replaced with a vegetated swale.

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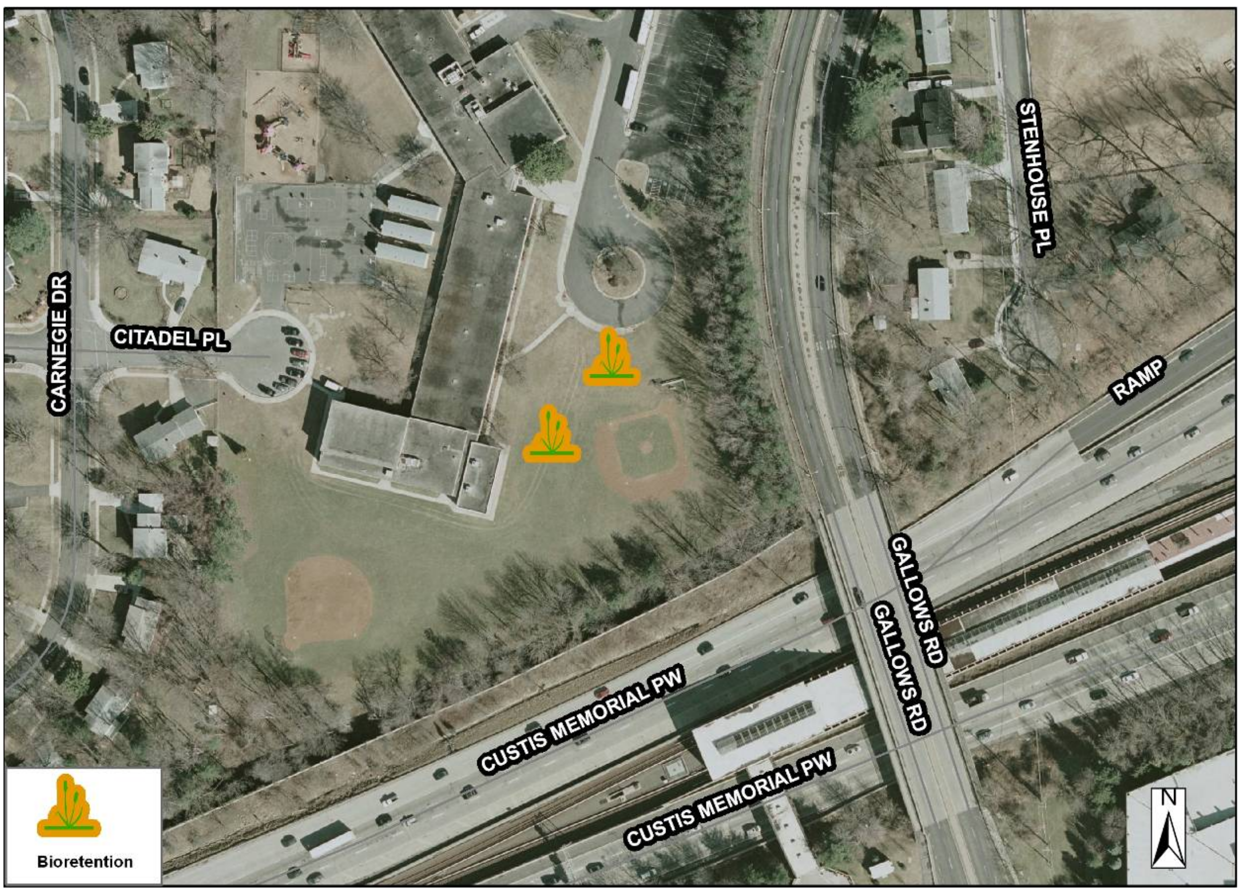
AC9551-BMP/LID

Address:	80526 Gallows Road
Location:	Stenwood Elementary School
Land Owner:	County - FCPS
PIN:	0492 01 0012
Control Type	Water Quality
Drainage Area	1.5 acres
Receiving Waters	Unknown tributary of Long Branch North

Description: Two bioretention filters or basins are proposed to treat the runoff from the rooftop and parking area of Stenwood Elementary School. Runoff from the parking area and rooftop is currently conveyed directly to the storm drain system. Disconnection and routing to the bioretention facilities would allow for water quality treatment before the runoff enters the stream system.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Bioretention facilities will provide water quality treatment for the rooftop and parking area during storm events. Bioretention facilities remove sediment, trash, nutrients, and oil and grease from storm water runoff. The location of the project could provide educational opportunities for the students of Stenwood Elementary. It is estimated that an annual total of 302 lbs of sediment, three lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from the adjacent parking lot, although the location of the baseball diamond nearby may constrain either the design or access to the project. As the site is a school, coordination and cooperation with the school district will be necessary for these sites. In order to treat the runoff from the parking area, curb cuts will be necessary to bypass the existing catch basin. To treat runoff from the rooftop, the internal downspouts will need to be disconnected from the catch basin and directed into the bioretention facility.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	151	SY	$150.00	$22,650
			Initial Project Cost	**$22,650**
Ancillary Items	1	LS	5% of project	$1,133
Erosion and Sediment Control	1	LS	10% of project	$2,265
			Base Construction Cost	**$26,048**
			Mobilization (5%)	$1,302
			Subtotal 1	**$27,350**
			Contingency (25%)	$6,837
			Subtotal 2	**$34,187**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$15,384
			Estimated Project Cost	**$50,000**

Site photo: Catch basin In parking area and bioretention facility location.

Site photo: Catch basin in field that includes rooftop connections.

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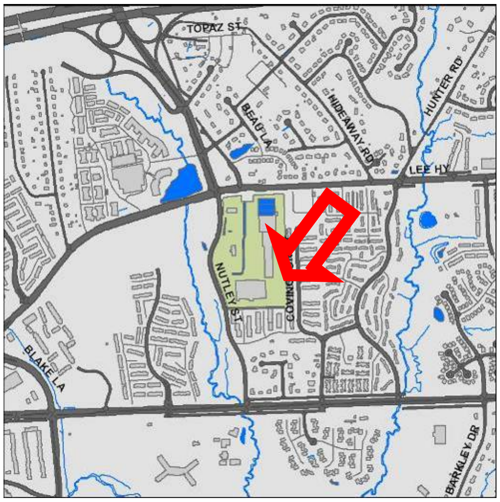
AC9553-BMP/LID



Address:	3091 Nutley Sreet
Location:	Panam Shopping Center
Land Owner:	Private
PIN:	0484 01 0012F
Control Type	Water Quality
Drainage Area	3.4 acres
Receiving Waters	Hunters Branch

Description: A series of tree box filters and bioretention basins are proposed to treat the runoff from the Panam Shopping Center parking lot located along Nutley Street and Lee Highway. The facilities will be installed adjacent to storm drain inlets at existing parking medians and along the vegetated area on the west side of the lot. An underdrain will be installed and the existing stormwater infrastructure will be used for overflow.

Project Area Map: Conceptual plan showing potential project location

Project Benefits: These BMP/LID facilities will provide water quality treatment for this parking lot during storm events. Bioretention facilities remove suspended solids, heavy metals, phosphorus and nitrogen and oil and grease from storm water runoff. They also prevent trash and debris from entering the storm drain system and have the ability to cool down warm runoff before it enters the stream system. It is estimated that an annual total of 878 lbs of sediment, ten lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Utilities are present in the project area and should be accounted for in the project design. Access to the proposed sites is excellent from roads and the commercial parking lot. Property ownership is private and coordination with the shopping center owner/management will be necessary.

