Chapter 4: Watershed Plan Actions

4.1 Summary of Watershed Actions

The proposed actions in this chapter are based upon the recommendations of the project team, with guidance from the community. The actions focus on protecting high quality environments within the Popes Head Creek Watershed and improving areas with degraded stream habitats. The goals of the plan will be accomplished by the following actions:

- Retrofitting existing stormwater facilities;
- Installing new Best Management Practices (BMPs) and Low Impact Development (LID) facilities;
- Retrofitting culverts and road crossings;
- Protecting and restoring riparian buffers and stream habitat; and
- Coordinating volunteer watershed stewardship activities and a public education campaign.

4.2 Watershed Project Descriptions

The projects for the Popes Head Creek Watershed Management Plan are identified using a 6-digit convention (XX9YZZ), where:

XX = Watershed Code = PH

Y = 0 for Regional Pond Projects
1 for Non-regional Ponds or Pond Retrofits
2 or 3 for Stream Restoration or Stabilization Projects
4 for Road Crossing Improvements
5 for Culvert Retrofits
6 for Flood Control Projects
8 for Low Impact Development projects (Bioretention Areas or "rain gardens", manufactured LIDs, grassed swales, and infiltration trenches)
9 for Obstruction Removal Projects

Z = Remaining digits in ascending order throughout the watershed, starting with 00 as the lowest point in the watershed (99 as the highest point).

The following diagrams describe each type of project that is proposed for the Popes Head Creek Watershed.

Stormwater Pond Retrofit

Description: Retrofit options that may be suitable for implementation include:

1. Increasing detention storage by means of additional excavation and grading.

2. Providing water quality improvements to facilities that currently only provide water quantity control. These facilities could be retrofitted to also provide water quality treatment by means of installing a micro-pool, sediment forebay, constructed stormwater wetlands, or by increasing the surrounding riparian buffer.

3. Modifying or replacing the existing riser structure and outlet controls to further reduce the discharge rate from the storm water management facility. A riser is a structure, typically made of concrete with a metal grate on top, which controls the level of water in the stormwater pond.

4. Adding infiltration features such as sand filters or bioretention to promote greater peak flow reduction, groundwater recharge, and improve water quality treatment. A soil survey of the existing facility would be required to verify that this retrofit is suitable. Stormceptors, or equivalent LID products, could be installed in parking lots or other areas with a large percentage of impervious area. These devices are placed in the manhole and trap sediments and petroleum products before they flow into the pond.

Maintenance: The maintenance requirements of a retrofitted pond are not significantly more than a traditional stormwater pond. A typical pond is inspected by County personnel trained in dam safety and pond maintenance, looking at the dam, pipes, and riser structure to ensure it is functioning properly and not failing. Additional items that need to be inspected are any pretreatment facilities for clogging by sediments and large debris items. If sediment buildup or clogging is evident, the area needs to be cleaned. Manufacturer's maintenance recommendations need to be followed for all Manufactured LID products.

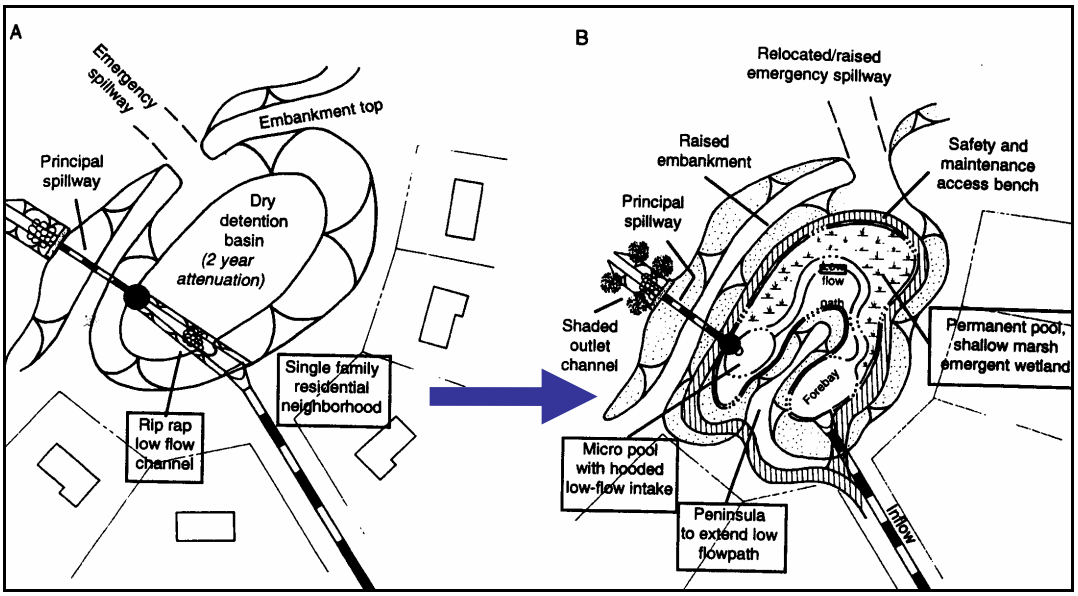


Figure 4.1: Stormwater Pond Retrofit

Source: Schueler, Thomas R. and Holland, Heather K. *The Practice of Watershed Protection.* Article 143. The Center for Watershed Protection, 2000.

Culvert Retrofit

Description: This stormwater retrofit option is installed upstream from existing road culverts by constructing a control structure and excavating a micro-pool. These projects are designed for intermittent or ephemeral streams. The control structure will consist of a gabion weir that will detain and reduce stormwater flow; the micro-pool is a small pool that will infiltrate the first 0.1 – 0.2 inches of stormwater runoff, improving water quality.

Maintenance: Maintenance of the micro-pool area is very minimal. The area needs to be inspected for large debris or sediments that may be clogging the area, dead or stressed plants, and erosion around the gabions. Remove large debris, built-up sediments, and replace dead or stressed plants as necessary. If there is erosion around the gabions, the area needs to be inspected and gabions stabilized, or placement modified as necessary.

These facilities have an expected life span of 25 years.

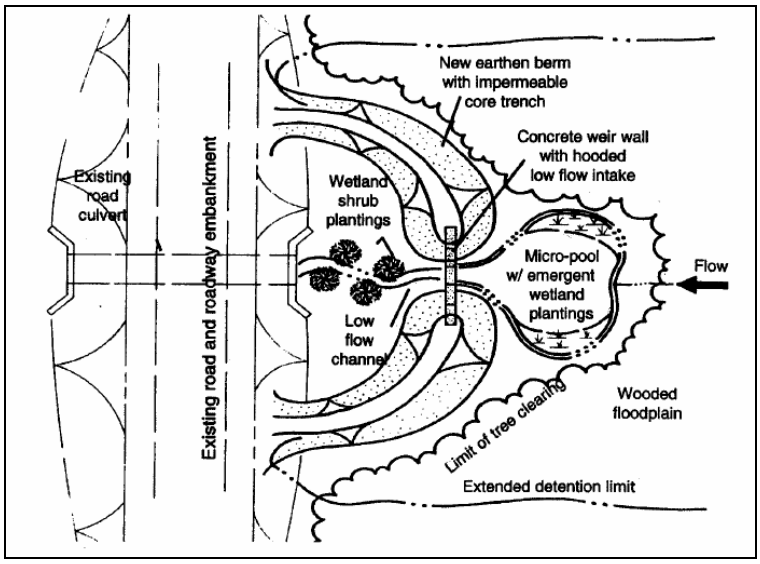


Figure 4.2: Culvert Retrofit

Source: Schueler, Thomas R. and Holland, Heather K. *The Practice of Watershed Protection.* Article 143. The Center for Watershed Protection, 2000.

Low Impact Development: Bioretention Area ("Rain Garden")

Description: Bioretention is a shallow depression utilized to detain and treat stormwater runoff by using a conditioned planting soil bed and planting materials. Pollutants are adsorped by plant material and slowly infiltrate through the soil bed, improving water quality.

Maintenance: Inspection of the treatment area's components and repair or replace as necessary. This area is akin to a landscape feature in general maintenance needs, such as removal of accumulated sediment and debris, replacement of dead or stressed plants, and annual mulching (or as necessary).

These facilities have an expected life span of 25 years.

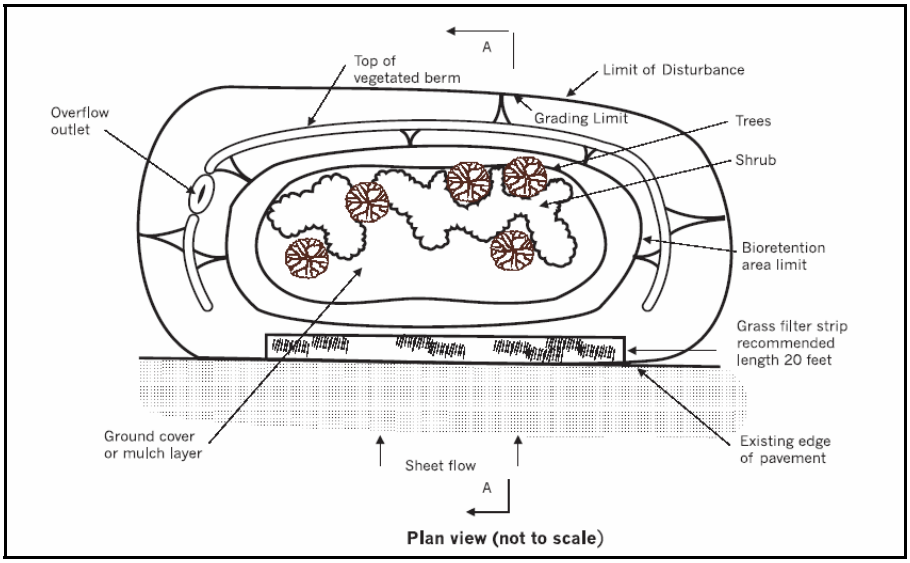
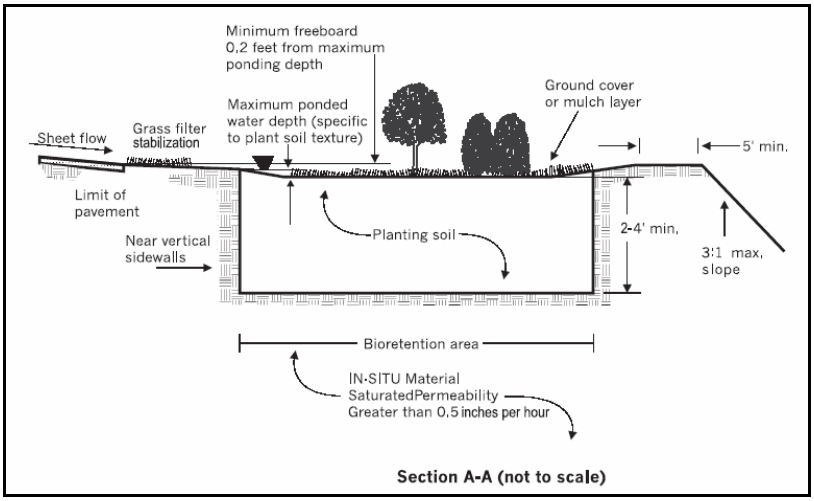


Figure 4.3: Bioretention Area



Source: Low-Impact Development Design Strategies: *An Integrated Design Approach.* Prince Georges's County, Maryland. Department of Environmental Resources Programs and Planning Division. January 2000.

Pipe Outfall Retrofits (Off-line Bioretention)

Description: This stormwater retrofit option is installed immediately downstream of a stormwater drainage pipe outfall. Flow splitters can be utilized to convey the water quality treatment volume to a sand filter, bioretention area, off-line wetland, or wet pond, while larger storms are allowed to bypass the retrofit.

Maintenance: Inspect the treatment area's components and repair or replace as necessary. This area is akin to a landscape feature in general maintenance needs, such as removal of accumulated sediment and debris, replacement of dead or stressed plants, and annual mulching (or as necessary). An observation well can identify if the underdrain is clogged or not working properly

These facilities have an expected life span of 25 years.

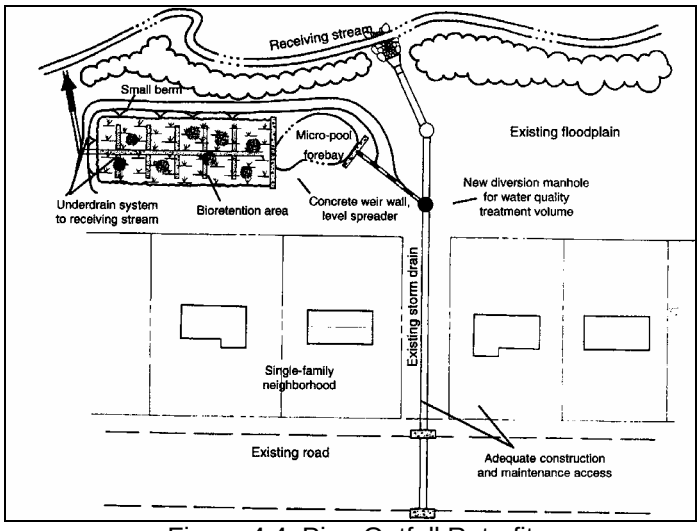


Figure 4.4: Pipe Outfall Retrofit

Source: Schueler, Thomas R. and Holland, Heather K. *The Practice of Watershed Protection.* Article 143. The Center for Watershed Protection, 2000.

Low Impact Development: Infiltration Trench

Description: An infiltration trench is an excavated trench that has been backfilled with stone to form a subsurface basin. Stormwater runoff is diverted into the trench and is stored until it can be infiltrated into the soil, usually over a period of several days. They are ideal for small urban drainage areas, and have a longer life cycle when some form of pretreatment, such as a grass swale, is included in the design.

Maintenance: Prevent sediments and debris from accumulating on the surface and clogging the trench. If a grass filter strip or any other pretreatment BMP is used in conjunction with the trench, maintenance of the BMP is very important. Filter strip maintenance consists of reseeding any eroded areas, and periodically mowing to a height equal or greater than the design flow height.

These trenches have an expected life span of 10 years.

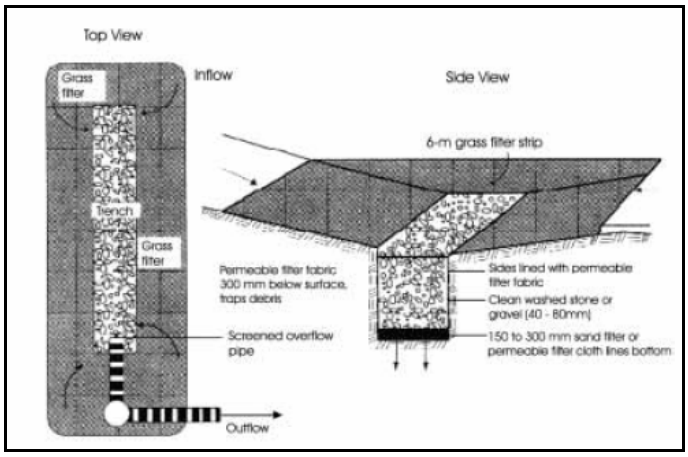


Figure 4.5: Infiltration Trench

Source: Low-Impact Development Design Strategies: *An Integrated Design Approach.* Prince Georges's County, Maryland. Department of Environmental Resources Programs and Planning Division. January 2000.

Low Impact Development: Grassed Swale

Description: Grassed swales provide water quantity and quality control infiltrating stormwater into the soil. Stormwater travels more slowly in a grass swale than it does in a concrete ditch, reducing runoff volume and downstream erosion.

Maintenance: Maintain a dense, healthy grass cover, akin to a mowed sodded area. The area should have periodic mowing (but not letting the grass get lower than the design flow depth), weeding, watering, reseeding of bare areas, and clearing of debris and blockages as necessary. The swale shall be checked periodically and after significant rain storms to fix any problems with sediment buildup and erosion. If sediment buildup occurs, the sediments should be removed manually to avoid concentrated flows in the swale. Fertilizers and pesticides should be avoided, and only used when the grass cover is diseased or dying. Parking shall be avoided on the swale area to avoid compaction.

These swales have an expected life span of 25 years.

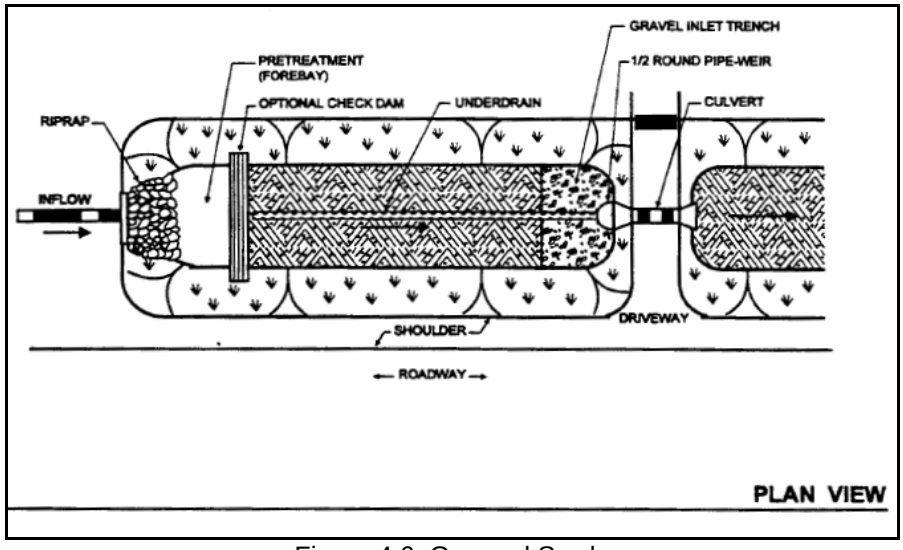


Figure 4.6: Grassed Swale

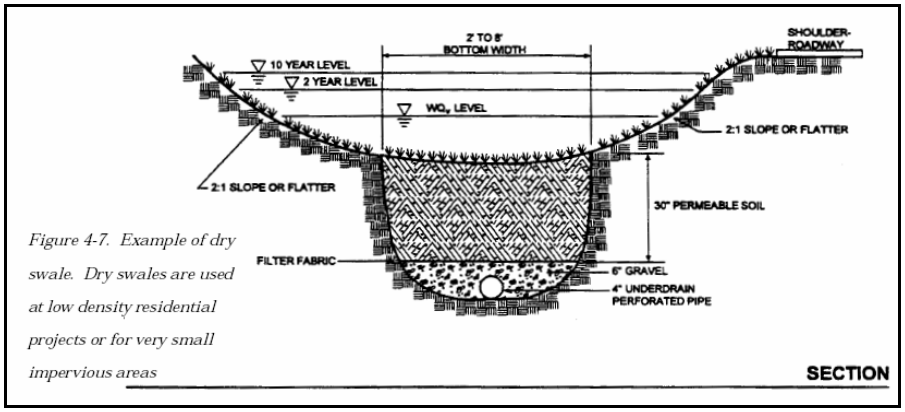


Figure 4-7. Example of dry swale. Dry swales are used at low density residential projects or for very small impervious areas

Source: Low-Impact Development Design Strategies: *An Integrated Design Approach.* Prince Georges's County, Maryland. Department of Environmental Resources Programs and Planning Division. January 2000.

Low Impact Development: Manufactured LIDs

Description: Manufactured LIDs, such as Filterra® or a comparable alternate, allow stormwater to flow through a specially designed filter mixture contained in a landscaped concrete container. The mixture immobilizes pollutants; those pollutants are then decomposed, volatilized and incorporated into the biomass of the Filterra®. Stormwater runoff flows through the media and into an underdrain system at the bottom of the container, where the treated water is discharged.

Maintenance: Debris and sediment removal, replacing dead or stressed plants, and mulching as necessary are the primary maintenance considerations. Most of these Manufactured LID come with an observation well that is to be used to identify if the underdrain is clogged or not working properly. If the system becomes clogged, the filter mixture shall be replaced. Additionally, most manufacturers have their own maintenance guidelines that need to be followed to maintain the performance level.

Manufactured LIDs have an expected life span of 25 years.

Figure 4.7: Manufactured LID

Source: Virginia Stormwater Management Program Technical Bulletin #6: Minimum Standard 3.11C - Filterra Bioretention Filter System (revised 11/01/02).

Low Impact Development: Rain Barrel

Description: Rain barrels are low-cost, effective and easily maintainable retention devices that can be used in both residential and commercial/industrial sites. They are connected to gutters and retain rooftop runoff. Rain barrels can be used to store runoff for later use in lawn and garden watering.

Maintenance: Rain barrels require very little maintenance. The barrel and attachments should be inspected for clogging several times a year and after significant storm events. Minor parts, including spigots, screens, downspouts, or leaders, may require replacement.

Because enclosed rain barrels are ideal breeding habitats for mosquitoes, who may carry the West Nile virus, it is important to completely drain the barrels once a week. A tightly fitting screen at the inlet can also prevent mosquito eggs and other debris from entering the rain barrel, but it is a good practice to drain the barrel weekly.

Rain barrels have an expected life span of 25 years.

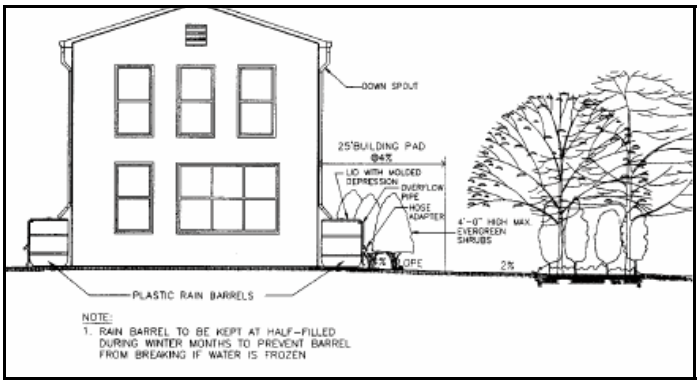


Figure 4.8: Rain barrel

Source: Low-Impact Development Design Strategies: *An Integrated Design Approach.* Prince Georges's County, Maryland. Department of Environmental Resources Programs and Planning Division. January 2000.

4.3 Watershed Plan Vision

The Popes Head Creek Watershed Management Plan will help the State of Virginia meet several commitments to improving water quality in the Chesapeake Bay Watershed. In May 1999, the U.S. EPA included most of Virginia's portion of the Bay and several tidal tributaries on the federal list of impaired waters based on failure to meet standards for dissolved oxygen and aquatic life use attainment. Popes Head Creek is currently listed as an impaired waterbody in the Virginia Department of Environmental Quality Total Maximum Daily Load (TMDL) Priority List, as described in Chapter 2.5.7.

The Chesapeake Bay 2000 Agreement commits Virginia to remove the Chesapeake Bay from the U.S. EPA's list of impaired waters by the year 2010. The draft Shenandoah and Potomac Basins Tributary Strategy, released in April 2004, will implement the nutrient and sediment reduction goals of the Chesapeake Bay 2000 Agreement. The goal is to reduce nitrogen loads from the estimated 2002 level of 22.8 million pounds per year to 12.8 million pounds per year in 2010; the estimated phosphorus load of 1.96 million pounds in 2002 will be reduced to 1.4 million pounds per year in 2010; finally, the estimated 720,000 tons of sediment in 2002 will be reduced to 617,000 tons per year in 2010. The Strategy relies heavily on urban BMPs to achieve the reduction goals, and will include 187,000 acres of urban nutrient management and 71,000 acres of urban retrofits, including bioretention facilities, swales, and other innovative BMPs. By reducing pollutant loads through the use of BMPs and restored stream buffers, the Popes Head Creek Watershed Management plan can contribute to these state goals.

While the Tributary Strategies program is technically voluntary, failure to meet target reductions has the potential to result in the U.S. EPA implementing a TMDL regulatory program under Section 303(d) of the Clean Water Act. This would effectively supplant the voluntary Chesapeake Bay Program and make implementation mandatory through Fairfax County's Virginia Pollutant Discharge Elimination System (VPDES) permit.

The Popes Head Creek Watershed Management Plan is consistent with Fairfax County's *Policy Plan* (the Countywide element of the County's comprehensive plan), within which the Board of Supervisors' adopted goals can be found. The Board of Supervisors' goal for environmental protection states,

> "The amount and distribution of population density and land uses in Fairfax County should be consistent with environmental constraints inherent in the need to preserve natural resources to meet or exceed federal, state, and local standards for water quality, ambient air quality, and other environmental standards. Development in Fairfax County should be sensitive to the natural setting to prevent degradation of the County's natural environment."

The County policy document also notes that,

> "The protection and restoration of the ecological quality of streams is important to the conservation of ecological resources in Fairfax County. Therefore, efforts to minimize adverse impacts of land use and development on the County's streams should be pursued."

This watershed management plan is intended to complement and supplement the County's policies and comprehensive plans over the next 25 years and support its commitment to the Clean Water Act and Virginia's commitment to the Chesapeake Bay Preservation Ordinance. The County and community members of the Popes Head Creek Watershed are committed to protecting Popes Head Creek and its tributaries from future degradation by promoting watershed-wide management actions that work to restore the creek and other areas to an environmentally healthy ecosystem. This commitment emphasizes the importance of protecting the County's valuable natural resources, including surface waters, and supports the sustainability and improvement of the environment which has a direct impact on the quality of life of the County's residents. Current stream conditions throughout the watershed are predominantly fair or good, and this plan proposes a comprehensive strategy for protecting these areas and improving areas with poor stream conditions. The plan was written to manage future changes in the watershed to protect the creek so it can be enjoyed by future generations. The objectives of the plan will also help the County meet or exceed federal, state, and local regulatory water quality requirements.

The planning process, initiated by Fairfax County, for development of this watershed management plan included the participation and recommendations of a watershed steering committee. The Popes Head Creek Citizen's Advisory Committee was convened to aid and advise the project team, and the committee members served as liaisons between their respective communities or organizations and the project team. Several public workshops were held to receive input from the community regarding the watershed issues and possible solutions. The project team used this information to help evaluate the watershed and provide recommendations for addressing the issues.

The Popes Head Creek Citizen's Advisory Committee developed the following guiding principles to aid in formulating the actions and strategies for implementing the objectives of this plan.

- Reduce or eliminate the adverse impacts of recreational activities in riparian areas.
- Actively support the enforcement of the Chesapeake Bay Preservation Ordinance.
- Encourage small steps that residents can implement easily.
- Concentrate on solutions in the upstream areas first.
- Place an emphasis on protecting the existing high quality streams, including smaller tributaries.

Three Goals were developed to fulfill the Citizen's Advisory Committee's guiding principles.

Goal A: Protect and improve the ecological health of Popes Head Creek and its tributaries.

Goal B: Have a well informed community that is actively involved in watershed stewardship.

Goal C: Maintain the Occoquan Reservoir as a clean and sustainable source of potable water for Fairfax County.

4.4 Goals, Objectives, and Actions

The goals of the Popes Head Creek Watershed Plan were derived from the issues identified by the community and the project team, based on their analysis of the watershed condition. The issues driving each goal are explained in greater detail with the supporting reasons for the goal. Objectives provide direction on how to achieve the goals, and the rationale for each objective describes why it is important to the plan. The actions for each objective describe the strategy for accomplishing the objective.

The following "tracks" have been identified for the implementation of watershed management plan recommendations throughout the County:

1. Structural and Non-structural Projects:
    - County-initiated Projects via the Capital Improvement Program
    - Developer-initiated via the Zoning Approval Process or waiver approval process (proffers and development conditions)
    - Volunteer Group Implementation
2. "Policy" Recommendations

Structural and non-structural recommendations are described in Chapter 4 of the Popes Head Creek Watershed Management Plan. Structural recommendations are summarized in Tables 4.1 – 4.8 and shown in detail in Appendices F - K. Non-structural recommendations are summarized in Table 4.9 and shown in detail in Appendix L.

"Policy" recommendations are described in Chapter 5. The policy recommendations include proposals that would typically involve amendments to the County Code and other supporting documents such as the Public Facilities Manual. These recommendations will need to be evaluated further in light of greater countywide implications. The current planned approach for processing of the policy recommendations from the Popes Head Creek Watershed Plan is to compare these with similar recommendations that will be developed with the Little Hunting Creek, Cameron Run, Cub Run, and Difficult Run Watershed Management Plans starting in 2006. Specific ordinance amendments would then be crafted that factor in other County initiatives and address the common ground that can be established between the various policy recommendations.

One of the frequent questions asked by the public during the watershed plan review process was "How will the County pay for the actions recommended in the plan?" Possible funding sources for the proposed actions in this plan include the general fund, a bond referendum, grants, cost sharing, and a storm water environmental utility fee. Annual general fund storm water allocations have ranged from $760,000 to $2.2 million over the past three years. The last storm water bond referendum to be approved was in 1988 in the amount of $12 million subject to cash flow restrictions. Currently $3.7 million of the storm water bond amount is allocated to existing projects. Since the mid-1990's the County has been considering the feasibility of a stormwater user fee. In the July 2004 preliminary report prepared for the county, "Watershed Community Needs Assessment and Funding Options", various alternatives to support an enhanced Countywide Stormwater Program were evaluated including a stormwater environmental utility fee. This report recommended the implementation of enhanced stormwater programming phased in over a five-year planning period. The estimated program costs ranged from $28 million in year one to $52 million in year five. The County FY 2006

budget included an additional $17.9 million for implementation of stormwater program initiatives including the watershed management plans.

The implementation costs depicted in this final version of the plan are order-of-magnitude cost estimates. Structural and non-structural projects will typically require additional design work, possible land rights acquisition, agreements, or other coordination during the implementation phase. It is assumed that contractors will be hired to execute individual projects. The use of volunteer labor on appropriate projects will reduce costs. As the projects are evaluated further, more detailed cost estimates will be performed.

Goal A: Protect and improve the ecological health of Popes Head Creek and its tributaries.

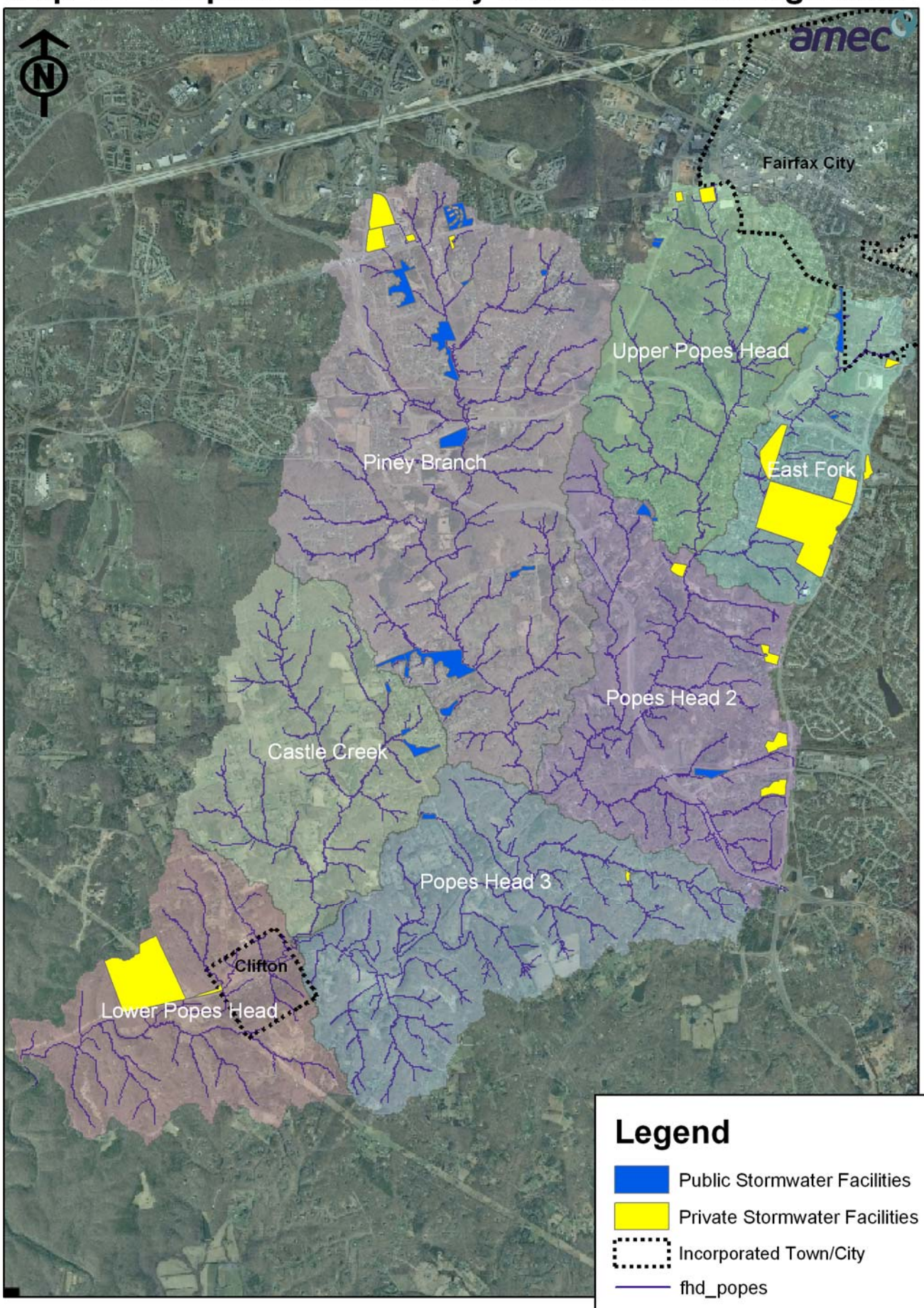
According to the 2003 Stream Physical Assessment study, Popes Head Creek Watershed is in good condition. Approximately 73% of the stream reaches were assessed as fair or good, with the remaining reaches assessed as poor or very poor. The good quality of stream habitat can be attributed to the 1982 rezoning that was approved by the Board of Supervisors in order to protect the health and quality of the Occoquan Reservoir, the potable water source for Fairfax County. Land in the rezoned area is classified as Residential-Conservation (R-C) District, and has a density of one dwelling unit per five acres. The low density has resulted in relatively low imperviousness; this in turn has resulted in less stormwater runoff and flooding when compared to more urban areas in the County. The project team and the community have agreed that it is important to protect this high quality habitat. It provides protection to the Occoquan Reservoir, as well an aesthetically pleasing character that adds to the quality of life for residents of the watershed.

Objective A1: Increase the effectiveness of and use of existing BMPs to reduce impacts from stormwater runoff.

Rationale: Existing privately owned stormwater basins (both dry and wet) may not be functioning as intended due to limited design and/or inadequate maintenance. In addition, the county has identified the need to increase the number and type of BMPs on its list of approved practices (see Industry Letter 01-11). The environment section of the county's Policy Plan, Objective 2, Policy "b" states, "Update Best Management Practice requirements as newer, more effective strategies become available." Policy "f" under Objective 2 also relates to BMP effectiveness, stating, "Where practical and feasible, retrofit older stormwater management facilities to perform water quality functions to better protect downstream areas from degradation." Map 4.1 shows properties with stormwater management facilities in the watershed, based upon the County's current database of stormwater facilities.