Costs:

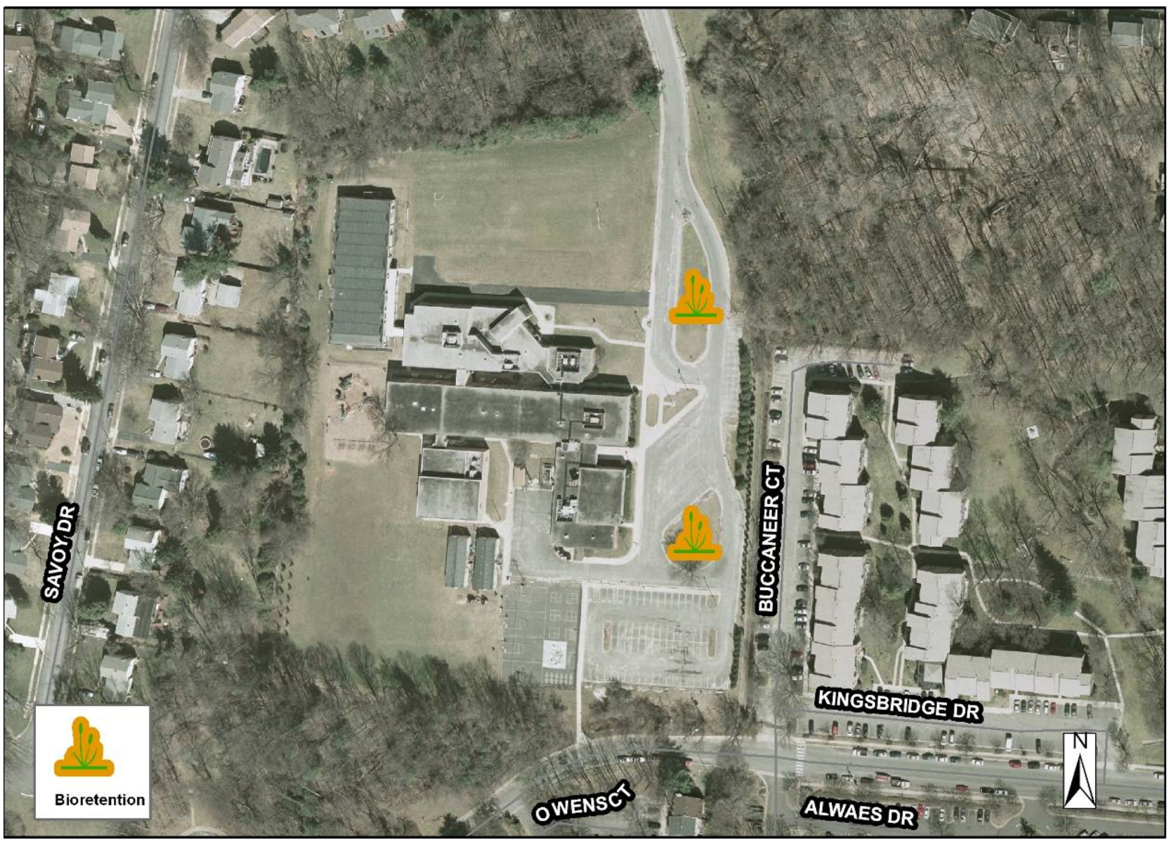
Tree Box Filters	5	EA	$10,000.00	$50,000
Bioretention Filter and Basin	591	SY	$150.00	$88,650
			Initial Project Costs	**$138,650**
Ancillary Items	1	LS	5% of Project	$6,933
Erosion and Sediment Control	1	LS	10% of Project	$13,865
			Base Construction Costs	**$159,448**
			Mobilization (5%)	$7,972
			Subtotal 1	$167,420
			Contingency (25%)	$41,855
			Subtotal 2	$209,275
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$94,174
			Estimated Project Cost	**$304,000**

Site photo: Potential tree box filter location.

AC9558-BMP/LID

Address:	9819 Five Oaks Road
Location:	Mosby Woods Elementary School
Land Owner:	County - FCPS
PIN:	0483 01 0016
Control Type	Water Quality
Drainage Area	2.1 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: This project proposes to install two bioretention facilities to treat a portion of the parking lot at the Mosby Woods School. Implementation would involve installing curb cuts in existing islands to allow runoff to bypass the storm drains and flow to the new bioretention facilities in the islands. The location provides excellent educational demonstration opportunities for the students of Mosby Woods Elementary School.



Site Photo: Parking lot island where bioretention facilities can be located.

Project Benefits: Implementing the proposed bioretention facilities will provide water quality treatment for the parking lot during storm events and remove sediment, heavy metal, nutrients and hydrocarbon pollutants. The location of the project at a public school will promote experiential learning opportunities for both students and the general public. It is estimated that an annual total of 285 lbs of sediment, four lbs of total nitrogen and one lb of total phosphorus would be reduced by this project.

Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from roads and the school parking lot. Property ownership is public, but coordination with the school district will be necessary.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filter and Basin	303	SY	$150.00	$45,450
			Initial Project Cost	**$45,450**
Ancillary Items	1	LS	5% of project	$2,273
Erosion and Sediment Control	1	LS	10% of project	$4,545
			Base Construction Cost	**$52,268**
			Mobilization (5%)	$2,613
			Subtotal 1	**$54,881**
			Contingency (25%)	$13,720
			Subtotal 2	**$68,601**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$30,870
			Estimated Project Cost	**$100,000**

Site Photo: Parking lot island where bioretention facilities can be located.

Site Photo: Parking lot island where bioretention facilities can be located.

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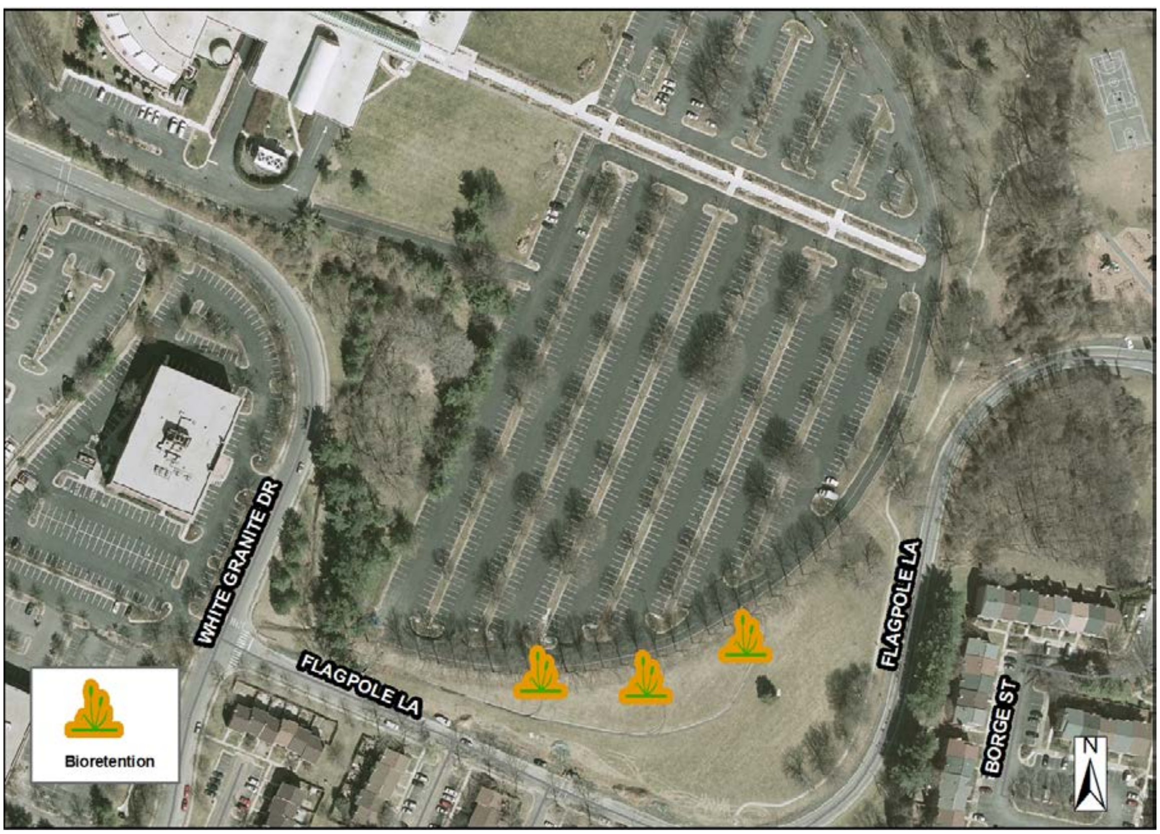
AC9562-BMP/LID

Address:	3033 Chain Bridge Road
Location:	AT&T office building
Land Owner:	Private - Commercial
PIN:	0472 01 0058
Control Type	Water Quality
Drainage Area	7.3 acres
Receiving Waters	Unknown tributary of Accotink Creek

Description: A series of bioretention filters and basins is proposed to treat runoff from the AT&T building and parking lot on Chain Bridge Road. Currently, the parking area drains through three outfalls to a dry pond with a concrete channel located in an open grass field at the south end of the parking lot. There is sufficient space at the inflows to the pond to create bioretention facilities to pre-treat runoff for water quality and maintain the existing detention characteristics of the pond.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Currently, runoff is treated in a dry pond that provides no significant water quality treatment. Adding bioretention facilities will improve water quality treatment for the office complex during storm events by removing sediment, heavy metals, oil and nutrients from the runoff. It is estimated that an annual total of 1,917 lbs of sediment, 21 lbs of total nitrogen and three lbs of total phosphorus would be reduced by this project.