Action A1.1 Retrofit suitable existing stormwater management facilities and BMPs to make them more effective. Retrofitting these facilities is intended to exceed the performance criteria or standards that were used to design the facility. The increased performance and/or coverage area will improve water quality in the watershed. Fairfax County will coordinate with all VDOT, Fairfax County Park Authority, and private pond owners to implement the pond retrofit projects.

Map 4.1 Properties Served by Stormwater Management



Strategy to Achieve Action: The existing stormwater management facilities and BMPs could be structurally retrofitted by various means. Increasing the area draining to the facility may also be desirable to increase the overall area mitigated by a stormwater management facility; the Stormwater Planning Division could coordinate closely with Land Development Services to determine if there are any implications of a proposed PFM amendment regarding natural drainage divides. Increasing the area draining to the facility would require the existing storm drain system to be modified or a new storm drain system constructed to redirect and convey runoff to the existing facility. The stormwater facility would likely need to be enlarged if more runoff is directed to the facility. One of the goals of retrofitting a stormwater management facility would be to reduce peak runoff downstream of the facility.

These capital projects can be made available to developers via voluntary proffers or development conditions; however, proffers are only applicable in rezoning applications, which are not likely to occur due to the 1982 rezoning to Residential-Conservation District (R-C District) in order to protect the Occoquan Reservoir (please see Chapter 2.3 for more information on the rezoning). Therefore, the applicability of proffers is limited in the Popes Head Creek watershed. The retrofits should result in the facilities being able to provide the necessary routed storage for the one-year storm for an extended detention release rate over 24 hours. Reducing peak flows by means of one-year extended detention over a 24-hour period will help to reduce downstream erosion by controlling the more frequent smaller storms and will also provide volume control benefits for the larger, less frequent storms.

There are 51 existing stormwater management facilities located within the watershed that were identified using the County database. Four facilities are underground storage units that were not considered for retrofit because of constructability issues and the large construction costs with small benefits. Nineteen facilities already were designed with BMP control. The remaining 28 ponds were assessed in the field for retrofit possibilities. After the field reconnaissance, 11 of these ponds were determined to have retrofit possibilities. Most of the ponds that were eliminated from consideration as retrofit possibilities were either located in the rezoned area with low impervious area or had a small drainage area, resulting in very little benefit for the construction cost. Three of the ponds were recreation features, and one pond was located at GMU, outside of the County jurisdiction; therefore, all four were eliminated. After conceptual calculations of the 11 ponds, it was determined that these ponds have retrofit possibilities. The locations of existing stormwater management facilities and BMPs that are suitable for retrofit projects are described in Table 4.1 and shown on Maps 4.2, 4.3, 4.4, and 4.5. Detailed information regarding each pond and possible retrofit options can be found in Appendix F.

Table 4.1: Stormwater Pond Retrofits

Project ID	Map #	Name	Type of Project	Location	Benefit	Estimated Cost
PH9130	4.6	Colchester Hunt	Stormwater Pond Retrofit	Colchester Hunt Subdivision	Provide water quality control for uncontrolled areas.	$140,000
PH9131	4.4	Innisvale Pond	Stormwater Pond Retrofit	West of Innisvale Drive	Prevent dam failure. Increase pollutant removal efficiency	$190,000
PH9170	4.3	Braddock Road Pond	Stormwater Pond Retrofit	Braddock Road Near Groves Lane.	Increase pollutant removal efficiency, remove oil and other urban pollutants before entering pond.	$70,000
PH9180	4.4	Brentwood Ponds	Stormwater Pond Retrofit	West Pond: East of Piney Branch Road; East Pond: East of Goodwood Drive	Increase pollutant removal efficiency.	$140,000
PH9190	4.4	Marymead Pond	Stormwater Pond Retrofit	4805 Marymead Dr.	Add pollutant removal to pond, increase pollutant filtering through buffers.	$560,000
PH9191	4.4	Merrifield Gardens Pond	Stormwater Pond Retrofit	Route 29, on the back of the Merrifield Gardens property.	Increase pollutant removal efficiency of facility, remove oil and other urban pollutants before entering pond.	$70,000
PH9192	4.4	FCPA-Piney Branch Park Pond	Stormwater Pond Retrofit	Piney Branch Stream Valley Park (Route 29 & Pheasant Ridge Rd).	Increase pollutant removal efficiency of facility by 15%.	$720,000
PH9193	4.4	Sports Authority Pond	Stormwater Pond Retrofit	South side of Sports Authority in the Costco Plaza.	Remove oil and other urban pollutants before entering pond.	$120,000
PH9194	4.4	Piney Branch Road Extention Pond	Stormwater Pond Retrofit	Piney Branch Road & Route 29.	Remove oil and other urban pollutants before entering pond.	$120,000
PH9195	4.4	Costco East Pond	Stormwater Pond Retrofit	East of Costco in the Costco Plaza.	Remove oil and other urban pollutants before entering pond.	$120,000
PH9196	4.2	Waples Mobile Home Park Pond	Stormwater Pond Retrofit	Waples Mobile Home Park, on Via Drive.	Increase pollutant removal efficiency of facility by 15%.	$930,000

Watershed Benefit: Increased detention and pollutant removal will reduce the impacts of stormwater runoff on the environment. Increased capacity will also help to prevent flooding. This action will help contribute to the nutrient reduction goals of Virginia's Shenandoah and Potomac Basins Tributary Strategy.

Action A1.2: Install new BMP and LID facilities in areas that do not have existing stormwater management facilities, or in areas where retrofitting existing facilities is not feasible.

Strategy to Achieve Action: Target areas that exhibit high peak flows or flooding. These projects will be placed in areas that lack water quality controls and near headwaters to optimize watershed protection. The locations for the proposed LID projects are described in Table 4.2 and shown on Maps 4.2, 4.3, 4.4, 4.5, 4.6, and 4.8. Detailed information regarding each LID project can be found in Appendix G.

Table 4.2: Low Impact Development Projects

Project ID	Map #	Name	Type of Project	Location	Benefit	Estimated Cost
PH9800	4.8	Clifton Elementary School.	1 Bioretention area, 1 Filterra manufactured LID	Clifton Elementary School.	Reduce pollutants and provide education to faculty and students	$90,000
PH9801	4.8	Intersection of Compton and Clifton Roads	Grassed swale	Intersection of Compton and Clifton Roads	Reduction of pollutants in areas without existing controls.	$50,000
PH9820	4.6	Clifton Green Subdivision	Bioretention area and Grassed swale	Clifton Green Subdivision	Reduction of pollutants in areas without existing controls.	$50,000
PH9821	4.5	Fairfax Station Subdivision	3 Grassed Swales, 5 bioretention areas	Fairfax Station Subdivision	Reduction of pollutants in areas without existing controls.	$220,000
PH9830	4.5	Pickwick Woods Subdivision	3 Bioretention areas	Pickwick Woods Subdivision	Reduction of pollutants in areas without existing controls.	$90,000
PH9831	4.5	Smoke Rise Subdivision	1 Bioretention area.	Smoke Rise Subdivision	Reduction of pollutants in areas without existing controls.	$40,000
PH9841	4.5	Barton Place Subdivision	Grassed swale and 2 Bioretention areas	Barton Place Subdivision	Reduction of pollutants in areas without existing controls.	$230,000
PH9842	4.5	Fairfax Hunt	1 Bioretention area	Fairfax Hunt Subdivision	Reduction of pollutants in areas without existing controls.	$50,000
PH9850	4.6	Vannoy Park Subdivision.	2 Grassed swales	Vannoy Park Subdivision.	Reduction of pollutants in areas without existing controls.	$100,000
PH9851	4.4	Lewis Park Subdivision	2 Grassed swales	Lewis Park Subdivision	Reduction of pollutants in areas without existing controls.	$60,000
PH9860	4.3	West Hill Subdivision	2 Grassed swales, 2 Filterra manufactured LIDs	West Hill Subdivision	Reduction of pollutants in areas without existing controls.	$140,000
PH9870	4.2, 4.3	Brecon Ridge Subdivision	6 grassed swales, 1 bioretention area	Brecon Ridge Subdivision	Reduction of pollutants in areas without existing controls.	$160,000
PH9871	4.2	Ridges of Glendilough Subdivision.	2 Bioretention area and 2 Filterra manufactured LIDs.	Ridges of Glendilough Subdivision.	Reduction of pollutants in areas without existing controls.	$200,000
PH9872	4.4	Willow Springs Elementary School.	1 Bioretention area and 1 Filterra manufactured LID	Willow Springs Elementary School.	Reduce pollutants and provide education to faculty and students	$80,000
PH9877	4.2	Brecon Ridge Woods Subdivision.	1 Grassed swale and bioretention at pipe outfall	Brecon Ridge Woods Subdivision.	Reduction of pollutants in areas without existing controls.	$110,000
PH9880	4.4	Brentwood Subdivision	4 grassed swales, 3 bioretention areas	Brentwood Subdivision	Reduction of pollutants in areas without existing controls.	$160,000
PH9882	4.3	Braddox Subdivision.	1 Bioretention area in abandoned road right of-way.	Braddox Subdivision.	Reduction of pollutants in areas without existing controls.	$30,000
PH9883	4.4	Buckner Forest Subdivision.	1 Bioretention area.	Buckner Forest Subdivision.	Reduction of pollutants in areas without existing controls.	$30,000
PH9884	4.2	Fairfax Villa Subdivision	8 Filterra Manufactured LIDs, 3 bioretention areas, Rain barrel program	Fairfax Villa Subdivision	Reduction of pollutants in areas without existing controls.	$400,000
PH9885	4.2	Fairfax Villa Elementary School	2 Bioretention facilities.	Fairfax Villa Elementary School	Reduce pollutants and provide education to faculty and students	$60,000
PH9890	4.2	University Square Subdivision	2 Filterra Manufactured LIDs.	University Square Subdivision	Reduction of pollutants in areas without existing controls.	$80,000
PH9891	4.4	Glen Alden Subdivision.	1 grassed swale	Glen Alden Subdivision.	Reduction of pollutants in areas without existing controls.	$20,000

Watershed Benefit: New water quality controls will help to reduce nutrient and pollutant inputs into the streams. They will also reduce the volume and velocity of stormwater runoff. This action will help contribute to the nutrient reduction goals of Virginia's Shenandoah and Potomac Basins Tributary Strategy.

Objective A2: Reduce and mitigate the impacts of impervious surface.

Rationale: Large parcels of impervious surface create stormwater runoff, which damages and degrades stream habitat. When total imperviousness within a watershed exceeds 10%, environmental quality begins to show the first signs of degradation. The total imperviousness of the watershed is approximately 9%, just below the 10% threshold for environmental degradation. Four of the seven subwatersheds currently have greater than 10% imperviousness, despite the low-density development that resulted from the 1982 rezoning. Five of the seven subwatersheds are projected to have greater than 10% imperviousness in the future, based upon the planned or zoned land uses in the Fairfax County Comprehensive Plan.

Action A2.1: Program to facilitate and encourage homeowners and developers to disconnect impervious areas.

Strategy to Achieve Action: Homeowners can be encouraged to disconnect their downspouts from their driveways by aiming them towards the lawn; this will reduce water velocity and allow water to infiltrate into the soil, rather than washing directly into the street. Rain barrels can be distributed by the County for free or at a subsidized rate to homeowners in the watershed headwaters. Homeowners must then sign a maintenance agreement in order to obtain a rain barrel. Developers can be encouraged to utilize natural landscaping techniques, including the use of grass swales, to disconnect impervious areas and provide open spaces for stormwater to infiltrate into the soil. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: This action will reduce the amount of stormwater runoff by providing areas for infiltration; this will also help to recharge groundwater supplies. Homeowners with rain barrels can use the captured water for lawn and gardening purposes.

Action A2.2: Monthly street sweeping program for parking lots in the watershed and residential streets in the Fairfax Villa subdivision.

Strategy to Achieve Action: Schedule monthly street sweeping frequency on parking lots and residential streets in the Fairfax Villa subdivision. Fairfax Villa is one of the oldest subdivisions in the watershed and does not have any existing stormwater controls. Due to the nature of the built environment, there is no space available to install a new stormwater management facility. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: This action will reduce the amount of sediment, debris, and other pollutants from parking lot and road surfaces that are a potential source of pollution impacting Popes Head Creek.

Objective A3: Preserve, maintain, and restore streams to benefit stream health and habitat.

Rationale: Approximately 53% of the streams in the Popes Head Creek Watershed are of fair quality, and 26% are of poor or very poor quality. With the majority of the stream in fair or better condition, there is the opportunity to perform minimal stabilization techniques to stream reaches to prevent future erosion rather than wait for more serious

erosion issues. In conjunction with the protection and restoration of the riparian buffers and other upstream modifications, restoring and maintaining the streams will result in improved water quality and aquatic habitat, as well as a reduction in sedimentation. Additionally, restoring the streams and stabilizing the banks will reduce the loss of land on properties adjacent to the streams.

Action A3.1*:* The county and community groups should perform stream restoration projects in the areas identified as good candidates.

Strategy for Achieving Action: The County's Stream Physical Assessment identified areas of erosion with poor habitat and eroded banks that are potential areas for stream restoration. The project team also examined other areas that have been identified by public comment. In the areas with major erosion, a variety of stream restoration techniques will need to be utilized to achieve an appropriate cross sectional area and plan form. The proper channel size and shape needs to be designed to accommodate the stream flows in order to decrease the velocities, reduce erosion, and increase habitat. Techniques that may be employed include J-hook vanes, rock weirs, vortex rock weirs, toe protection, channel realignment, and removal of large woody debris. In areas with minimal erosion, less invasive techniques such as spot stabilization, removal of invasive/exotic plants, buffer revegetation, as mentioned above, and trash/debris removal can be utilized to reduce future erosion. Larger, more involved projects will be designed and constructed under County or the project team's supervision, while the minimal erosion area projects could be completed by citizen groups or individual homeowners. The locations of proposed stream restoration sites are described in Table 4.3 and shown on Maps 4.3, 4.6, 4.7, and 4.8. Detailed information regarding each stream restoration project can be found in Appendix H.

Table 4.3: Stream Restoration Projects

Project ID	Map #	Name	Type of Project	Location	Benefit	Estimated Cost
PH9200	4.8	Clifton Creek #2	Stabilization bank or minor channel realignment to reduce erosion of bank adjacent to Clifton Creek Drive	Along Clifton Creek Drive, west of Wesley Tyler Road	Reduction of erosion and stabilization of stream banks	$120,000
PH9201	4.8	Clifton Creek #1	Spot Stabilization of approximately 50% of stream along Clifton Creek Drive Increase buffer on private landowner side along entire reach length.	Along Clifton Creek Drive, from Main Street to Wesley Tyler Road	Prevent road failure and reduce future property loss	$90,000
PH9202	4.8	Clifton Road	Spot Stabilization of stream as necessary. Several locations where outfalls to the stream channel are highly eroded. Several locations where the buffer needed to be increased and stream stabilized adjacent to houses.	Along Clifton Road between Newman Road and just upstream of Great Oak Lane.	Reduce future stream and erosion of Clifton Road	$360,000
PH9204	4.7	Young Branch Drive	Stabilize 2-4' tall banks along 85% of reach, and stabilize 5-6' tall banks along 5% of reach. Several locations with 20-40' tall eroded banks adjacent to private homes need stabilization or minor channel realignment near Havener Road.	Adjacent to Young Branch Drive, from outfall to SWM pond. Between Havenner Road cul-de-sac and Sudley Church Court respectively.	Prevent sediment flowing to downstream lake. Reduce future property and structure loss	$1,080,000
PH9210	4.6	Wycklow Drive	Increase buffer along entire stream length	Wycklow Drive and Wandering Lane.	Minimize future erosion and decrease pollutants to stream.	$60,000
PH9230	4.5	Queen's Brigade Drive	Ditch stabilization project. Investigate local drainage pattern and armor ditch	Queen's Brigade Drive	Minimize future erosion	$20,000
PH9270	4.3	Brookline Drive	Increase the stream buffer, install check dam	Upstream and downstream of Brookline Drive, surrounded by the County Club of Fairfax.	Mitigate high flows and velocities from the County Club.	$30,000
PH9271	4.2	Berwynd Road	Stabilize 2-4' tall banks along 75% of the reach. Remove large wood debris obstruction from blocking the channel at the south end of the reach.	West of Berwynd Road	Reduction of erosion and stabilization of stream banks, reduction of property loss	$330,000
PH9272	4.2	Fox Chapel Road	Stabilize 2-4' tall banks along 75% of the reach. Restore buffer to prevent future land loss.	South of Braddock Road, west of Fox Chapel Road	Reduction of erosion and stabilization of stream banks, reduction of property loss	$310,000

Watershed Benefit: This action will benefit the watershed by increasing the stream health and habitat, and reduce erosion potential in the future. In a stable stream system there will be minimal erosion and very little loss of sediments that are clogging ponds and culverts, causing more problems downstream.

***Action A3.2**:* Retrofit existing road culverts to reduce flooding and erosion at road crossings.

Strategy to Achieve Action: Install a control structure, such as a gabion dam or concrete weir structure, upstream of the road culvert on ephemeral or intermittent

streams. Remove invasive plant species and plant native species to filter runoff and prevent erosion. The locations of proposed culvert retrofit sites are described in Table 4.4 and shown on Maps 4.4, 4.5, 4.6, and 4.7. Detailed information regarding each culvert retrofit project can be found in Appendix I.

Table 4.4: Culvert Retrofit Projects

Project ID	Map #	Name	Type of Project	Location	Benefit	Estimated Cost
PH9502	4.7	Tepper Drive	Install a 2 foot tall gabion dam upstream of the culvert. This will create a micro-pool in the shallow swale in the upstream wooded area.	Tepper Drive	Stormwater quality control	$40,000
PH9504	4.7	Private Drive near Yates Ford Road	Install a 2' high gabion dam upstream.	Private Drive near Yates Ford Road	Stormwater quality control	$50,000
PH9505	4.7	Balls Ford Road	Install a 3' high gabion dam upstream. Have gabion dam detain flow from concrete "V" ditches from road.	Balls Ford Road	Stormwater quality control	$70,000
PH9512	4.7	Fairfax Station Road	Remove blockage within culvert. Install a 3' high gabion dam upstream.	Fairfax Station Road	Stormwater quality control	$70,000
PH9530	4.6	Saddle Horn Road	Install a 3' high gabion dam upstream. Remove invasive/exotic plants and replant with native vegetation	Saddle Horn Road	Stormwater quality control	$60,000
PH9540	4.5	Smoke Rise Road	Install a 3' high gabion dam upstream.	Smoke Rise Road	Stormwater quality control	$60,000
PH9580	4.4	Fairfax County Parkway	Install a 4' high gabion dam upstream of Caisson Road.	Fairfax County Parkway	Stormwater quality control	$90,000

Watershed Benefit: A micro-pool will be formed upstream of the gabion weir structure, reducing stormwater runoff. This action will also allow water to infiltrate into the soil, recharging groundwater supplies.

Action A3.3: Replace road crossings that overtop and flood.

Strategy to Achieve Action: Replace culverts and bridges that overtop during one-year storm events. The 1979 *Proposed Drainage Plan, The Occoquan Watersheds* report (Parsons, Brinckerhoff, Quade and Douglas) identifies 30 road drainage projects in the Popes Head Creek watershed. This plan proposes to "roll over" 10 of the 30 proposed projects; the other 20 projects have been completed or recommended for deletion. Table 4.5 depicts the Master Drainage Plan proposed projects, with projects recommended for deletion shaded in grey.

Table 4.5: Master Drainage Plan Proposed Projects

SEGMENT	TAXMAP	Type of Work	Old Project Name	Old Project Number	Comments
ACADEMY	76-2	RAISE RD & RPL CULV FAIRFAX STATION ROAD		PH471	New Project PH9420
CASTLE CREEK	75-4	RAISE RD & RPL CULV NEWMAN RD		PH411	New Project PH9411
CASTLE CREEK	75-4	RAISE RD @ NEWMAN RD		PH412	Not added to study - based on field visit Feb 11, 2005, not exhibiting erosion or flooding at this time
CLIFTON	76-3	RAISE RD & RPL BRIDGE COLCHESTER ROAD		PH431	New Project PH9403
EAST FORK	68-1	FLOODPROOF HOUSE 4716 GROVESLN	Groves Lane	Z00018	Active project - not added to study
EAST FORK	68-1	RIP RAP	Breacon Ridge Sub	PH0291	New Project PH9270
EAST FORK	68-1	RAISE RD/REG SWM PND	Brookline Drive		Recommended for Deletion
LEGATO	56-1	STREAM RESTOR & STABIL		PH261	No erosion identified in SPA - not added to Plan
LEWIS PARK	66-2	LOWER INV & RPL CULVERT WALCOTT AVENUE		PH452	New Project PH9462
LEWIS PARK	67-1	LOWER INV & RPL CULV BRADDOCK		PH453	From photos - pipes have been enlarged since 1979 study - not added to study
LEWIS PARK	67-1	LOWER INV & RPL CULV		PH451	Recommended for Deletion
PINEY BRANCH	67-3	LOWER INV & RPL CULVERT POPES HEAD ROAD		PH422	New Project PH9453
PINEY BRANCH	76-1	RAISE RD & RPL CULVERT FAIRFAX STATION ROAD		PH441	New Project PH9414
POPES HEAD	75-4	RPL CULV & CHANNEL IMPROVEMENT ALONG CLIFTON ROAD		PH201	New Projects PH9401 and PH9202
POPES HEAD	75-4	RPL CULV @ CLIFTON RD		PH401	New Project PH9402
SHIRLEY GATE	57-3	STREAM RESTOR & STABIL		PH281	No erosion identified in SPA - not added to study
SHIRLEY GATE	57-3	STREAM STABIL	San Carlos DrR0010	X00014	Recommended for Deletion
VANNOY PARK	67-3	LOWER INVERT & RPL CULV NEWMAN		PH422	New Project PH9435
VANNOY PARK	76-1	LOWER INVERT & RPL CULVERT COLCHESTER ROAD		PH421	A swm pond is now located just upstream of this structure - not added to plan

Deleted projects are shaded in grey.

The locations of all proposed road crossing replacement projects, including those rolled over from the 1979 Proposed Drainage Plan, are described in Table 4.6 and shown on Maps 4.3, 4.4, 4.5, 4.6, 4.7 and 4.8. Detailed information regarding each road crossing project can be found in Appendix J.

Table 4.6: Road Crossing Projects

Project ID	Map #	Name	Type of Project	Location	Benefit	Estimated Cost
PH9400	4.8	Clifton Road and Popes Head Creek	Bridge Project	Clifton Road and Popes Head Creek	Reduce road flooding frequency – emergency access.	$1,850,000
PH9401	4.8	Clifton Road #2 and #3 at Popes Head Creek unnamed trib	Culvert Replacement	Clifton Road #2 and #3 at Popes Head Creek unnamed trib	Reduce road flooding frequency – emergency access.	$260,000
PH9403	4.6	Newman Road and Castle Creek	Bridge Project	Newman Road and Castle Creek	Reduce road flooding frequency – emergency access.	$390,000
PH9404	4.7	Colchester Road and Popes Head Creek	Bridge Project	Colchester Road and Popes Head Creek	Reduce road flooding frequency – emergency access.	$1,240,000
PH9412	4.6	Newman Road and Castle Creek Trib 1	Culvert Replacement	Newman Road and Castle Creek Trib 1	Reduce road flooding frequency – emergency access.	$430,000
PH9414	4.4	Fairfax Station Road and Piney Branch, Popes Head Creek, Trib to Popes Head	Culvert Replacement	Fairfax Station Road and Piney Branch, Popes Head Creek, Trib to Popes Head	Reduce road flooding frequency – emergency access.	$4,190,000
PH9420	4.5	Fairfax Station Road and Popes Head Creek unnamed trib	Culvert Replacement	Fairfax Station Road and Popes Head Creek unnamed trib	Reduce road flooding frequency – emergency access.	$160,000
PH9435	4.7	Newman Road and Castle Creek unnamed trib	Culvert Replacement	Newman Road and Castle Creek unnamed trib	Reduce road flooding frequency – emergency access.	$130,000
PH9450	4.6	Colchester Road and Castle Creek Trib 1	Drainage Improvement	Colchester Road and Castle Creek Trib 1	Reduce road flooding identified by community	$1,020,000
PH9452	4.4	Popes Head Road and Piney Branch	Bridge Project	Popes Head Road and Piney Branch	Reduce road flooding frequency – emergency access.	$10,000
PH9453	4.4	Popes Head Road and Piney Branch unnamed trib	Culvert Replacement	Popes Head Road and Piney Branch unnamed trib	Reduce road flooding frequency – emergency access.	$180,000
PH9461	4.5	Popes Head Road and Popes Head Creek	Bridge Project	Popes Head Road and Popes Head Creek	Reduce road flooding frequency – emergency access.	$1,050,000
PH9462	4.4	Walcott Ave and Piney Branch	Culvert Replacement	Walcott Ave and Piney Branch	Reduce road flooding frequency – emergency access.	$100,000
PH9470	4.3	Brookline Drive and East Fork	Culvert Replacement	Brookline Drive and East Fork	Reduce road flooding frequency – emergency access.	$300,000

Watershed Benefit: This action will reduce the number of roads that are flooded during large storm events. It will provide safe access for emergency vehicles and residents of the watershed.

***Action A3.4**:* Remove dumpsites and obstructions from stream corridors.

Strategy to Achieve Action: Dump sites and obstructions were identified in the watershed using the Stream Physical Assessment GIS data. In certain cases, community members and volunteers can assist in the removal and cleanup of small dumpsites. The locations of obstruction removal projects are shown on Maps 4.2, 4.3, 4.4, 4.5, and 4.8. Detailed information regarding each maintenance activity project can be found in Appendix K.

Table 4.7: Obstruction Removal Projects

Project ID	Map #	Name	Location	Type of Project	Benefit	Estimated Cost
PH9900	4.8	Kincheloe Road	Kincheloe Road, south of the Town of Clifton	Debris Removal	Removal of 55-Gallon Drums, tires, and trash	$4,000
PH9960	4.4	Hope Park Road	Hope Park Road, south of Rochester Drive	Debris Removal	Reduce safety risk and eliminate pollutant source	$3,000
PH9961	4.4	Hope Park Road #2	Hope Park Road and Piney Branch Tributary	Debris Removal	Reduce safety risk and eliminate pollutant source	$1,400,000
PH9962	4.5	Popes Head Road	Popes Head Road, west of Fairfax County Parkway	Debris Removal	Removal of debris which includes furniture, pallets, pulleys, and lawn waste	$5,000
PH9970	4.2	Washington Street	Washington Street and 2nd Road	Automobile/Debris Removal	Reduce safety risk and eliminate pollutant source	$5,000
PH9973	4.2	Bentonbrook	West of Bentonbrook	Obstruction Removal /collapsed footbridge removal	Remove dam and return stream to natural slope for fish to be able to swim upstream. Remove wooden footbridge for fish to swim upstream	$6,000
PH9981	4.4	Crescent Drive	South of Crescent Drive	Automobile Removal	Reduce safety risk and eliminate pollutant source	$5,000

Watershed Benefit: This action will remove unsightly debris from the watershed, which poses a safety risk. It will improve the aesthetic quality of the watershed. It also provides an opportunity for public outreach and education. The removal of obstructions will provide passage for fish to swim upstream.

Objective A4: Preserve, maintain, and restore riparian buffers to protect stream health and water quality.

Rationale: Approximately half of the stream buffers in the Popes Head Creek Watershed are of moderate, low, or poor quality. The primary cause for stream buffer loss in this watershed is clearing for lawns. Riparian buffers are needed to support watershed habitats by providing filtering of runoff from adjacent lands and providing a place for native plants and animals to live. The County's Chesapeake Bay Preservation ordinance requires that riparian buffers not be disturbed for perennial streams. The environment section of the County's *Policy Plan*, Objective 9 states: "Identify, protect, and enhance an integrated network of ecologically valuable land and surface waters for present and future residents of Fairfax County." Objective 10 states: "Conserve and restore tree cover on developed and developing sites. Provide tree cover on sites where it is absent prior to development." This watershed plan objective for restoring and managing riparian buffers helps to meet these *Policy Plan* objectives.

Action A4.1: Plant native vegetation next to streams in areas that are identified as good candidates for buffer restoration.

Strategy to Achieve Action: Restoring riparian buffers on public property is the first step. Also, work with private landowners to have them increase any stream buffers on their property. Additionally, place the land in a conservation easement if possible. The need for easements on private property will have to be determined to facilitate the restoration of riparian buffers. The removal of invasive/exotic species and the restoration of native species will be performed for all of the buffer restoration projects. When removing invasive/exotic species the use of herbicides will be limited and other methods, such as manual removal, employed where possible. The County and landowners will coordinate with the Virginia Department of Forestry, the National Wildlife Foundation, and the Virginia Native Plants Society to provide appropriate buffer material and species mixes. The Virginia Department of Forestry features a Riparian Forest Buffer Establishment

Pack and a cost sharing program. The locations of proposed riparian buffer restoration sites are described in Table 4.3 and shown on Maps 4.3, 4.6, 4.7, and 4.8. Detailed information regarding each stream restoration project can be found in Appendix H.

Watershed Benefit: The buffers will increase the amount of habitat area, protect floodplain areas from erosion, protect properties from damage due to lateral stream movement, decrease stormwater runoff, and help filter pollutants from runoff. Buffers also provide shade to the stream. Reduced temperature of water released to streams will reduce mortality of stream animals during peak flow events and increase available oxygen in the base flow. A typical 50-foot riparian buffer can reduce over 90% of suspended solids, 60% of phosphorous, and 70% of nitrogen from stormwater runoff that flows through the buffer area. This action will help contribute to the nutrient reduction goals of Virginia's Shenandoah and Potomac Basins Tributary Strategy.

Action A4.2: Monitor the condition of restored and existing riparian buffer with annual stream walks to evaluate the condition and areas needing improvement.

Strategy to Achieve Action: The County will encourage volunteers to perform annual stream walks to collect information about the condition of the buffer. County personnel will teach the volunteers about the benefits of healthy buffers and identify the appropriate plants to use. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: This action will benefit the watershed by providing a way to monitor the success or failure of protecting existing and restored riparian buffers. It also provides an opportunity for public outreach and education.

Objective A5: Maintain the open space and pastoral quality of the watershed and preserve the aesthetic quality in both urban and rural areas.

Rationale: The open space and the pastoral quality in the watershed are a source of community pride, and community members are very interested in protecting these characteristics, stating that they add to their quality of life. Open space and pastoral land allow water to infiltrate into the soil, reducing the amount of stormwater runoff and reducing flooding.

***Action A5.1*:** Facilitate the acquisition and donation of conservation easements by community groups for riparian buffer and stream protection, and public/private open space for the environmental quality corridors described in the *Fairfax County Comprehensive Plan.*

Strategy to Achieve Effort: Increase partnership opportunities with organizations such as the Northern Virginia Conservation Trust (NVCT) and support the acquisition of additional trail and conservation easements in the watershed. The NVCT already holds a 5.5 acre easement and holds in joint ownership with the Town of Clifton approximately 9 acres along Popes Head Creek, both in the Town of Clifton, and is working with landowners and local Park Authorities to create a trail system for recreation.

Landowner education must be a strong component of this action in order to inform owners about potential benefits and tax credits that they might receive. Conservation easements will be primarily targeted in headwaters areas that lack riparian buffers where

possible, or in areas with environmentally sensitive lands that are not otherwise protected by ordinance. Large blocks of forest will also be targeted; this will provide large habitat areas for wildlife and prevent fragmentation. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: Although the benefit of this action is not easily quantifiable, its implementation will benefit the watershed by increasing and improving riparian buffers and protecting streams for perpetuity. The benefits of riparian buffers and stream protection are improved habitat, reduced stream and property erosion, and filtering of pollutants from runoff.

Objective A6: Develop water quality sensitive recreational opportunities.

Rationale: The need to balance environmental quality and recreational opportunities has always been a challenge for land managers. Excessive utilization of a resource can lead to a "tragedy of the commons" scenario, whereby the resource is depleted or degraded by the use of many different parties. In the Popes Head Creek Watershed, the use of All Terrain Vehicles (ATVs) is the most common recreational use that has contributed to the degradation of stream habitat. The Code of Virginia presently precludes the operation of ATVs on another person's property without the written consent of the owner; however, this activity continues to occur. Many of the frequently used ATV trails pass through the RPAs, destroying vegetation that holds soil particles together; other trails cross the streams, resulting in erosion and sedimentation.

Action A6.1*:* Post official County signage that publicizes the existence of the Resource Protection Areas (RPAs) and states that ATV and other usages that destroy vegetation and cause erosion are not permitted in the RPA.

Strategy to Achieve Action: The signs will be placed in highly visible locations near known ATV trails. The County will coordinate with local landowners to determine where the optimum placement for the signs is. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: The signs may deter ATV riders from damaging vegetation and causing erosion within the RPAs.

Action A6.2: Coordinate with the Fairfax County Police to target areas with significant ATV impacts for enforcement of existing laws and ordinances (e.g. trespassing and environmental regulations).

Strategy to Achieve Action: Establish "neighborhood watch" groups to report ATV violations on private property or Fairfax County parkland. The neighborhood watch groups could coordinate with the local Fairfax County Police community liaison to enforce "no trespassing" and RPA regulations. They could also help educate citizens about the impacts ATVs have on the watershed. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: This action will provide a deterrent to illegal ATV use and will reduce the number of ATV violations. It will also provide a good opportunity for public education and outreach.

Objective A7: Maintain the diversity of wildlife in the watershed.

Rationale: Community residents expressed a desire to provide a high quality environment for both humans and wildlife within the watershed. Communities that are highly diverse are indicative of healthy and strong ecosystems.

Action A7.1: Conserve land and water ecosystems to provide high quality habitat for wildlife.

Strategy to Achieve Action: This action will be accomplished by the implementation of Actions A4.1 and A5.1. The County will consult with local landowners to determine key areas to target for protection.

Watershed Benefit: The conservation of habitat will have many different benefits for the watershed. Residents will benefit from increased recreational opportunities, such as bird and wildlife viewing, hiking, and fishing. Trees in the riparian buffer zone will provide shade and food for aquatic life. The riparian buffer will also protect floodplain areas from erosion, protect properties from damage due to lateral stream movement, decrease stormwater runoff, and help filter pollutants from runoff. A typical 50-foot riparian buffer can reduce over 90% of suspended solids, 60% of phosphorous, and 70% of nitrogen from stormwater runoff that flows through the buffer area.

Action A7.2*:* Preserve large blocks of forest to prevent further fragmentation.

Strategy to Achieve Action: Increase partnership opportunities with organizations such as the Northern Virginia Conservation Trust (NVCT) and support the acquisition of large blocks of forest to place under conservation easement. The NVCT already holds a 5.5 acre easement and holds in joint ownership with the Town of Clifton approximately 9 acres along Popes Head Creek, both in the Town of Clifton, and is working with landowners and local Park Authorities to create a trail system for recreation.

Landowner education must be a strong component of this action in order to inform owners about potential benefits and tax credits that they might receive. Conservation easements will be primarily targeted in headwaters areas that lack riparian buffers where possible, or in areas with environmentally sensitive lands that are not otherwise protected by ordinance.