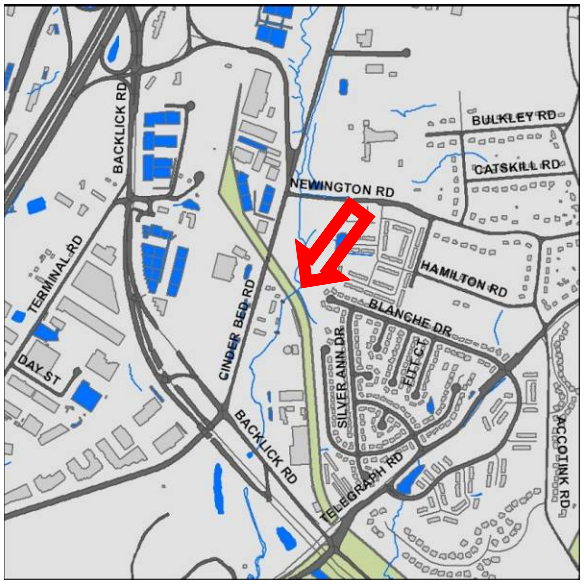
Project Design Considerations: No environmental constraints or permitting issues are anticipated. Access to the proposed sites is excellent from adjacent roads. As the property is privately owned, coordination with the owner/management will be necessary. Construction will cause negligible impacts to the use of the property and no loss of parking is anticipated.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Bioretention Filters and Basins	999	SY	$150.00	$149,850
			Initial Project Cost	**$149,850**
Ancillary Items	1	LS	5% of project	$7,493
Erosion and Sediment Control	1	LS	10% of project	$14,985
			Base Construction Cost	**$172,328**
			Mobilization (5%)	$8,616
			Subtotal 1	**$180,944**
			Contingency (25%)	$45,236
			Subtotal 2	**$226,180**
Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)				$101,781
			Estimated Project Cost	**$328,000**

Site photo: One of three bioretention sites, at pond inflow as indicated.

AC9600 Flood Protection/Mitigation



Address:	Behind 8311 Cinder Bed Road
Location:	Culvert under railroad behind Industrial Park
Land Owner:	Federal
PIN:	1152 01 0001
Control Type	Water Quantity
Drainage Area	N/A
Receiving Waters	Long Branch South

Description: Based on results of watershed modeling, the culvert under the railroad behind Industrial Park overtops for both the 100-year and the 10-year events. This project will reconstruct the crossing to allow the 100-year flows to pass safely without overtopping.

Project Area Map

Project Benefits: Reconstructing the culvert under the railroad tracks will allow it to convey the 10- and 100-year storm without overtopping, minimize backwater effects and potentially reduce or eliminate fish passage issues at the downstream end of the culvert.

Project Design Considerations: Stormwater pond retrofit projects upstream of the crossing could impact the crossing. No projects are located within the immediate vicinity. The project site can be accessed from Cinder Bed Road. There are minimal environmental permitting requirements anticipated.

Costs:

ITEM	QUANTITY	UNITS	UNIT COST	TOTAL
Excavation	1930	CY	$30.00	$57,900
Stabilization graded Aggregate Base	490	CY	$50.00	$24,500
Structure (twin box 9 x 5)	1	LS	$100,000.00	$100,000
Graded Base	145	SY	$15.00	$2,175
Curb and Gutter	200	LF	$30.00	$6,000
Turf grass establishment	470	SY	$3.00	$1,410
Placing Topsoil	470	SY	$5.00	$2,350
Soil Stabilization matting	470	SY	$5.00	$2,350
			Initial Project Cost	**$196,685**
Plantings	1	LS	5% of project (excluding pervious pavement)	$9,834
Ancillary Items	1	LS	5% of project	$9,834
Erosion and Sediment Control	1	LS	10% of project	$19,669
			Base Construction Cost	**$236,022**
			Mobilization (5%)	$11,801
			Subtotal 1	$247,823
			Contingency (25%)	$61,956
			Subtotal 2	$309,779
			Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%)	$139,401
			Estimated Project Cost	**$450,000**

Figure 1: Upstream endwall

Figure 2: Downstream endwall

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6 Benefits of Plan Implementation

6.1 Introduction

This section presents the modeled benefits of the projects proposed in the Accotink Creek Watershed Management Plan. The results show that there would be a significant pollutant reduction in many WMAs, and measurable reductions watershed-wide, after the implementation of the proposed projects. Hydrologic benefits are not as high, with runoff volume reduced about 2 percent and peak flows even less for the whole watershed.

For a number of reasons, project selection and recommendation tended towards two types of projects: 1) projects that would improve runoff quality by reducing pollutants and 2) projects that would help restore eroding streams and reduce the subsequent negative sediment and nutrient loads caused by the erosion. There were fewer large projects proposed to improve watershed hydrology (i.e. reduce volume and velocity of stormwater).

The primary reason is that the Accotink Creek watershed is substantially built out, having been developed before stormwater management regulations came into effect to require new development to manage stormwater runoff. As a result, there are fewer existing stormwater management ponds which can be retrofitted in Accotink Creek than in other watersheds, and little open space in which to plan and develop new ponds.

Projects that improve quality of stormwater runoff can be easier to implement in already developed areas. These include parking lot BMP/LID retrofits and area-wide projects, both of which involve small treatment systems dispersed throughout an area, with treatment focused on inlets and other parts of the publicly-owned storm drain system. Stream restoration projects, many sited in publicly-owned areas, also have significant water quality benefits by eliminating stream bank erosion.

It should be noted that the quantified benefits presented in this section do not include non-structural projects. These types of projects can provide significant improvements in both water quality and quantity. Downspout disconnection, tree planting, buffer restoration and implementation of rain gardens and rain barrels can reduce excessive stormwater runoff from entering our stream systems. Benefits are difficult to model; however, because the outcome of the programs to change behavior is highly variable.

6.2 Models and Scenarios

In order to assess the benefits of the Accotink Creek Watershed Management Plan, final hydrologic, hydraulic and pollutant loading modeling was conducted for three separate scenarios:

- *Existing Conditions:* represented watershed conditions at the time the plan was prepared,
- *Future Conditions without Projects:* represented watershed conditions that included forecast for changes in land use and,
- *Future Conditions with Projects:* added the proposed projects in this plan to the *Future Conditions without Projects* scenario.

All the proposed projects were modeled for pollutant reductions. Hydrologic and hydraulic benefits were calculated for the 10-year projects with significant storage, such as new stormwater ponds, pond retrofits, or some culvert retrofits. Additional information about the models used in this plan may be found in Section 2, while detailed results are discussed in Appendix B.

- Hydrologic modeling was conducted using SWMM. This model uses parameters for land cover, soils and stormwater management to estimate the amount and timing of runoff and stream flow that is generated from precipitation. Modeling was done for two precipitation events: the 2-year storm, with a 50 percent probability of occurrence in any one year, and the 10-year storm, which has a 10 percent probability of occurrence in any one year.

- HEC-RAS was used for hydraulic modeling. This model takes stream flow and estimates the speed and depth of the water. When the results are compared with elevations of buildings and structures, it is possible to determine whether or not they will be impacted.

- Pollutant loading is a type of water quality modeling that estimates how much of a particular pollutant (i.e. total suspended solids (TSS), total nitrogen (TN) or total phosphorus (TP) is being generated and delivered to streams and other water bodies through various land-use activities. The spreadsheet-based STEPL model was used to estimate stormwater runoff loads and assess the reductions of these pollutants through implementation of the proposed projects. Pollutant loads from stream erosion were estimated based on the length and severity of erosion identified in the SPA assessment. Stream restoration projects were assumed to reduce the TSS, TN, and TP loads to zero for the entire length of the restored reach.

6.3 Hydrology

Comparisons between the *Future Conditions without Projects* and *Future Conditions with Projects* scenarios showed a reduction in runoff volume of three percent for the 2-year event and two percent for the 10-year event. The peak flow reductions were negligible for both events. Again, because the Accotink Creek watershed is already built out with little land available for quantity control projects, there were few opportunities to create projects to capture and treat excess stormwater runoff. A summary of the results is presented in Tables 6-1 and 6-2.

The modeled hydrological benefits showed an unusual result in several cases where runoff volume or flow became larger after projects have been implemented. Most of these increases were well under one percent and were a result of minor changes in the model between the two scenarios, not a function of the project itself.

One case, in Mainstem 3, showed an interesting result of implementing retrofits for detention. In this case, the detained 2-year peak from Long Branch North coincided with the undetained peak flowing in Accotink Creek. Detention in this case caused a higher peak than would have occurred if the flows from Long Branch North had not been held back. After reviewing the model, it was decided that the substantial flow reductions from Long Branch North justified the modestly higher peak in Mainstem 3, particularly since it was completely attenuated by the time it reached Mainstem 4.

6.4 Hydraulics

The future conditions HEC-RAS hydraulic model was updated to show results of projects by incorporating the flows from the SWMM model of future conditions with projects. A Flood Mitigation project, located in Long Branch South was included in the model. This project is a culvert retrofit under the existing railroad behind the Newington Industrial Park (AC9600). The

Future Conditions without Projects model showed the crossing will be overtopped for the 10- and 100-year storm event. By increasing the cross-sectional area that the flow can pass through, both storm over-toppings were eliminated in the *Future Conditions with Projects* scenario.

6.5 Pollutant Loading

The pollutant load model results showed slight increases in the modeled pollutant loads between the *Existing Conditions* and *Future Conditions without Projects* scenarios for all the WMAs. The increases are a result of land use changes and associated pollutant loads modeled in STEPL. Stream erosion was not a factor, since it was assumed that stream characteristics and erosion loads would not change for these scenarios.

Stream erosion and STEPL results were both included in the comparison of the *Future Conditions without Projects* and *Future Conditions with Projects* scenarios. This comparison showed that the 10-year implementation plan reduced sediment by about fifteen percent, and nitrogen and phosphorus by about four and a half and seven percent, respectively. With all the proposed projects for the 10- and 25-year plans included, the model results showed reductions of about sixteen percent for sediment, six percent for nitrogen, and eight percent for phosphorus. Several WMAs saw large pollutant reductions, most notably Bear Branch whose projects will reduce sediment by 54 percent, nitrogen by 14 percent and phosphorous by 25 percent.

6.6 Plan Cost and Benefits

The total estimated cost of the 120 structural projects for the 10-year plan is $75 million. Implementation of the 109 11-25 year structural projects adds $12 million for a total of $87 million. It should be noted that the 10-year plan costs are more accurate as these projects were scoped in more detail.

The benefits of the plan include eliminating the overtopping of one crossing, reducing flooding potential, restoration of twelve miles of streams and one mile of stream buffers. Pollutant loads would be reduced by as much as 3,032 tons per year of sediment, 9,914 pounds per year of nitrogen and 2,758 pounds per year of phosphorus for the 10-year implementation plan. The full 25-year plan implementation would reduce pollutant loading by 3,149 tons per year of sediment, 12,376 pounds per year of nitrogen and 3,244 pounds per year of phosphorous. These benefits will help meet the County's goals for water quality and stream improvements and provide a positive impact on the residents and conditions of the watershed.

Table 6-1: Pollutant Loading and Flow Reduction by Watershed

Watershed	Area (ac)	Scenario[3]	Runoff Volume (in)[1] 2-Year	Runoff Volume (in)[1] 10-Year	Peak Flow (cfs/ac)[1] 2-Year	Peak Flow (cfs/ac)[1] 10-Year	TSS (lb/ac/yr)[2]	TN (lb/ac/yr)[2]	TP (lb/ac/yr)[2]
Accotink Creek	32,679	Existing Conditions	1.155	2.897	0.113	0.316	1,218.0	6.3372	1.1369
		Future Without Projects	1.252	3.017	0.118	0.325	1,235.6	6.6310	1.1796
		Future With Projects(10 yr)	1.212	2.958	0.117	0.324	1,050.1	6.3277	1.0952
		Future With Projects(25 yr)					1,042.9	6.2524	1,0804
		Reduction (10-year Plan)	0.040 (3%)	0.059 (2%)	0.001 (1%)	0.001 (0%)	185.5 (15.0%)	0.3033 (4.6%)	0.0844 (7.2%)
		Reduction (25-year Plan)	N/A	N/A	N/A	N/A	192.7 (15.6%)	0.3786 (5.7%)	0.0992 (8.4%)

[1]Flow is cumulative
[2]Loads are representative of individual land area contributions
[3]25-year projects were not evaluated in the hydrologic model

Table 6-2: Pollutant Loading and Flow Reduction by WMA

WMA	Area (ac)	Scenario[3]	Runoff Volume (in)[1] 2-Year	Runoff Volume (in)[1] 10-Year	Peak Flow (cfs/ac)[1] 2-Year	Peak Flow (cfs/ac)[1] 10-Year	TSS (lb/ac/yr)[2]	TN (lb/ac/yr)[2]	TP (lb/ac/yr)[2]
Bear Branch	1,392.2	Existing	1.303	3.057	0.460	0.990	2,380.1	8.0691	1.6352
		Future without projects	1.336	3.095	0.486	1.009	2,392.1	8.3029	1.6714
		Future 10-yr projects	1.336	3.096	0.495	1.007	1,109.9	7.1542	1.2507
		Future 25-yr projects	N/A	N/A	N/A	N/A	1,092.3	6.9431	1.2110
		Reduction 10-yr projects	0.000 (0%)	-0.001 (0%)	-0.009 (0%)	-0.003 (0%)	1,282.2 (53.6%)	1.1487 (13.8%)	0.4207 (25.2%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	1,299.8 (54.3%)	1.3598 (16.4%)	0.4604 (27.5%)
Crook Branch	1,099.0	Existing	1.282	3.028	0.483	1.024	1,325.7	6.4708	1.1743
		Future without projects	1.299	3.049	0.492	1.041	1,330.6	6.5674	1.1898
		Future 10-yr projects	1.300	3.050	0.493	1.043	798.9	5.8523	0.9716
		Future 25-yr projects	N/A	N/A	N/A	N/A	798.0	5.8435	0.9697
		Reduction 10-yr projects	-0.001 (0%)	-0.001 (0%)	-0.001 (0%)	-0.002 (0%)	531.7 (40.0%)	0.7151 (10.9%)	0.2182 (18.3%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	532.6 (40.0%)	0.7239 (11.0%)	0.2201 (18.5%)
Daniels Run[4]	1,208.7	Existing	1.046	2.683	0.377	0.827	1,095.4	5.2317	0.9392
		Future without projects	1.048	2.685	0.377	0.827	1,095.6	5.2336	0.9391
		Future 10-yr projects	1.042	2.673	0.376	0.818	1,095.6	5.2336	0.9391
		Future 25-yr projects	N/A	N/A	N/A	N/A	1,095.6	5.2336	0.9391
		Reduction 10-yr projects	0.006 (1%)	0.012 (0%)	0.001 (0%)	0.009 (1%)	0.0 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	0.0 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)