Watershed Benefit: This action will provide large habitat areas for wildlife and prevent fragmentation of habitat. Large blocks of forested land also provide increased stormwater infiltration, reducing stormwater runoff and increasing water quality in the watershed.

Goal B: Have a well informed community that is actively involved in watershed stewardship.

Public participation and outreach is a vital component of the watershed plan. An educated and active citizen base can promote environmental stewardship by “spreading the word” to neighbors, co-workers, friends and family members. They can identify new problem areas in the watershed and report them to the proper officials. A well informed and active community can also leverage political or financial support for watershed management projects.

Objective B1: Achieve community sponsorship of the watershed.

Rationale: Education and involvement in watershed issues will help to drive the actions for all of the goals of this plan. The community has been involved in all phases of the process to develop the Popes Head Creek Watershed Management Plan, and continued involvement will help in improving the state of the watershed. The County will also help to facilitate this goal through its Community Watershed Services Support project. This program will support community education and involvement strategies by distributing educational materials to the public, providing technical assistance to the community, and assisting in conducting outreach to neighborhood groups and associations. Community sponsorship is important for communicating plan successes, monitoring progress, and modifying the plan as necessary to adapt to changing conditions and ensure future success.

Action B1.1: Support the formation of a "Friends of Popes Head Creek" group composed of local citizens.

Strategy to Achieve Action: The current Citizen's Advisory Committee will be encouraged to continue to meet after the watershed planning process has been completed. They will coordinate with other existing organizations to create a robust network of watershed stewards. The County will provide guidance and technical assistance through the Community Watershed Support Services program. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: The benefits produced by active citizen involvement cannot easily be quantified; however, there are many different advantages that this action will achieve. The Friends of Popes Head Creek group will coordinate with existing local and state organizations to promote volunteer opportunities such as stream cleanup, stream monitoring, and education activities. They can seek grants and community sponsors to help fund watershed improvement projects. A feeling of community "ownership" of the watershed can also persuade residents to protect their environment.

Action B1.2: Establish a group of volunteer stream monitors and monitoring sites.

Strategy to Achieve Action: The main stem of Popes Head Creek does not currently have any active volunteer stream monitors in the stream monitoring program run by the Northern Virginia Soil and Water Conservation District. The Community Watershed Support Services program or members of the Stream Protection Strategy (SPS) will provide training to volunteers and assign them to the existing SPS sampling sites, as shown on Map 2.11. The volunteers will also coordinate with the existing group of volunteers at the Audubon Naturalist Society's Webb Sanctuary, who monitor an unnamed tributary of Popes Head Creek. The volunteers will conduct sampling at the SPS sites four times a year, and report their findings to the County. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: This action will supplement and enhance the level of monitoring that is currently performed in Popes Head Creek and provide a more complete dataset for evaluation. It will engage the citizens and provide them with an opportunity to learn more about biological monitoring. It provides an opportunity for public outreach and

participation. This action can also be used to evaluate the impacts of BMPs and LID projects that have been installed upstream of the monitoring sites.

Objective B2: Develop and consolidate educational materials that describe the value of the watershed.

Rationale: Many community members have expressed a desire to "do their part" to help protect the watershed by improving landscaping and water use practices at home. However, they have stated that existing materials are often hard to find and not specific to their watershed. Many citizens have suggested that new educational materials be developed that will specifically tell homeowners what species of native plants to use, where to obtain the plants, and where to use the plants on their property. They also stressed that consolidation of materials is very important; the materials must be easily accessible to the public, and contain all of the required information in one package.

Action B2.1*:* Develop and distribute educational materials that describe beneficial landscaping techniques for homeowners.

Strategy to Achieve Action: There are numerous existing materials that describe various aspects of watershed protection; the materials that are most applicable to the Popes Head Creek Watershed will be consolidated and packaged together. If the existing materials do not adequately address the specific issues found in Popes Head Creek, then new educational materials will be produced by the County. The materials will, at a minimum, address the following issues:

- Nutrients and proper lawn care;
- The benefits provided by riparian buffers;
- The benefits of using native plants for landscaping, and how to identify and remove invasive plant species;
- Identification keys for native plant species;
- Local nurseries that sell native plants;
- Care of home ponds;
- Contact information for the Fairfax County Master Gardener and the Agricultural Extension Office.
- Easy-to-implement solutions to stormwater runoff, designed for homeowners.

Because Popes Head Creek is primarily composed of Estate Residential land uses, the educational materials will address the management and maintenance of large lots that are greater than one acre. Most existing educational materials for homeowners describe management strategies for medium-density, quarter acre lots, which may not be appropriate for the majority of the watershed.

There are several different strategies for distribution of education materials. They can be mailed annually to homeowner associations (HOAs) for redistribution. The materials can be included in quarterly notices from the Fairfax County Water Authority; however, some residents in the watershed maintain private wells and do not receive mail from the Water Authority. Another strategy is to include educational materials in the Fairfax County Health Department's annual notice to switch septic drain fields. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefits: The benefits provided by this action are not easily quantifiable. However, a well informed and educated community is more likely to engage in stewardship and volunteer opportunities within the watershed. They may also spread the environmental protection techniques they have learned to neighbors, co-workers, friends, and family members, strengthening a network of environmental stewards.

Action B2.2: Develop and distribute educational materials that describe beneficial landscaping techniques to landscaping companies and suppliers.

Strategy to Achieve Action: These brochures will be distributed to landscaping companies and lawn and garden suppliers who are highly active within the watershed. Materials will be printed in multiple languages to facilitate understanding. They will stress the importance of water quality protection, and detail the dangers that result from the over-application of fertilizers and pesticides. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: This action will help prevent excessive nutrients from running off into the streams, preventing eutrophication. Eutrophication occurs when algal blooms, stimulated by excessive nutrients, prevent sunlight from reaching other aquatic plants; the algal blooms eventually die and decompose, reducing the amount of dissolved oxygen available for aquatic life. This action will also prevent harmful pesticides from running off into streams. This action will help contribute to the nutrient reduction goals of Virginia's Shenandoah and Potomac Basins Tributary Strategy.

Action B2.3: Distribute educational materials about appropriate horse care and grazing management in the Resource Protection Area.

Strategy to Achieve Action: Coordinate with the Northern Virginia Soil and Water Conservation District (NVSWCD) to promote the existing educational program for horse care and grazing practices. These educational materials will be distributed to local veterinarians who care for horses or other large animals; they can then redistribute the materials to horse owners during annual examinations. Educational materials will also be distributed to suppliers of horse care products and supplies. The materials will also be given to local organizations, such as the Clifton Horse Society. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: A significant number of people within the watershed own horses. If horse owners are taught techniques for proper horse management within the RPA, erosion and sedimentation can be decreased. Fecal coliform levels will also decrease if animal waste is stored in an appropriate location, thus protecting water quality.

Action B2.4: Distribute educational materials to private pond owners that describe proper maintenance.

Strategy to Achieve Action: The Virginia Department of Game and Inland Fisheries produces a brochure that describes best management practices for private ponds. These brochures can be distributed to private pond owners and to local realtors who market properties that contain ponds. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: Proper pond maintenance can prevent the growth of harmful vegetation and the cultivation of mosquitoes. It can also prevent dam failure.

Action B2.5: Develop and distribute educational materials for proper ATV usage in the watershed.

Strategy to Achieve Action: Distribute educational materials to ATV dealers that describe the impacts of ATVs on the stream corridor, governing regulations, and proper ATV etiquette. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: The educational materials may deter ATV riders from damaging vegetation and causing erosion within the RPAs. They will also be informed of the potential penalties that result from illegal usage of ATVs on public or private property.

Action B2.6*:* Develop and distribute educational materials that describe the benefits of wildlife, such as beavers, in the watershed.

Strategy to Achieve Action: Coordinate with agencies, such as the Fairfax County Park Authority and the Virginia Department of Game and Inland Fisheries, to distribute educational materials to landowners in areas where wildlife is abundant. Detailed information regarding this non-structural project can be found in Appendix L.

Watershed Benefit: Wildlife performs many important functions in ecosystems. Beavers can increase plant biodiversity by damming streams, which creates habitat diversity. Beaver dams decrease downstream flooding, and allow pollutants to infiltrate into the ground, therefore increasing water quality benefits.

Goal C: Continue to maintain the Occoquan Reservoir as a clean and sustainable source of potable water for Fairfax County.

The Occoquan Reservoir is the major source of potable water for the residents of Fairfax County. It is a 2,100 acre impoundment that is managed by the Fairfax County Water Authority, forming the boundary between Fairfax and Prince William Counties. As stated previously in this report, over 41,000 acres in the Occoquan Watershed were rezoned in 1982 to protect water quality. Land in the rezoned area is classified as Residential-Conservation (R-C) District, or one dwelling unit per five acres.

Objective C.1: Reduce the amount of pollutants, such as fecal coliform, nitrogen, phosphorus, and sediment that enters the Occoquan Reservoir.

Rationale: Excessive nutrients cause algal blooms to form. These blooms prevent sunlight from reaching other aquatic plants, and eventually die and decompose, reducing the amount of dissolved oxygen available for aquatic life. This process is known as eutrophication, and increases the cost of treatment at the Fairfax County Water Authority water treatment plant.

Action C1.1: Install new LIDs and BMPs or enhance the performance of existing stormwater management facilities to reduce sediment and phosphorus loading in stormwater runoff.

Strategy to Achieve Action: New LIDs and BMPs will be installed in strategic locations to maximize pollutant removal, such as downstream of large impervious areas, or downstream of known sources of nutrient-rich runoff. The retrofit of existing stormwater management facilities will provide a greater pollutant removal benefit through nutrient uptake by plants, or by detaining water for a longer time in detention facilities. The County would not have to obtain an easement for retrofitting existing public stormwater management facilities unless additional areas around the facilities are needed. The cost is minimal to create a wetland in the bottom of an existing dry detention facility and/or reconfigure the outlet structure. This Action will be achieved through the implementation of Action A1.1: *Retrofit Existing Stormwater Management Facilities* and Action The locations of existing stormwater management facilities and BMPs that are suitable for retrofit projects are described in Table 4.1 and shown on Maps 4.2, 4.3, 4.4, and 4.5. Detailed information regarding each pond and possible retrofit options can be found in Appendix F. The locations for new proposed LID projects are described in Table 4.2 and shown on Maps 4.2, 4.3, 4.4, 4.5, 4.6, and 4.8. Detailed information regarding each LID project can be found in Appendix G.

Watershed Benefit: This action would reduce the amount of polluted runoff that enters the Occoquan Reservoir. This will prevent the formation of harmful algal blooms and decrease the treatment costs of the Fairfax County Water Authority Water Treatment Plant. It will also help contribute to the nutrient reduction goals of Virginia's Shenandoah and Potomac Basins Tributary Strategy.

Action C1.2: Manage large existing areas of lawn at institutional and commercial properties to minimize nutrient loading in streams.

Strategy to Achieve Action: Coordinate with large landowners, including George Mason University and the Country Club of Fairfax, to reduce fertilizer and nutrient runoff from athletic fields and other large areas of managed turf. The County will provide education on nutrient management to grounds crews at these properties. The Special Exception Amendment for the County Club of Fairfax (SEA 99-S-012, approved February 23, 2004) requires the County Club to meet various floodplain, water quality, and stormwater management conditions. The Zoning Enforcement Branch and DPWES will monitor the Country Club to ensure that these conditions are being met.

Watershed Benefit: Proper procedures for managing these areas will minimize nutrient and sediment loading in streams. This will help contribute to the nutrient reduction goals of Virginia's Shenandoah and Potomac Basins Tributary Strategy.

4.4.1 Summary of Projects:

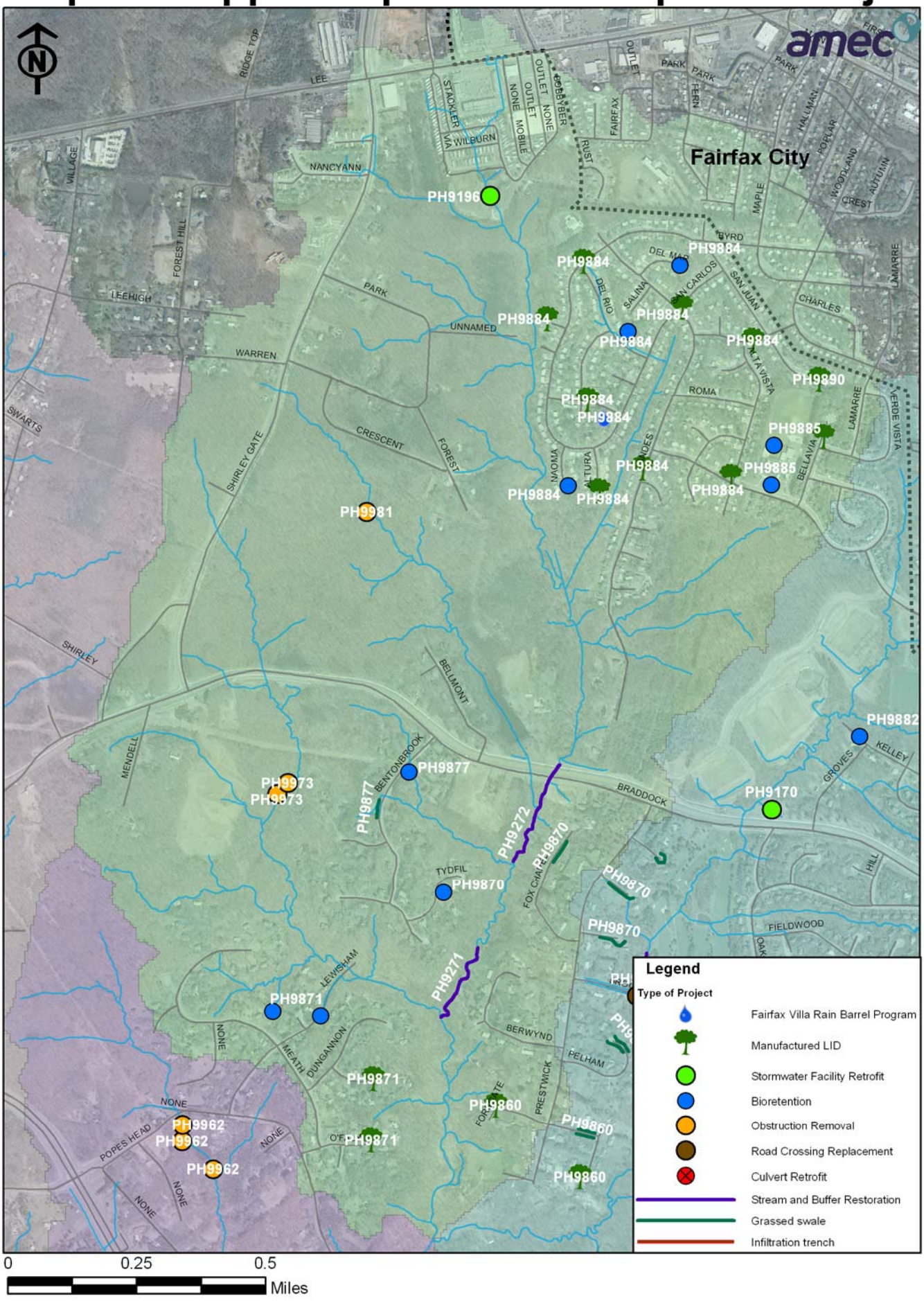
Maps 4.2 – 4.8 show the locations of structural projects in each of the seven subwatersheds. Table 4.8 summarizes the non-structural projects, which do not have a specific location attributed to them.