WMA	Area (ac)	Scenario[3]	Runoff Volume (in)[1]		Peak Flow (cfs/ac)[1]		TSS (lb/ac/yr)[2]	TN (lb/ac/yr)[2]	TP (lb/ac/yr)[2]
			2-Year	10-Year	2-Year	10-Year			
Hunters Branch	1,202.4	Existing	1.452	3.22	0.28	0.678	1,364.5	7.5810	1.3570
		Future without projects	1.544	3.329	0.299	0.708	1,393.9	8.1460	1.4406
		Future 10-yr projects	1.544	3.329	0.299	0.708	1,046.6	7.8101	1.3227
		Future 25-yr projects	N/A	N/A	N/A	N/A	1,045.1	7.7964	1.3201
		Reduction 10-yr projects	0.000 (0%)	0.000 (0%)	0.000 (0%)	0.000 (0%)	347.3 (24.9%)	0.3359 (4.1%)	0.1179 (8.2%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	348.8 (25.0%)	0.3496 (4.3%)	0.1205 (8.4%)
Long Branch Central	2,429.4	Existing	1.284	3.011	0.356	0.734	2,458.4	7.5343	1.5767
		Future without projects	1.300	3.030	0.360	0.740	2,463.7	7.6391	1.5934
		Future 10-yr projects	1.296	3.026	0.353	0.728	2,323.9	7.2312	1.4982
		Future 25-yr projects	N/A	N/A	N/A	N/A	2,313.9	7.1295	1.4774
		Reduction 10-yr projects	0.004 (0%)	0.004 (0%)	0.007 (2%)	0.012 (2%)	139.8 (5.7%)	0.4079 (5.3%)	0.0952 (6.0%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	149.8 (6.1%)	0.5096 (6.7%)	0.1160 (7.3%)
Long Branch North	1,487.4	Existing	1.581	3.359	0.517	1.077	1,726.0	8.2507	1.4779
		Future without projects	1.695	3.494	0.634	1.220	1,760.1	9.0027	1.5694
		Future 10-yr projects	1.697	3.498	0.610	1.103	820.6	8.0358	1.2431
		Future 25-yr projects	N/A	N/A	N/A	N/A	817.0	7.9956	1.2355
		Reduction 10-yr projects	-0.002 (0%)	-0.004 (0%)	0.024 (4%)	0.117 (10%)	939.5 (53.4%)	0.9669 (10.7%)	0.3263 (20.8%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	943.1 (53.6%)	1.0071 (11.2%)	0.3339 (21.3%)
Long Branch South	3,121.3	Existing	1.677	3.470	0.246	0.577	836.5	7.9910	1.2598
		Future without projects	1.801	3.615	0.283	0.668	915.3	8.9723	1.3981
		Future 10-yr projects	1.809	3.627	0.264	0.680	851.5	8.4506	1.2949
		Future 25-yr projects	N/A	N/A	N/A	N/A	841.4	8.3722	1.2791
		Reduction 10-yr projects	-0.008 (0%)	-0.012 (0%)	0.019 (7%)	-0.012 (0%)	63.8 (7.0%)	0.5217 (5.8%)	0.1032 (7.4%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	73.9 (8.1%)	0.6001 (6.7%)	0.1190 (8.5%)
Mainstem 1	3,652.6	Existing	1.486	3.231	0.554	1.162	1,596.3	7.8558	1.4165
		Future without projects	1.523	3.275	0.574	1.198	1,608.7	8.0490	1.4428
		Future 10-yr projects	1.527	3.280	0.543	1.149	1,596.1	7.9183	1.4175
		Future 25-yr projects	N/A	N/A	N/A	N/A	1,590.2	7.8567	1.4045
		Reduction 10-yr projects	-0.004 (0%)	-0.005 (0%)	0.031 (5%)	0.049 (4%)	12.6 (0.8%)	0.1307 (1.6%)	0.0253 (1.8%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	18.5 (1.1%)	0.1923 (2.4%)	0.0383 (2.7%)

WMA	Area (ac)	Scenario[3]	Runoff Volume (in)[1]		Peak Flow (cfs/ac)[1]		TSS (lb/ac/yr)[2]	TN (lb/ac/yr)[2]	TP (lb/ac/yr)[2]
			2-Year	10-Year	2-Year	10-Year			
Mainstem 2	2,069.4	Existing	1.157	2.867	0.251	0.621	2,329.4	6.8232	1.4503
		Future without projects	1.215	2.935	0.261	0.640	2,338.5	7.0804	1.4861
		Future 10-yr projects	1.215	2.935	0.258	0.640	2,223.2	6.9346	1.4396
		Future 25-yr projects	N/A	N/A	N/A	N/A	2,222.1	6.9220	1.4369
		Reduction 10-yr projects	0.000 (0%)	0.000 (0%)	0.003 (1%)	0.000 (0%)	115.3 (4.9%)	0.1458 (2.1%)	0.0465 (3.1%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	116.4 (5.0%)	0.1584 (2.2%)	0.0492 (3.3%)
Mainstem 3	3,127.9	Existing	1.321	3.036	0.215	0.533	1,613.9	7.2637	1.3729
		Future without projects	1.360	3.084	0.219	0.550	1,620.0	7.4293	1.3956
		Future 10-yr projects	1.360	3.085	0.222	0.550	1,266.0	6.9986	1.2600
		Future 25-yr projects	N/A	N/A	N/A	N/A	1,246.4	6.7573	1.2101
		Reduction 10-yr projects	0.000 (0%)	-0.001 (0%)	-0.003 (-1%)	0.000 (0%)	354.0 (21.9%)	0.4307 (5.8%)	0.1356 (9.7%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	373.6 (23.1%)	0.6720 (9.0%)	0.1855 (13.3%)
Mainstem 4	1,811.6	Existing	1.271	2.980	0.165	0.454	1,311.5	6.2792	1.1355
		Future without projects	1.272	2.981	0.172	0.471	1,314.6	6.3122	1.1404
		Future 10-yr projects	1.273	2.982	0.172	0.471	875.5	5.7437	0.9704
		Future 25-yr projects	N/A	N/A	N/A	N/A	863.0	5.6171	0.9470
		Reduction 10-yr projects	-0.001 (0%)	-0.001 (0%)	0.000 (0%)	0.000 (0%)	439.1 (33.4%)	0.5685 (9.0%)	0.1700 (14.9%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	451.6 (34.4%)	0.6951 (11.0%)	0.1934 (17.0%)
Mainstem 5	2,444.7	Existing	1.285	2.968	0.151	0.419	1,119.7	6.7839	1.1870
		Future without projects	1.311	3.000	0.156	0.431	1,129.5	6.9422	1.2093
		Future 10-yr projects	1.312	3.003	0.156	0.431	956.7	6.7701	1.1498
		Future 25-yr projects	N/A	N/A	N/A	N/A	949.5	6.6827	1.1346
		Reduction 10-yr projects	-0.001 (0%)	-0.003 (0%)	0.000 (0%)	0.000 (0%)	172.8 (15.3%)	0.1721 (2.5%)	0.0595 (4.9%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	180.0 (15.9%)	0.2595 (3.7%)	0.0747 (6.2%)
Mainstem 6	1,531.7	Existing	1.207	2.909	0.146	0.399	523.8	5.7462	0.9450
		Future without projects	1.273	2.994	0.149	0.412	538.9	6.0661	0.9976
		Future 10-yr projects	1.283	3.008	0.149	0.412	502.4	5.8895	0.9600
		Future 25-yr projects	N/A	N/A	N/A	N/A	499.3	5.8660	0.9551
		Reduction 10-yr projects	-0.010 (0%)	-0.014 (0%)	0.000 (0%)	0.000 (0%)	36.5 (6.8%)	0.1766 (2.9%)	0.0376 (3.8%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	39.6 (7.3%)	0.2001 (3.3%)	0.0425 (4.3%)

WMA	Area (ac)	Scenario[3]	Runoff Volume (in)[1]		Peak Flow (cfs/ac)[1]		TSS (lb/ac/yr)[2]	TN (lb/ac/yr)[2]	TP (lb/ac/yr)[2]
			2-Year	10-Year	2-Year	10-Year			
Mainstem 7	2,391.3	Existing	1.480	3.252	0.134	0.368	511.0	6.5664	0.9739
		Future without projects	1.691	3.503	0.139	0.380	554.8	7.4372	1.1042
		Future 10-yr projects	1.681	3.489	0.139	0.379	531.3	7.2365	1.0708
		Future 25-yr projects	N/A	N/A	N/A	N/A	523.8	7.1778	1.0607
		Reduction 10-yr projects	0.010 (1%)	0.014 (0%)	0.000 (0%)	0.001 (0%)	23.5 (4.2%)	0.2007 (2.7%)	0.0334 (3.0%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	31.0 (5.6%)	0.2594 (3.5%)	0.0435 (3.9%)
Mainstem 8	3,233.4	Existing	0.880	2.468	0.115	0.319	186.1	3.4934	0.5347
		Future without projects	0.894	2.484	0.119	0.329	191.5	3.5900	0.5495
		Future 10-yr projects	0.886	2.472	0.119	0.327	186.5	3.5349	0.5389
		Future 25-yr projects	N/A	N/A	N/A	N/A	185.6	3.5272	0.5375
		Reduction 10-yr projects	0.008 (1%)	0.012 (0%)	0.000 (0%)	0.002 (1%)	5.0 (2.6%)	0.0551 (1.5%)	0.0106 (1.9%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	5.9 (3.1%)	0.0628 (1.7%)	0.0120 (2.2%)
Potomac[4]	479.3	Existing	Tidal	Tidal	Tidal	Tidal	101.3	1.6476	0.2595
		Future without projects	Tidal	Tidal	Tidal	Tidal	106.4	1.8268	0.2890
		Future 10-yr projects	Tidal	Tidal	Tidal	Tidal	106.4	1.8268	0.2890
		Future 25-yr projects	N/A	N/A	N/A	N/A	106.4	1.8268	0.2890
		Reduction 10-yr projects	Tidal	Tidal	Tidal	Tidal	0.0 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)
		Reduction 25-yr projects	N/A	N/A	N/A	N/A	0.0 (0.0%)	0.0000 (0.0%)	0.0000 (0.0%)

[1]Flow is cumulative
[2]Loads are representative of individual land area contributions
[3]25-year projects were not evaluated in the hydrologic model
[4]No projects were proposed in the Daniels Run or Potomac WMAs

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7 Glossary and Acronyms

Glossary

A

Armor-in-Place: Restoration technique intended to help stream banks withstand high flows from altered hydrology. “Armor” can consist of hard elements such as concrete, rip rap, or rock, or natural materials such as fiber logs or root wads. This technique is usually used when site constraints limit other restoration options.

B

Baseflow: The portion of stream flow that is not from runoff, resulting from seepage of groundwater into a channel. Also called dry weather flow.

Berm: A ridge of earth formed to direct or control the flow of surface water.

Best Management Practice (BMP): A practice designed to lessen the impacts of changes in land use on surface water and groundwater. Structural BMPs are physical structures which generally involve engineering, design and construction. Non-structural BMPs are more programmatic and usually focus on controlling stormwater at the source.

Bioengineering: Stream restoration techniques which use plants and living materials in preference to rock to stabilize eroding streams or to redirect flow to improve habitat.

Bioretention: A water quality practice that uses landscaping and soils to collect and treat urban stormwater runoff. Water is collected in shallow depressions in the ground and allowed to slowly filter through a layer of filter media and soil, while plants take up water and nutrients.

Build-out: The total potential land development area based on current and future land development and zoning plans.

Buffer: A vegetated, natural area adjacent to shorelines, wetlands, or streams. See also, *Resource Protection Area* and *Riparian Buffer*.

C

Channel: A natural or manmade waterway.

Chesapeake Bay Preservation Area (CBPA): Land area regulated during the process of development or redevelopment that is considered to have a significant effect on the water quality and health of the Chesapeake Bay, as established in accordance with Chapter 118 of the Fairfax County Code. See also *Intensely Developed Area, Resource Management Area, and Resource Protection Area.*

Confluence: The point where two or more streams join to create a combined, larger stream.

Control Structure: See Riser

D

Daylighting: A stream restoration technique which involves demolition and removal of a section of storm sewer and reconstructing a natural stream channel in its place, restoring the stream flow to “daylight”.

Deposition: The process in which particles (e.g., silt, sand, gravel) in the water settle to the stream bottom. Too much deposition can create a thick layer of particles on the stream bottom causing a loss of habitat and spawning areas for *aquatic* insects and fish. Stream bank erosion is a common source for the particles.

Detention: The temporary storage of stormwater runoff used to control peak runoff amounts and provide time for the gradual settling of pollutants.

Dewatering Device: A component of a stormwater pond which can be opened up to drain the pond completely dry for maintenance.

Discharge: The volume of water that passes a given location within a given period of time, usually expressed for stream flow and stormwater in cubic feet per second.

Disconnected Impervious Area (DCIA): Impervious area which drains to a pervious area. It is considered disconnected from the storm drain system because the flow can infiltrate and evaporate. A roof where the downspouts flow on to a lawn is disconnected.

Dissolved Oxygen (DO): The amount of oxygen that is present in water**.** An adequate supply of oxygen is necessary to support life in a body of water. Measuring the amount of dissolved oxygen in water provides a means of determining the water quality.

Drainage: The flow of surface water or *groundwater* from a land area.

Drainage Area: The area of land draining to a single outlet point.

Dry Pond: See *Detention Basin*.

Detention Basin: A stormwater management pond that temporarily holds runoff and slowly releases it to a downstream stormwater system. Since a detention basin holds runoff only temporarily, it is normally dry during periods of no rainfall. (Also called a *Dry Pond*.)

Dwelling Unit: A residential building or part of a building intended for use as a complete, independent living facility.

E

Ecosystem: All of the organisms in an ecological community and their environment that together function as a unit.

Effluent: Water that flows from a sewage or other type of treatment plant after it has been treated.

Embankment: The structure, typically of earth or concrete, which is designed to hold back water in a stormwater pond.

Endwall: A structure at the point where a free-flowing stream enters or discharges from a pipe or culvert. The endwall protects the pipe end from erosion and guides the flow in or out.

Ephemeral: A stream with no baseflow which flows only periodically or occasionally, usually during and immediately after precipitation.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents. In streams, erosion is the removal of soil from the stream banks or streambed by rapid flows.

Estuary: A partially enclosed body of water where freshwater from rivers and streams mixes with salty seawater. Although influenced by the tides, estuaries are protected from the full force of ocean waves, winds, and storms by the reefs, barrier islands, or fingers of land, mud, or sand.

Eutrophication: The process of over-enrichment of waterbodies by nutrients, often resulting in excess algae. Excess algae reduces dissolved oxygen in water, required for living organisms.

Evapotranspiration: The loss of water to the atmosphere from the earth's surface by both evaporation and by *transpiration* through plants.

Extended Detention: Additional depth in a stormwater pond (usually 2 to 3 feet) above the permanent pool or dry bottom to increase holding time and sedimentation. The additional storage is used for improving water quality or reducing flooding or peak discharges that can cause downstream channel erosion.

F

Fecal Coliform Bacteria: A group of organisms that live in the intestinal tracts of humans and animals. The presence of fecal coliform bacteria in water is an indicator of pollution from human and/or animal excrement.

Filter Strips: A vegetated area that treats *sheet flow* and/or interflow by removing sediment and other pollutants. The area may be grass-covered, forested or of mixed vegetative cover (e.g., wildflower meadow).

Fish Passage: Unobstructed movement of fish within the stream system. Fish require the ability to move between various habitat types and during migration.

Flashy: A description of stream flow that varies widely and rapidly between very low baseflow and significantly higher flows in wet weather.

Floatables: Trash, debris, and other large (gross) pollutants that tend to float on the surface of streams, lakes, and ponds, and which are not removed by sedimentation, filtration, or other processes in most stormwater management facilities.