Table 4.8: Non Structural Projects

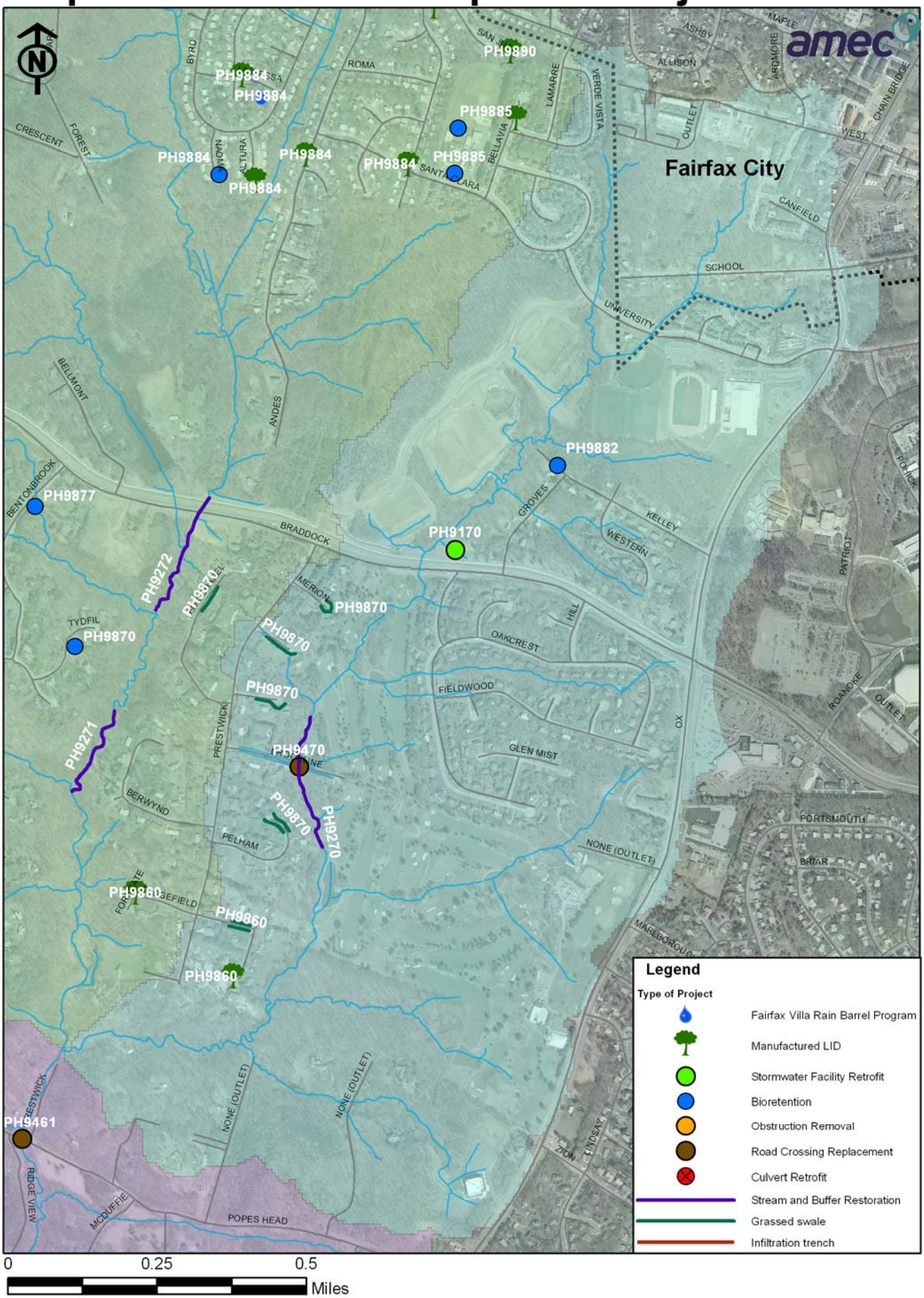
Action ID	Description	Benefit	Estimated Cost
A2.1	Program to facilitate and encourage homeowners and developers to disconnect impervious areas.	Reduction in stormwater runoff flowing directly to the street and storm drain system	$8,000 annual cost
A2.2	Monthly street sweeping program for parking lots in the watershed and residential streets in the Fairfax Villa subdivision	Street sweeping will removed the sediments, debris and gross particulate matter	$40,000 annual cost
A4.2	Monitor the condition of restored and existing riparian buffers	Provides public outreach and a way to monitor the success or failure of protecting existing and restored buffers.	$10,000 annual cost
A5.1	Facilitate the acquisition and donation of conservation easements for riparian buffer and stream protection	Increased and improved riparian buffers to protect the streams for perpetuity. Additionally, this will result in improved habitat	$30,000 annual cost
A6.1	Post official County signage that publicizes the existence of the Resource Protection Areas (RPAs)	The signs may deter ATV users and others from activities that damage vegetation and cause erosion within the RPAs.	$15,000 initial cost, $3,200 annual cost
A6.2	Coordinate with the Fairfax County Police to target areas with significant ATV impacts	Provides a deterrent to illegal ATV use on private land and RPAs and reduce the number of ATV violations.	$10,000 annual cost
B1.1	Support the formation of a “Friends of Popes Head Creek” group composed of local citizens.	Promotes volunteer opportunities such as stream cleanup, stream monitoring, and education activities.	$4,800 annual cost
B1.2	Establish a group of volunteer stream monitors and monitoring sites.	Supplements and enhances the level of monitoring that is currently performed in Popes Head Creek and provides a more complete dataset for evaluation.	$8,000 annual cost
B2.1	Develop and distribute educational materials that describe beneficial landscaping techniques for homeowners.	A well informed and educated community is more likely to engage in stewardship and volunteer opportunities within the watershed.	$8,000 annual cost
B2.2	Develop and distribute educational materials that describe beneficial landscaping techniques to landscaping companies	This will help prevent excessive nutrients and harmful pesticides from running off into the streams, preventing eutrophication.	$8,000 annual cost
B2.3	Develop and distribute educational materials about appropriate horse care and grazing management in the RPA.	Decreased erosion, sedimentation, and fecal coliform levels.	$4,800 annual cost

Action ID	Description	Benefit	Estimated Cost
B2.4	Develop and distribute educational materials to private pond owners that describe proper maintenance.	Proper pond maintenance can prevent the growth of harmful vegetation and the cultivation of mosquitoes.	$4,800 annual cost
B2.5	Develop and distribute educational materials for proper ATV usage in the watershed.	The educational materials may deter ATV riders from damaging vegetation and causing erosion within the RPAs.	$4,800 annual cost
B2.6	Develop and distribute educational materials that describe the benefits of wildlife, such as beavers, in the watershed.	Beavers can increase plant biodiversity by damming streams, which creates habitat diversity.	$4,800 annual cost
C1.2	Manage large existing areas of lawn at institutional and commercial properties to minimize nutrient loading in streams	Proper procedures for managing the athletic fields will minimize nutrient and sediment loading in the stream	$8,000 annual cost

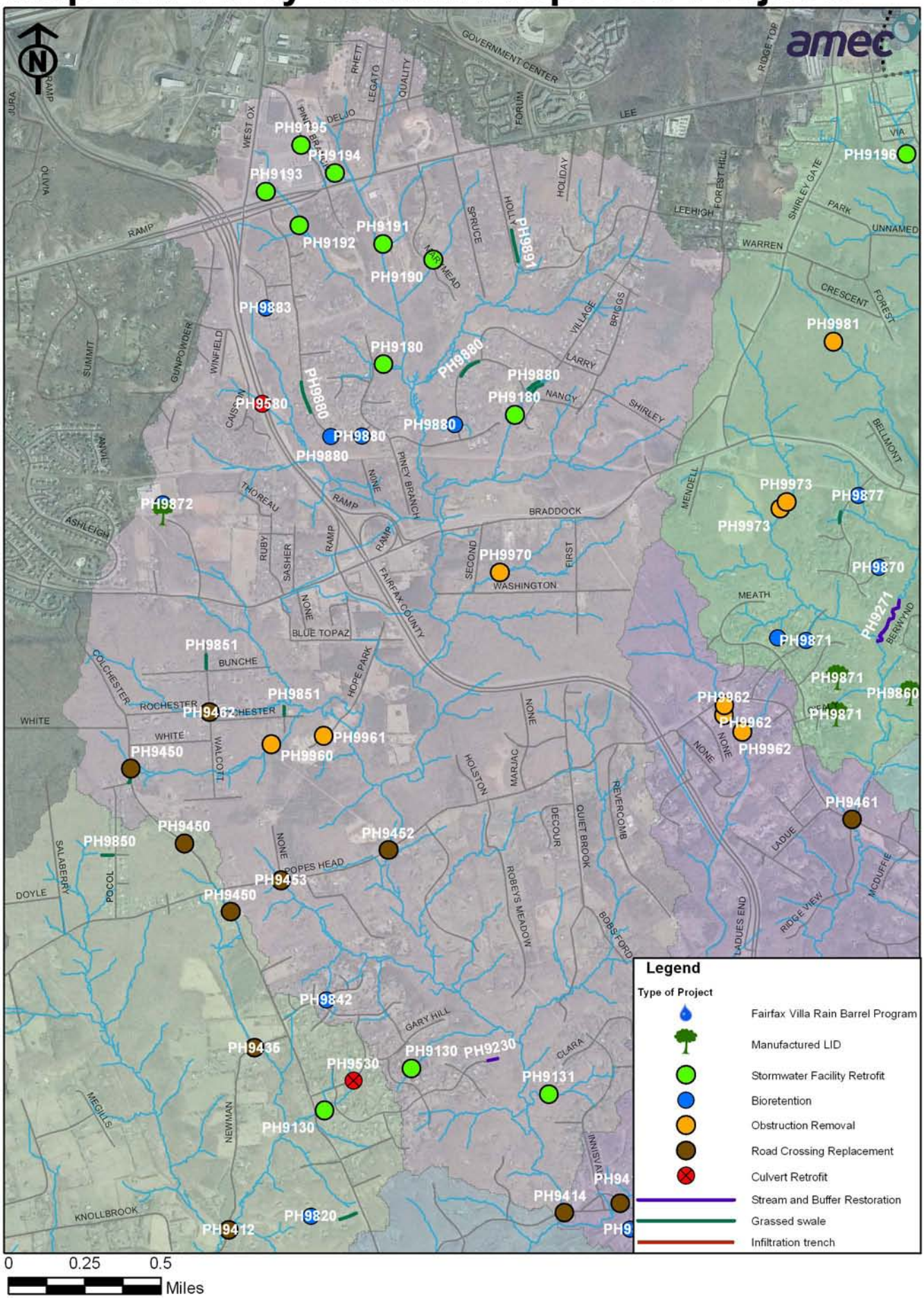
Map 4.2: Upper Popes Head Proposed Projects