Flood limit: Those land areas in and adjacent to streams subject to continuous or periodic inundation from flood events. A 100-year flood limit is an area with a 1 percent chance of inundation in any given year. Differs from a floodplain.

Floodplain: An ecosystem adjacent to a stream which undergoes fairly frequent inundation during high flows when the stream overtops its banks.

Forebay: A small storage area near the inlet of a stormwater pond to trap incoming sediment where it can be removed easily before it can accumulate in the pond.

G

Gabion: A wire basket or cage that is filled with rock, used to stabilize stream banks, change flow patterns, or prevent erosion.

Geographic Information System (GIS): A computer system for mapping and spatial analysis.

Grade Control (Streams): A method of stream restoration intended to halt and repair incision by adjusting the slope of the stream through a series of step pools, riffles and pools, or other constructed features.

Groundwater: Water that flows or seeps downward and saturates soil or rock, supplying springs and wells. The upper surface of the saturated zone is called the water table.

H

Habitat (Aquatic): A measurable description of the features of a stream which are necessary for insects, fish, and other creatures to thrive, including depth, flow, velocity, substrate, substrate size, and riparian cover.

Head Cut: A type of incision in a streambed consisting of a sudden change in elevation from upstream to downstream, similar to a waterfall. High flows erode the upstream channel at a headcut, resulting in the erosion and incision migrating upstream.

Headwater: The source of a stream or watercourse.

Hydraulics: The physical science and technology of the stationary and active behavior of fluids.

Hydrology: The science dealing with the distribution and movement of water, including the hydrologic cycle of rainfall, runoff, groundwater flow, surface water flow, and evaporation.

I

Impervious Surface: A surface composed of any material that impedes or prevents *infiltration* of water into the soil. Impervious surfaces include roofs, buildings, streets, and parking areas. Also called impervious cover.

Incised (Stream): A channel which has cut downward through its bed, becoming disconnected from its floodplain. High flows which previously overtopped the stream banks and dissipated energy in the floodplain stay within the banks of an incised channel, increasing erosion.

Infill: A residential development that has occurred near, or within, an already established neighborhood.

Infiltration: The process by which water drains into the ground. Some of this water will remain in the shallow soil layer, where it will gradually move through the soil and subsurface material. Eventually, it might enter a stream by seepage out of a stream bank or it may penetrate deeper, recharging *groundwater aquifers*.

Infiltration Facility: A stormwater management facility that temporarily stores runoff so it can be absorbed into the surrounding soil. Since an infiltration facility confines runoff only temporarily, it is normally dry during periods of no rainfall. Infiltration ponds, infiltration trenches, infiltration dry wells, and porous pavement are considered infiltration facilities.

Inflow: The source of flow into a stormwater pond. Usually a pipe or man-made channel.

Intensely Developed Area (IDA): CBPA areas consisting of existing development and *infill* sites where development is concentrated and little of the natural environment remains.

Invert: The lowest elevation of a feature in the drainage network: the bottom of a pond, the bottom of a manhole or pipe, the lowest part of a control structure,

L

Land Development: A man-made change to, or construction on, the land surface.

Land Use: Describes the type of activity on the land such as commercial or residential. The County zoning requirements dictates the type of land use allowed for a given area.

Low-flow Channel: In a stormwater pond, the low-flow channel guides baseflow through the pond during dry periods. Older designs used straight channels made with concrete; newer designs use meandering paths in natural soils, frequently planted with wetland vegetation.

Low-Impact Development (LID): A suite of stormwater management techniques that reduces the stormwater impacts from new development or redevelopment, which combines site design and onsite treatment techniques. Site design can include reducing the amount of *impervious surfaces* and designing the site to take advantage of the natural conditions can reduce the amount of runoff produced by a development area. Onsite treatments include techniques such as vegetated swales and *bioretention* filters or basins to reduce runoff rates and promote *infiltration*.

M

Marsh: A wet land area, periodically inundated with water.

Meander: A stream bend or series of stream bends. Erosion is frequently found on the outer banks of meander bends because they take the force of the flow as it turns.

Median (Parking lot): A small unpaved area in the middle of a parking lot. Most designs use raised medians with curbs. LID techniques can use depressed medians for stormwater treatment.

Micropool: A small permanent pool in a larger stormwater pond system, usually at the pond outlet to provide additional settling of pollutants.

Mitigation: To make a development scenario less harmful than the original plan; or to provide a habitat in another more conducive, larger, or better-suited area, typically in a different location from the original.

Municipal Separate Storm Sewer System (MS4) Permit: An NPDES (National Pollutant Discharge Elimination System) permit issued to municipalities requiring the reduction in pollutants contributing to the discharges from the municipality’s storm sewer system outfalls.

N

National Pollutant Discharge Elimination System (NPDES): The national program for issuing, modifying, monitoring, and enforcing permits under Sections 307, 402, 318 and 405 of the Clean Water Act. The NPDES permits regulate wastewater and stormwater discharges to the waters of the United States, and are administered by the Virginia Department of Environmental Quality and Virginia Department of Conservation and Recreation.

Nested Channel: A stream restoration technique for incised and overwidened streams which mimics a natural, recovered stream by constructing a small, low-flow channel with an adjacent floodplain bench, all within the existing channel.

Nitrogen: A chemical element that occurs naturally as a gas and makes up 78 percent of the atmosphere. Combined with oxygen as nitrate, it is required by plants for growth and is found in most fertilizers. Too much nitrogen in the water can cause *eutrophication* and result in excess algal blooms, reducing the amount of oxygen available to aquatic life. *Total Nitrogen* refers to all nitrogen compounds forms: nitrate, nitrite, ammonia, and organic nitrogen.

Nutrient: A substance that provides food or nourishment. In the aquatic environment, nutrients refer to compounds of phosphorus, nitrogen, and potassium that contribute to *eutrophication*.

O

Open Space: A portion of a development site that is permanently set aside for public or private use and will not be developed. The space may be used for recreation, or may be reserved to protect or buffer natural areas.

Outfall: Defined in the *NPDES* program as the point where discharge from a regulated system flows into waters of the United States.

Outlet: The point at which water flows from one waterbody to another, such as a stream or river to a lake or larger river.

Overwidened (Stream): A stream with a channel cross-section which has eroded and become wider over time. Low flows become very shallow and provide poorer habitat.

P

Peak Discharge: The maximum flow rate at a given location during a rainfall event. Peak discharge is a primary design factor for the design of stormwater runoff facilities such as pipe systems, storm inlets and culverts, and swales.

Perennial Streams: A body of water that normally flows year-round, supporting a variety of aquatic life.

Pervious: Any material that allows for the passage of liquid through it. Any surface area that allows *infiltration*.

Phosphorus: An element found in fertilizers and soil that can contribute to the *eutrophication* of waterbodies. It is the keystone pollutant in determining pollutant removal efficiencies for various *best management practices* as defined by the Virginia Stormwater Management Regulations. *Total Phosphorus* refers to all phosphorus compounds forms: orthophosphorus and both dissolved and particulate organic and inorganic phosphorus.

Plunge Pool: A small pond located at either a stormwater outfall or an inflow to a stormwater pond, designed to dissipate the energy of high-speed flows.

Pollutant: Any substance introduced to water that degrades its physical, chemical, or biological quality.

Pollutant Loading: The rate at which a pollutant enters a surface water or *groundwater* system. This is typically determined by water quality modeling and expressed in terms such as pounds per acre, per year.

Pollution Prevention: Any activity intended to reduce or eliminate stormwater pollution by reducing the amount of runoff, or by reducing the opportunity for stormwater to wash off and transport pollutants downstream.

Pool: The reach of a stream between two *riffles*; a small and relatively deep body of quiet water in a stream or river. Natural streams often consist of a succession of pools and riffles.

Post-Development: Refers to conditions that exist after completion of a land development activity on a specific site or tract of land.

Pre-Development: Refers to the conditions that exist at the time that plans for land development of a tract of land are approved by the plan approval authority.

Pre-Treatment: A smaller stormwater treatment system located upstream of another system, designed to reduce sediment or other pollutants that would make the downstream system less effective over time.

Q

Quantity Control: *Stormwater management facilities* designed to reduce *post-development peak discharge* to the peak *discharge* that occurred in the *pre-development* conditions, or to reduce the amount of runoff.

Quality Controls: *Stormwater management facilities* designed to remove *pollutants* from *runoff* and improve water quality.

R

Rain Barrel: A storage container connected to a roof downspout, typically including a hose attachment to allow for reuse of rooftop runoff.

Reach: General term used to describe a length of stream.

Recharge: The downward movement of water through the soil into *groundwater*; for example, rainfall that seeps into a groundwater aquifer.

Redevelopment: The substantial alteration, rehabilitation, or rebuilding of a property for residential, commercial, industrial, or other purposes.

Regional Ponds: Larger stormwater management facilities designed to treat the runoff from drainage areas of 100 to 300 acres.

Regrade: A stream restoration technique for incised or over-widened channels which involves excavation and fill to change the cross-section of the stream banks from an easily eroded, usually vertical, form, to a more stable, usually sloping, shape.

Resource Management Area (RMA): CBPA areas not adjacent to streams and shorelines where development may cause an impact to aquatic resources. May include steep slopes, erodible soils, or other areas designated by the locality.

Resource Protection Area (RPA): CBPA lands at or near shorelines or streams that have an intrinsic water quality value due to the ecological and biological processes they perform.

Retention Basin: A stormwater management pond that permanently stores water for the purpose of improving water quality. It is normally wet, even during periods without rainfall. Also called a *Wet Pond*.

Retrofit: The modification of stormwater management systems to improve water quality or to change characteristics of peak discharge control by adding storage, changing outflow characteristics, or adding water quality treatments such as pools, meanders, wetland plantings, or other features.

Riparian Buffer: Strips of grass, shrubs, and/or trees along the banks of rivers and streams that filter polluted runoff. These buffers provide a transition zone between water and human land use. Buffers are also complex ecosystems that provide habitat and improve the stream communities they shelter.

Riprap: A protective layer of large stones placed on a streambank to prevent erosion.

Riffle: A reach of stream that is characterized by shallow, fast-moving water broken by the presence of rocks and boulders.

Riffle/Run: Streams that are generally characterized by a high slope (gradient), and a mixture of riffle and run habitat.

Riser: A pipe or structure used to control the discharge rate from a stormwater management pond.

Runoff: The portion of precipitation, snowmelt, or irrigation water that flows off the land into surface waters instead of *infiltrating*.

Run: A segment of stream length that is characterized by moderate depths, smooth flowing water at a moderate pace. A run is intermediate between a *riffle* and a *pool*.

S

Sand Filter: A stormwater management facility consisting of a large, flat area which collects stormwater in a shallow pond and allows it to slowly percolate through a sand bed to remove sediment and pollutants. Usually has an underdrain to collect and convey the filtered stormwater.

Sanitary Sewer: The pipe network that carries domestic or industrial wastewater to a treatment plant. Some systems in older cities and towns may also convey stormwater; these are known as combined sewer systems.

Scour: Removal of sediment from the streambed and banks caused by fast moving water. See also *Erosion*.

Sedimentation (Treatment): In a water treatment context, sedimentation refers to a pollutant removal method in which pollutants are removed by gravity as sediment settles out of the water column. An example of a *best management practice* using sedimentation is a *detention pond/wet pond*.

Sedimentation (Streams): See Deposition

Sheet Flow: Runoff that flows over the ground surface as a thin, even layer, not concentrated in a channel.

Sinuous: Sinuosity describes how a stream or river turns back and forth across the land as it flows downstream. A stream with many tight meanders for its length is more sinuous than one with shallow bends.

Stakeholder: Stakeholders include groups of people within the watershed (e.g., residents, industry, local government, agencies, and community groups), as well as those who work in the *watershed*.

Storm Drain: See *Storm Sewer*.

Storm Sewer: A man-made drainage system that carries only surface runoff, street wash, and snow melt from the land. In a separate storm sewer system, storm sewers are completely separate from sanitary sewers that carry wastewater. In a combined sewer, a single conveyance system carries both stormwater and wastewater.

Stormwater: Surface water flow that results from rainfall.

Stormwater Management (SWM) Facility: A structure, such as a pond, that controls the quantity and quality of stormwater runoff.

Stormwater Outfall: A single location, pipe discharge, or outlet structure that releases stormwater into a stream, river, or pond.

Stormwater Ponds: A depression or dammed area with an outlet device that controls stormwater outflow. Stormwater ponds retain water from upstream areas, thereby reducing peak flows downstream. In Fairfax County, stormwater ponds are either dry (*dry pond*) or contain a permanent pool of water (*wet pond*) and are typically designed to control the peak runoff rate for selected storm events.

Stormwater Wetlands: Areas intentionally designed to emulate the water quality improvement function of wetlands for the primary purpose of removing pollutants from stormwater.

Stream Restoration: The reestablishment of the structure and function of a stream, as closely as possible to its pre-existing condition.

Substrate: The material forming the bottom of a stream channel. Channel materials are generally broken into categories (listed smallest to largest) such as clay, silt, sand, gravel, cobble and boulder.

Subwatershed: A smaller subsection of a larger *watershed*, often delineated to describe a particular tributary to a larger waterbody.

Suspended solids: Particles that are suspended in and carried by the water. The term includes sand, mud, and clay particles as well as solids in wastewater.

Swale: A natural depression or wide shallow ditch used to temporarily store, route, or filter runoff.

T

Toe Protection (Streams): A stream restoration technique to provide erosion protection for the the bottom of the streambank. Typically constructed of stone and tied into a regraded and revegetated bank.

Transpiration: The process by which water vapor escapes from living plants and enters the atmosphere. Studies have shown that about 10 percent of the moisture found in the atmosphere is released by plants through transpiration.**Tree Canopy Cover:** The area directly beneath the crown and within the drip line of a tree.

Turbidity: The amount of solid particles that are suspended in water, making it cloudy or even opaque in extreme cases.

U

Underdrain: A series of perforated pipes installed under a filtration treatment system which collects filtered water and conveys it to a storm sewer or stream. May be installed in infiltration systems to divert high flows.

W

Watershed: An area of land that drains directly, or through tributary streams, into a particular river or waterbody. A watershed includes its associated groundwater. Elevated landforms, such as ridges or even roads can serve as watershed divides.

Weir: A section of a riser which limits the discharge from a stormwater pond to the level determined by the design.

Wetlands: Areas where the soil or substrate is saturated with water during at least a part of the growing season. These saturated conditions determine the types of plants and animals that live in these areas.

Wet Pond: See *Retention Basin*

Acronyms

BMP	Best Management Practice
BPJ	Best Professional Judgment
BRAC	Base Realignment and Closure
CBA	Cost Benefit Analysis
CEM	Channel Evolution Model
DCIA	Disconnected Impervious Area
DEQ	(Virginia) Department of Environmental Quality
DO	Dissolved Oxygen
DPWES	Fairfax County Department of Public Works and Environmental Services
EPA	Environmental Protection Agency
FCPA	Fairfax County Park Authority
FCPS	Fairfax County Public Schools
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
HEC-RAS	Hydrologic Engineering Center River Analysis System
HOA	Homeowners Association
HSI	Hotspot Site Investigation
IBI	Index of Biological Integrity
LID	Low Impact Development
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NSA	Neighborhood Source Assessment
NVSWCD	Northern Virginia Soil and Water Conservation District
NWI	National Wetland Inventory
RPA	Resource Protection Area
SPA	Stream Physical Assessment
SPS	Stream Protection Strategy
STEPL	Spreadsheet Tool for Estimating Pollutant Load
SWM	Stormwater Management
SWMM	Stormwater Management Model
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USLE	Universal Soil Loss Equation
VDOT	Virginia Department of Transportation
VPDES	Virginia Pollutant Discharge Elimination System

VWPP Virginia Water Protection Permit
WAG Watershed Advisory Group
WMA Watershed Management Area

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