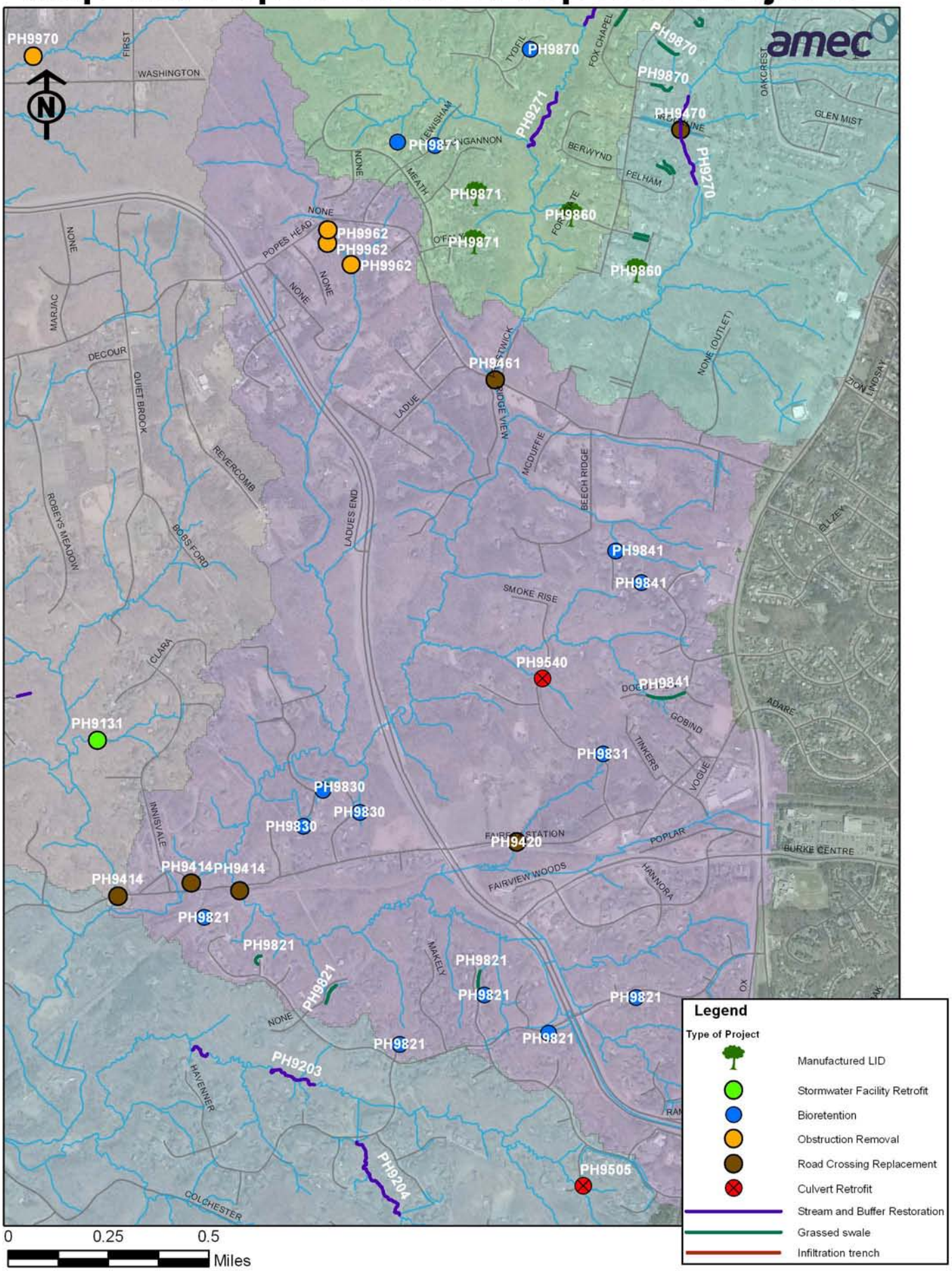
Map 4.3: East Fork Proposed Projects



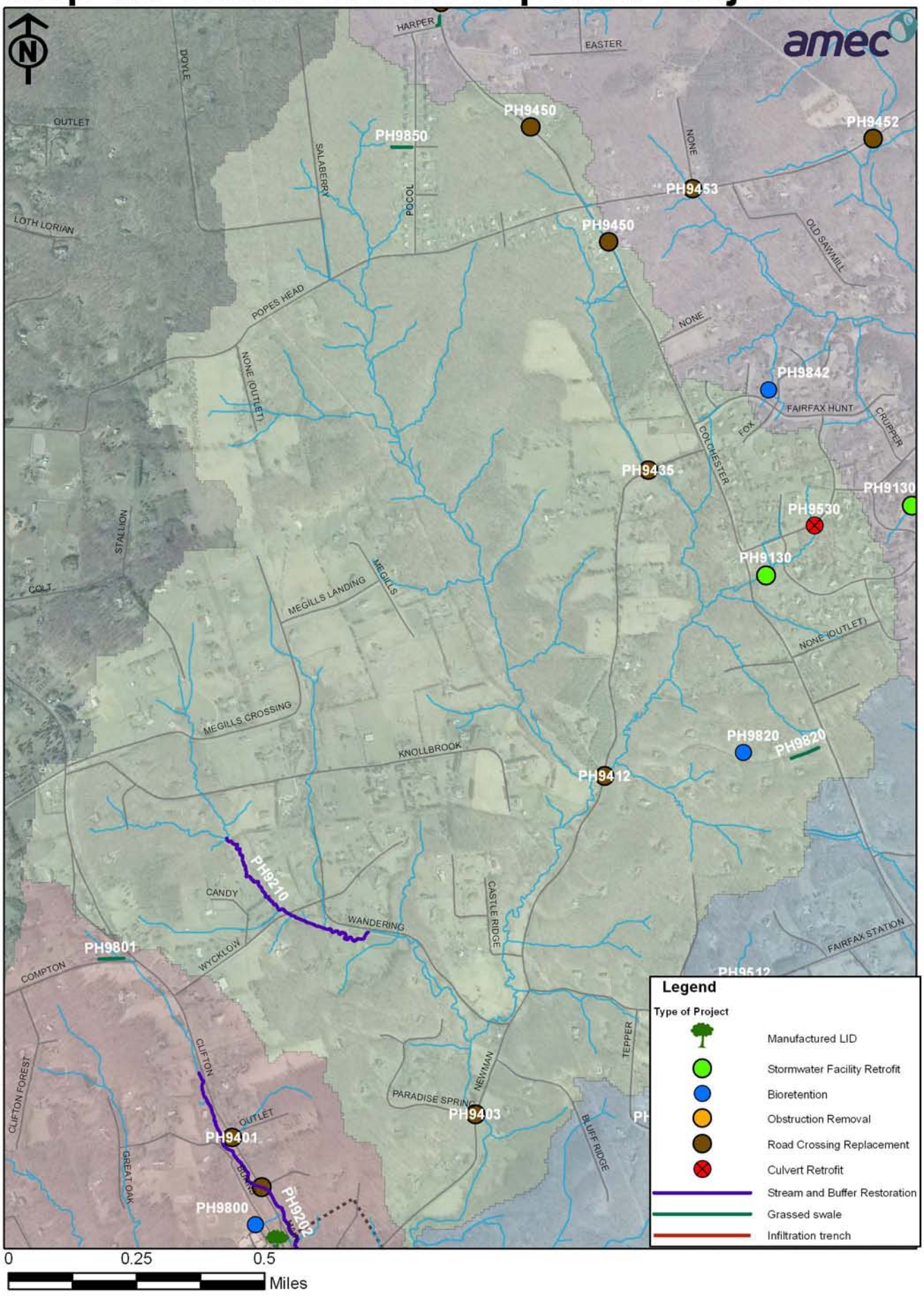
Map 4.4: Piney Branch Proposed Projects



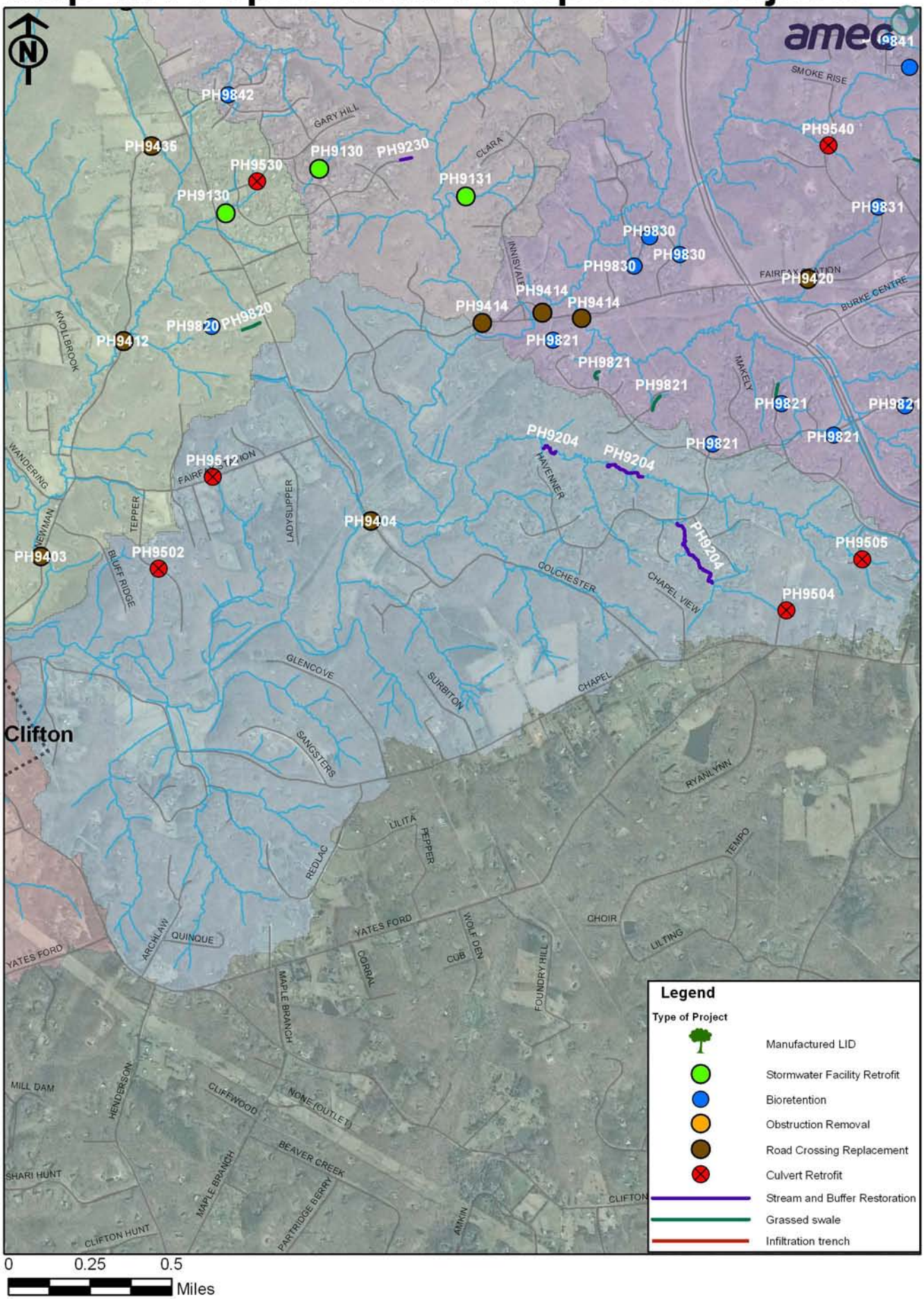
Map 4.5: Popes Head 2 Proposed Projects



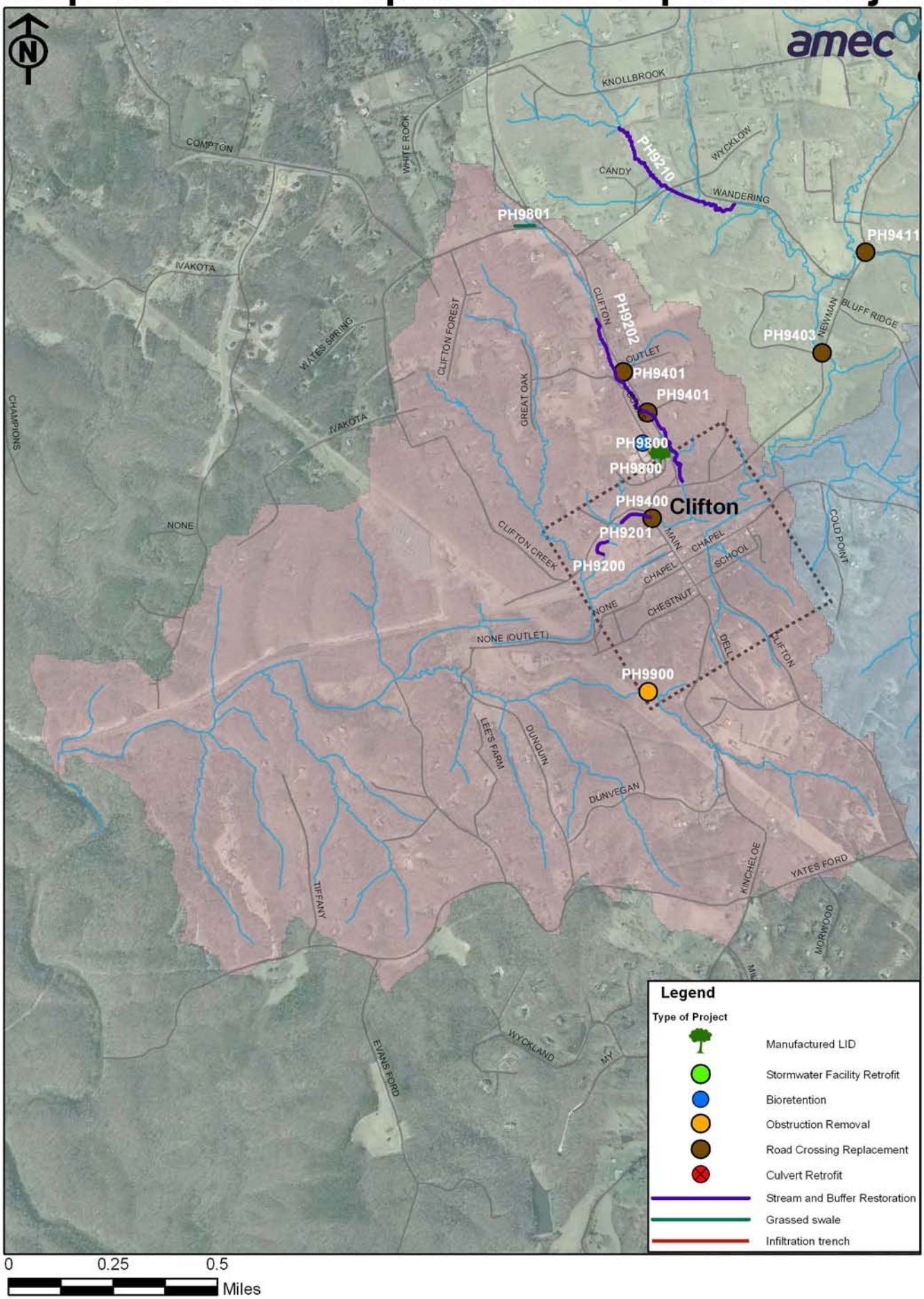
Map 4.6 Castle Creek Proposed Projects



Map 4.7: Popes Head 3 Proposed Projects



Map 4.8: Lower Popes Head Proposed Projects



4.5 Benefits of Plan Actions

Future conditions and future conditions with proposed BMPs were modeled to compare the condition of the watershed when development is continued without any changes to the watershed, and when projects identified above are completed. Unlike other watersheds within Fairfax County, the Popes Head Creek watershed is currently in good condition, with a future imperviousness of only 11.4%, due to the 1982 rezoning for the Occoquan reservoir. Even though it is not a highly developed watershed, it is still important to implement the proposed actions to preserve the watershed and because Popes Head Creek is a major tributary to the Occoquan Reservoir, which serves as one of the primary drinking water sources for Fairfax County. With this in mind, most of the proposed BMP projects and watershed wide actions are for water quality control, not water quantity control.

The proposed actions in the Popes Head Creek Watershed Management Plan will reduce pollutant loadings throughout the watershed. The future conditions with proposed BMPs model shows a 8.93% decrease in Total Suspended Solids (TSS), a 3.15% decrease in Total Phosphorus (TP), and a 2.85% decrease in Total Nitrogen (TN) pollutant loads for the entire Popes Head Creek watershed. It is important to note that the Popes Head Creek watershed will not show significant decreases in pollutant loading due to the relatively pristine existing condition of the watershed. The Piney Branch and Popes Head 2 subwatersheds both show above average improvements. This is important because both subwatersheds were given "fair" Stream Protection Strategy site condition ratings, as shown on Map 2.11. All other subwatersheds have "good" or "excellent" site condition ratings. Table 4.9 shows pollutant reductions by subwatershed if the proposed BMP projects are implemented.

Table 4.9 Pollutant Loading by Subwatershed

Subwatershed	Future TSS (lb/ac/yr)	Future TSS with proposed BMPs (lb/ac/yr)	Reduction in TSS (lb/ac/yr)	% Decrease TSS	Future TP (lb/ac/yr)	Future TP with proposed BMPs (lb/ac/yr)	Reduction in TP (lb/ac/yr)	% Decrease TP	Future TN (lb/ac/yr)	Future TN with proposed BMPs (lb/ac/yr)	Reduction in TN (lb/ac/yr)	% Decrease TN
Castle Creek	31.78	31.03	0.75	2.37	0.39	0.39	0.00	0.76	2.98	2.96	0.02	0.50
Piney Branch	58.84	46.51	12.33	20.95	0.56	0.52	0.04	6.82	4.20	3.97	0.23	5.54
East Fork	152.52	145.63	6.89	4.52	0.88	0.86	0.02	1.71	7.52	7.35	0.17	2.29
Upper Popes Head	91.34	89.37	1.97	2.16	0.85	0.84	0.01	1.29	6.18	6.10	0.08	1.21
Popes Head 2	67.70	60.29	7.40	10.93	0.59	0.57	0.02	4.05	4.91	4.70	0.21	4.30
Popes Head 3	37.75	36.48	1.27	3.36	0.44	0.44	0.01	1.58	3.47	3.45	0.02	0.58
Lower Popes Head	56.32	54.69	1.63	2.89	0.47	0.46	0.01	1.71	4.33	4.26	0.06	1.50
Popes Head Creek Total	63.64	57.96	5.69	8.93	0.57	0.55	0.02	3.15	4.52	4.39	0.13	2.85

Stream Habitat Improvements

The proposed stream restoration projects will also improve the stream habitat and improve water quality. To quantify the benefits of the proposed stream restoration projects, the Army Corps of Engineers (COE) stream condition index (SCI) rating was applied to the stream reaches to determine the increase in stream habitat and reduction in erosion and sediment loss. Briefly, the SCI is determined by looking at 5 variables within the stream and rating them from 1.0 to 5.0. The stream was then ranked from 1.0 (worst) to 5.0 (best) as to it's condition. The potential stream restoration areas have a SCI ranging from 2.8 to 4.15. Please see table 4.10 below showing the overall rating for the existing and proposed conditions. The table demonstrates that there is an increase in the SCI, showing that the stream restoration projects will improve the stream habitat and water quality of the watershed.

Table 4.10: Stream Condition Index Scores

Project ID	Stream Reach	Existing SCI	Proposed SCI	Increase SCI (%)
PH9201	Clifton Creek #1	4.15	4.50	8
PH9200	Clifton Creek #2	4.15	4.5	8
PH9202	Clifton Road	2.95	3.95	34
PH9210	Wycklow Drive	3.2	4.2	31
PH9204	Young Branch Road - Part 1	3.85	4.35	13
PH9204	Young Branch Road – Part 2	2.8	3.85	38
PH9270	Brookline Drive	2.95	4.55	54
PH9271	Fox Chapel Road	4.05	4.50	11
PH9272	Berwynd Drive	4.05	4.50	11

Again, the watershed plan focuses more on the water quality improvements because of the watershed land usage. The watershed is primarily zoned for 5 acres lots, therefore water quantity control is not as necessary as in a more developed area. The nature of the future development in this watershed is for minimal impervious area and a large increase in water volume is not anticipated. Future development located in the upper watershed outside of the resource conservation district will be required to provide water quantity and quality controls. Additionally, most of the existing development in the upper watershed is relatively new and the SWM ponds that do exist already have stringent water quantity controls in place. This is why the plan projects and watershed wide actions focus on water quality improvements.

4.6 Implementation of Plan Actions

The recommended plan actions described in Section 4.4 will be implemented over the 25-year life of the Popes Head Creek Watershed Management Plan. This plan will serve as guidance for all County agencies and officials to protect and maintain the health of the Popes Head Creek watershed. The plan will be considered as an active, or "living," document that is revisited every five years. The initial implementation schedule was developed as described below.

The first step in developing a logical and feasible implementation schedule was to prioritize the actions and evaluate how well they meet the Goals of the plan. A weighted set of five categories was used to prioritize each plan action. Each weight factor is indicated in parenthesis:

1. Board Adopted Stormwater Control Project Prioritization Categories (40%)
    - Projects that are mandated by state or federal regulations for immediate implementation and projects that address critical/emergency dam safety issues.
    - Projects that alleviate structures from damage by flood waters or by being undermined by severe erosion.

- Projects that achieve stormwater quality improvement in specific conformance with the County's obligation under the Chesapeake Bay initiatives and/or the VPDES permit for storm sewer system discharges
- Projects that alleviate severe streambank and channel erosion.
- Projects that alleviate moderate and minor streambank and channel erosion.
- Projects that alleviate yard flooding.
- Projects that alleviate road flooding.

2. Direct Regulatory Contribution (10%)
   - Hybrid projects that accomplish multiple objectives.
   - Contributions directly to MS4 and Virginia Tributary Strategies compliance.
   - Contributions towards TMDL compliance.
   - Indirect water quality benefits.
   - Flood mitigation.

3. Public Support (10%)
   - Citizen's Advisory Committee support.
   - Support for projects by affected residents.

4. Effectiveness/Location (25%)
   - Quantity control projects are more desirable in "headwaters" areas that lack stormwater management controls.
   - Quality control projects are desirable in areas that previously lacked controls.
   - An indication of relative benefit of a project, such as pollutant reduction or efficiency, increased retrofit area, etc.

5. Ease of Implementation (15%)
   - Project Complexity.
   - Land acquisition.

The actions in the plan were scored 1 to 5 for each of the prioritization categories, with 5 as the best score and 1 as the worst score. The information used to score the actions was both quantitative and qualitative. The quantitative data that was used in the prioritization scoring included the amount of peak flow reduction, size of the existing or proposed drainage area.

The actions were ranked according to their total score, from highest to lowest. Policy recommendations were ranked separately from the structural and non-structural projects and are listed in Chapter 5.

Table 4.11: Prioritization of Proposed Projects

Project Number	Project Location	Description	Board Adopted Categories (40%)	Direct Regulatory Contribution (10%)	Public Support (10%)	Effectiveness/ Location Rating (25%)	Ease of Implementation Rating (15%)	Total Score
PH9190	Marymead Pond	SWM Pond Retrofit	5	5	5	5	5	5.00
PH9885	Fairfax Villa Elementary School	2 Bioretention facilities.	5	4	5	5	5	4.90
PH9170	Braddock Road Pond	SWM Pond Retrofit	5	5	5	4	5	4.75
PH9192	FCPA-Piney Branch Park Pond	SWM Pond Retrofit	5	5	5	4	5	4.75
PH9180	Brentwood Pond	SWM Pond Retrofit	5	5	5	4	5	4.75
PH9195	Costco East Pond	SWM Pond Retrofit	5	5	5	5	3	4.70
PH9194	Piney Branch Road Extention Pond	SWM Pond Retrofit	5	5	5	5	3	4.70
PH9193	Sports Authority Pond	SWM Pond Retrofit	5	5	5	5	3	4.70
PH9884	Fairfax Villa Subdivision	8 Filterra Manufactured LIDs, 3 bioretention areas, Rain barrel program	5	5	5	5	3	4.70
PH9890	University Square Subdivision	2 Filterra Manufactured BMPs.	5	5	5	5	3	4.70
PH9872	Willow Springs Elementary School.	1 Bioretention area and 1 Filterra manufactured LID	5	4	5	4	5	4.65
PH9880	Brentwood Subdivision	4 grassed swales, 3 bioretention areas	5	4	5	5	3	4.60
PH9130	Colchester Hunt	SWM Pond Retrofit	5	5	3	4	5	4.55
PH9191	Merrifield Gardens Pond	SWM Pond Retrofit	5	5	5	4	3	4.45
PH9196	Waples Mobile Home Park Pond	SWM Pond Retrofit	5	5	5	4	3	4.45

Project Number	Project Location	Description	Board Adopted Categories (40%)	Direct Regulatory Contribution (10%)	Public Support (10%)	Effectiveness/ Location Rating (25%)	Ease of Implementation Rating (15%)	Total Score
PH9883	Buckner Forest Subdivision.	1 Bioretention area.	5	4	3	5	3	4.40
PH9821	Fairfax Station Subdivision	3 Grassed Swales, 5 bioretention areas	5	4	3	5	3	4.40
PH9800	Clifton Elementary School.	Bioretention area, 1 Filterra manufactured LID	5	4	5	3	5	4.40
PH9820	Clifton Green Subdivision	Bioretention area and Grassed swale	5	4	3	4	3	4.15
PH9860	West Hill Subdivision	2 Grassed swales and 2 Filterra manufactured LIDs	5	4	3	4	3	4.15
PH9831	Smoke Rise Subdivision	1 Bioretention area.	5	4	3	4	3	4.15
PH9841	Barton Place Subdivision	Grassed swale and 2 bioretention areas.	5	4	3	4	3	4.15
PH9870	Brecon Ridge Subdivision	6 grassed swales, 1 bioretention area	5	4	3	4	3	4.15
PH9871	Ridges of Glendilough Subdivision.	2 Bioretention areas, 2 Filterra manufactured LIDs	5	4	3	4	3	4.15
PH9877	Brecon Ridge Woods Subdivision.	1 Grassed swale and bioretention at pipe outfall	5	4	3	4	3	4.15
PH9830	Pickwick Woods Subdivision	3 Bioretention areas	5	4	3	4	3	4.15
PH9842	Fairfax Hunt	1 Bioretention Area	5	4	3	4	3	4.15
PH9131	Innisvale Pond	SWM Pond Retrofit	5	5	3	2	4	3.90
PH9850	Vannoy Park Subdivision.	2 Grassed swales	3	4	3	5	3	3.60
PH9882	Braddox Subdivision.	1 Bioretention area in abandoned road right-of-way.	3	4	3	5	3	3.60
PH9891	Glen Alden Subdivision.	1 grassed swale	3	4	3	5	3	3.60
PH9271	Berwynd Road	Stream Restoration	3	5	5	3	4	3.55

Project Number	Project Location	Description	Board Adopted Categories (40%)	Direct Regulatory Contribution (10%)	Public Support (10%)	Effectiveness/ Location Rating (25%)	Ease of Implementation Rating (15%)	Total Score
PH9801	Intersection of Compton and Clifton Roads	Grassed swale	3	4	3	4	3	3.35
PH9851	Lewis Park	2 Grassed swales	3	4	3	4	3	3.35
PH9210	Wycklow Drive	Stream Restoration	3	5	5	3	2	3.25
PH9270	Brookline Drive	Stream Restoration	3	5	5	3	2	3.25
PH9272	Fox Chapel Road	Stream Restoration	3	5	5	3	2	3.25
PH9201	Clifton Creek #1	Stream Restoration	3	5	5	3	2	3.25
PH9200	Clifton Creek #2	Stream Restoration	3	5	5	3	2	3.25
PH9202	Clifton Road	Stream Restoration	3	5	5	3	2	3.25
PH9204	Young Branch Drive	Stream Restoration	3	5	5	3	2	3.25
PH9230	Queen's Brigade Drive	Ditch Stabilization	3	5	3	3	3	3.20
PH9530	Saddle Horn Road	Culvert Retrofit	2	4	3	1	3	2.20
PH9580	Fairfax County Parkway	Culvert Retrofit	2	4	3	1	3	2.20
PH9540	Smoke Rise Road	Culvert Retrofit	2	4	3	1	3	2.20
PH9580	Fairfax Station Road	Culvert Retrofit	2	4	3	1	3	2.20
PH9502	Tepper Drive	Culvert Retrofit	2	4	3	1	3	2.20
PH9900	Kincheloe Road	Debris Removal	1	2	5	1	5	2.10
PH9961	Hope Park Road	Remove fill from stream and restore stream.	1	2	5	1	5	2.10
PH9960	Hope Park Road	Debris Removal	1	2	5	1	5	2.10
PH9970	Washington Street	Automobile/Debris Removal	1	2	5	1	5	2.10
PH9962	Popes Head Road	Debris Removal	1	2	5	1	5	2.10
PH9981	Crescent Drive	Automobile Removal	1	2	5	1	5	2.10
PH9505	Balls Ford Road	Culvert Retrofit	2	4	3	1	2	2.05

Project Number	Project Location	Description	Board Adopted Categories (40%)	Direct Regulatory Contribution (10%)	Public Support (10%)	Effectiveness/ Location Rating (25%)	Ease of Implementation Rating (15%)	Total Score
PH9504	Private Drive near Yates Ford Road	Culvert Retrofit	2	4	3	1	2	2.05
PH9973	Bentonbrook	Obstruction Removal/ collapsed footbridge removal	1	0	3	1	5	1.70
PH9403	Newman Road and Castle Creek	Bridge Project	2	0	3	1	1	1.50
PH9401	Clifton Road #2 and #3 and Popes Head Creek	Culvert Replacements	2	0	3	1	1	1.50
PH9414	Fairfax Station Road and Piney Branch, Popes Head Creek, Trib to Popes Head	Culvert Replacements	2	0	3	1	1	1.50
PH9452	Popes Head Road and Piney Branch	Bridge Project	2	0	3	1	1	1.50
PH9450	Colchester Road and Castle Creek	Drainage Improvements	2	0	3	1	1	1.50
PH9412	Newman Road and Castle Creek Trib 1	Culvert Replacement	2	0	3	1	1	1.50
PH9400	Clifton Road and Popes Head Creek	Bridge Project	2	0	3	1	1	1.50
PH9461	Popes Head Road and Popes Head Creek	Bridge Project	2	0	3	1	1	1.50
PH9435	Newman Road and Castle Creek	Culvert Replacement	2	0	3	1	1	1.50
PH9470	Brookline Drive and East Fork	Culvert Replacement	2	0	3	1	1	1.50

Project Number	Project Location	Description	Board Adopted Categories (40%)	Direct Regulatory Contribution (10%)	Public Support (10%)	Effectiveness/ Location Rating (25%)	Ease of Implementation Rating (15%)	Total Score
PH9404	Colchester Road and Popes Head Creek	Bridge Project	2	0	3	1	1	1.50
PH9462	Walcott Avenue and Piney Branch unnamed Trib	Culvert Replacement	2	0	3	1	1	1.50
PH9453	Popes Head Road and Piney Branch unamed Trib	Culvert Replacement	2	0	3	1	1	1.50
PH9420	Fairfax Station Road and Popes Head unnamed Trib	Culvert Replacement	2	0	3	1	1	1.50

The structural and non-structural projects implementation plan is shown in Table 4.13. Each project has been grouped into one of five implementation groups, based on relative priority, as listed below:

Group A: Fiscal Year 2006 – 2010
Group B: Fiscal Year 2011 – 2015
Group C: Fiscal Year 2016 – 2020
Group D: Fiscal Year 2021 – 2025
Group E: Fiscal Year 2026 – 2030

The dates for implementation are target dates, subject to County funding approval and ongoing updates to the plan. Maps 4.9 – 4.13 show the implementation grouping for projects that have specific locations.

Some of the actions in the implementation plan were scheduled with the assistance of the Citizen's Advisory Committee according to the following important factors in addition to the prioritization ratings:

- Dump sites when highly visible and if they present an immediate water quality threat.
- Stream Restoration projects if there are no headwaters projects to implement first.

These project types were put into the implementation Group A.

Table 4.12: Implementation of Proposed Projects

Project Number	Project Location	Description	Implementation Timeframe	Total Cost
Action A2.1	Non-structural Practice	Disconnect Imperviousness	A	$200,000 (over 25 years)
Action A2.2	Non-structural Practice	Monthly Street Sweeping in Fairfax Villa	A	$1,000,000 (over 25 years)
Action A5.1	Non-structural Practice	Conservation Easement Acquisition	A	$250,000 (over 25 years)
Action B1.1	Non-structural Practice	Formation of Friends of Popes Head Creek group	A	$120,000 (over 25 years)
Action B1.2	Non-structural Practice	Volunteer Stream Monitoring	A	$200,000 (over 25 years)
Action B2.1	Non-structural Practice	Landowner Education	A	$200,000 (over 25 years)
Action B2.2	Non-structural Practice	Landscape Company Education	A	$200,000 (over 25 years)
Action B2.3	Non-structural Practice	Horse Care Education	A	$120,000 (over 25 years)
Action B2.4	Non-structural Practice	Private Pond Owner Education	A	$120,000 (over 25 years)
Action B2.6	Non-structural Practice	Wildlife Education	A	$120,000 (over 25 years)
Action C1.2	Non-structural Practice	Institutional/Commercial Property Nutrient Management	A	$200,000 (over 25 years)
PH9900	Kincheloe Road	Debris Removal	A	$4,000
PH9961	Hope Park Road	Remove fill from stream and restore stream.	A	$1,400,000
PH9960	Hope Park Road	Debris Removal	A	$3,000
PH9970	Washington Street	Automobile/Debris Removal	A	$5,000
PH9962	Popes Head Road	Debris Removal	A	$5,000
PH9981	Crescent Drive	Automobile Removal	A	$5,000
PH9973	Bentonbrook	Obstruction Removal/ collapsed footbridge removal	A	$6,000
PH9190	Marymead Pond	SWM Pond Retrofit	A	$560,000
PH9170	Braddock Road Pond	SWM Pond Retrofit	A	$70,000
PH9192	FCPA-Piney Branch Park Pond	SWM Pond Retrofit	A	$720,000
PH9180	Brentwood Pond	SWM Pond Retrofit	A	$140,000
PH9210	Wycklow Drive	Stream Restoration	A	$60,000

Project Number	Project Location	Description	Implementation Timeframe	Total Cost
PH9201	Clifton Creek #1	Stream Restoration	A	$90,000
PH9200	Clifton Creek #2	Stream Restoration	A	$120,000
PH9202	Clifton Road	Stream Restoration	A	$360,000
PH9204	Young Branch Drive	Stream Restoration	A	$1,080,000
PH9885	Fairfax Villa Elementary School	2 Bioretention facilities.	B	$60,000
Action A4.2	Non-structural Practice	Monitor Riparian Buffers	B	$250,000 (over 25 years)
Action A6.1	Non-structural Practice	RPA Signage Installation	B	$80,000 (over 25 years)
Action A6.2	Non-structural Practice	ATV Usage Violation Enforcement	B	$250,000 (over 25 years)
Action B2.5	Non-structural Practice	ATV Usage Education	B	$120,000 (over 25 years)
PH9195	Costco East Pond	SWM Pond Retrofit	B	$120,000
PH9194	Piney Branch Road Extension Pond	SWM Pond Retrofit	B	$120,000
PH9193	Sports Authority Pond	SWM Pond Retrofit	B	$120,000
PH9130	Colchester Hunt	SWM Pond Retrofit	B	$140,000
PH9191	Merrifield Gardens Pond	SWM Pond Retrofit	B	$70,000
PH9196	Waples Mobile Home Park Pond	SWM Pond Retrofit	B	$930,000
PH9884	Fairfax Villa Subdivision	8 Filterra Manufactured LIDs, 3 bioretention areas, Rain barrel program	B	$400,000
PH9890	University Square Subdivision	2 Filterra Manufactured BMPs.	B	$80,000
PH9131	Innisvale Pond	SWM Pond Retrofit	B	$190,000
PH9872	Willow Springs Elementary School.	1 Bioretention area and 1 Filterra manufactured LID	B	$80,000
PH9880	Brentwood Subdivision	4 grassed swales, 3 bioretention areas	B	$160,000
PH9850	Vannoy Park Subdivision.	2 Grassed swales	B	$100,000
PH9882	Braddox Subdivision.	1 Bioretention area in abandoned road right-of-way.	B	$30,000
PH9883	Buckner Forest Subdivision.	1 Bioretention area.	B	$30,000
PH9891	Glen Alden Subdivision.	1 grassed swale	B	$20,000
PH9821	Fairfax Station Subdivision	3 Grassed Swales, 5 bioretention areas	B	$220,000

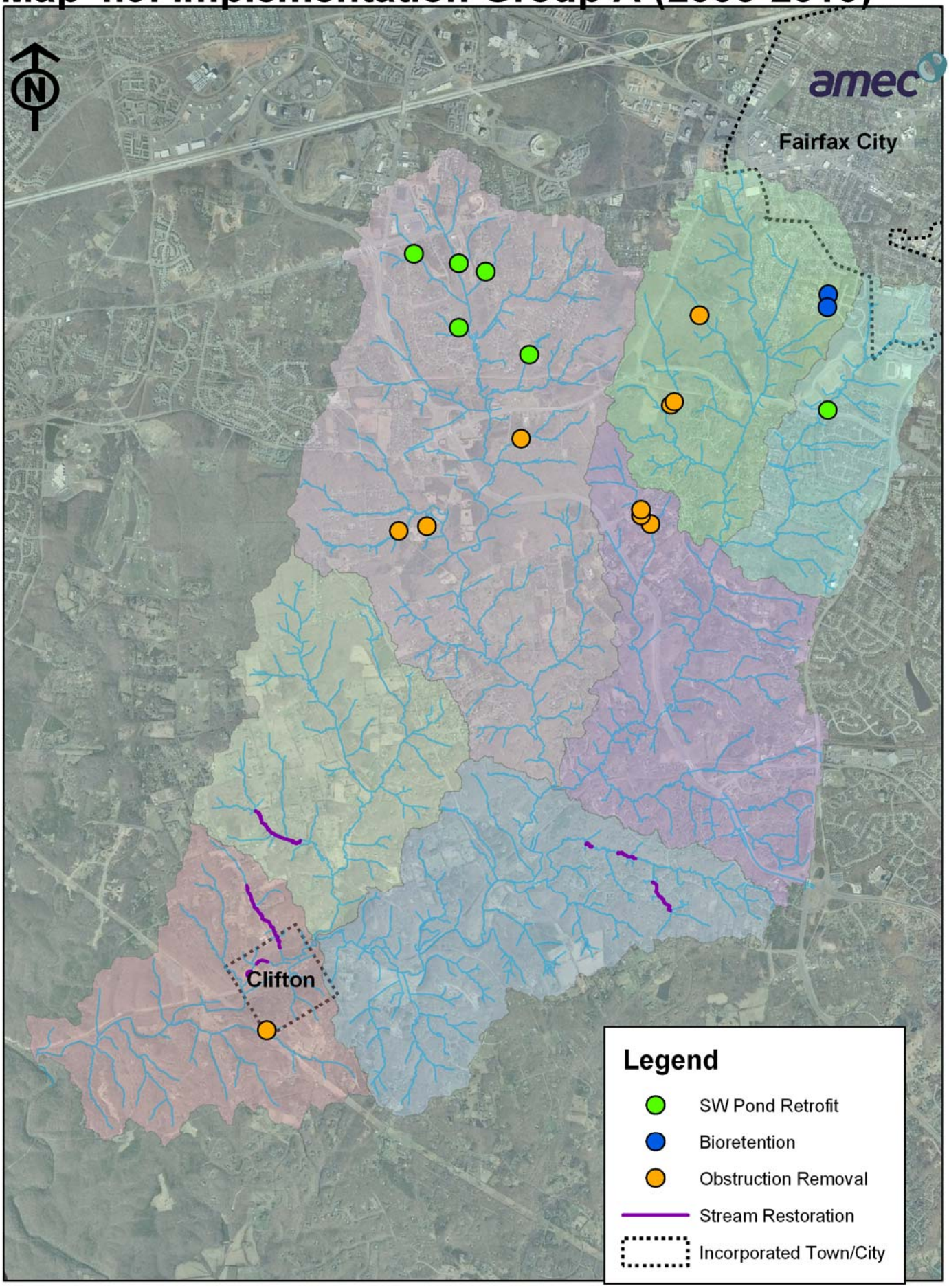
Project Number	Project Location	Description	Implementation Timeframe	Total Cost
PH9800	Clifton Elementary School.	Bioretention area, 1 Filterra manufactured LID	B	$90,000
PH9271	Berwynd Road	Stream Restoration	B	$330,000
PH9270	Brookline Drive	Stream Restoration	B	$30,000
PH9272	Fox Chapel Road	Stream Restoration	B	$310,000
PH9820	Clifton Green Subdivision	Bioretention area and Grassed swale	B	$50,000
PH9860	West Hill Subdivision	2 Grassed swales and 2 Filterra manufactured LIDs	B	$140,000
PH9801	Intersection of Compton and Clifton Roads	Grassed swale	B	$50,000
PH9831	Smoke Rise Subdivision	1 Bioretention area.	B	$40,000
PH9841	Barton Place Subdivision	Grassed swale and 2 bioretention areas.	B	$230,000
PH9870	Brecon Ridge Subdivision	6 grassed swales, 1 bioretention area	B	$160,000
PH9871	Ridges of Glendilough Subdivision.	2 Bioretention areas, 2 Filterra manufactured LIDs	B	$200,000
PH9877	Brecon Ridge Woods Subdivision.	1 Grassed swale and bioretention at pipe outfall	B	$110,000
PH9830	Pickwick Woods Subdivision	3 Bioretention areas	B	$90,000
PH9851	Lewis Park	2 Grassed swales	B	$60,000
PH9842	Fairfax Hunt	1 Bioretention Area	B	$50,000
PH9530	Saddle Horn Road	Culvert Retrofit	C	$60,000
PH9580	Fairfax County Parkway	Culvert Retrofit	C	$90,000
PH9540	Smoke Rise Road	Culvert Retrofit	C	$60,000
PH9512	Fairfax Station Road	Culvert Retrofit	C	$70,000
PH9502	Tepper Drive	Culvert Retrofit	C	$40,000
PH9505	Balls Ford Road	Culvert Retrofit	C	$70,000
PH9504	Private Drive near Yates Ford Road	Culvert Retrofit	C	$50,000
PH9403	Newman Road and Castle Creek	Bridge Project	C	$390,000
PH9401	Clifton Road #2 and #3 and Popes Head Creek	Culvert Replacements	C	$260,000

Project Number	Project Location	Description	Implementation Timeframe	Total Cost
PH9414	Fairfax Station Road and Piney Branch, Popes Head Creek, Trib to Popes Head	Culvert Replacements	C	$4,190,000
PH9452	Popes Head Road and Piney Branch	Bridge Project	C	$10,000
PH9450	Colchester Road and Castle Creek	Drainage Improvements	C	$1,020,000
PH9412	Newman Road and Castle Creek Trib 1	Culvert Replacement	D	$430,000
PH9400	Clifton Road and Popes Head Creek	Bridge Project	D	$1,850,000
PH9461	Popes Head Road and Popes Head Creek	Bridge Project	E	$1,050,000
PH9435	Newman Road and Castle Creek	Culvert Replacement	E	$130,000
PH9470	Brookline Drive and East Fork	Culvert Replacement	E	$300,000
PH9404	Colchester Road and Popes Head Creek	Bridge Project	E	$1,240,000
PH9462	Walcott Avenue and Piney Branch unnamed Trib	Culvert Replacement	E	$100,000
PH9453	Popes Head Road and Piney Branch unnamed Trib	Culvert Replacement	E	$180,000
PH9420	Fairfax Station Road and Popes Head unnamed Trib	Culvert Replacement	E	$160,000
			Total Capital Cost	$24.6 million

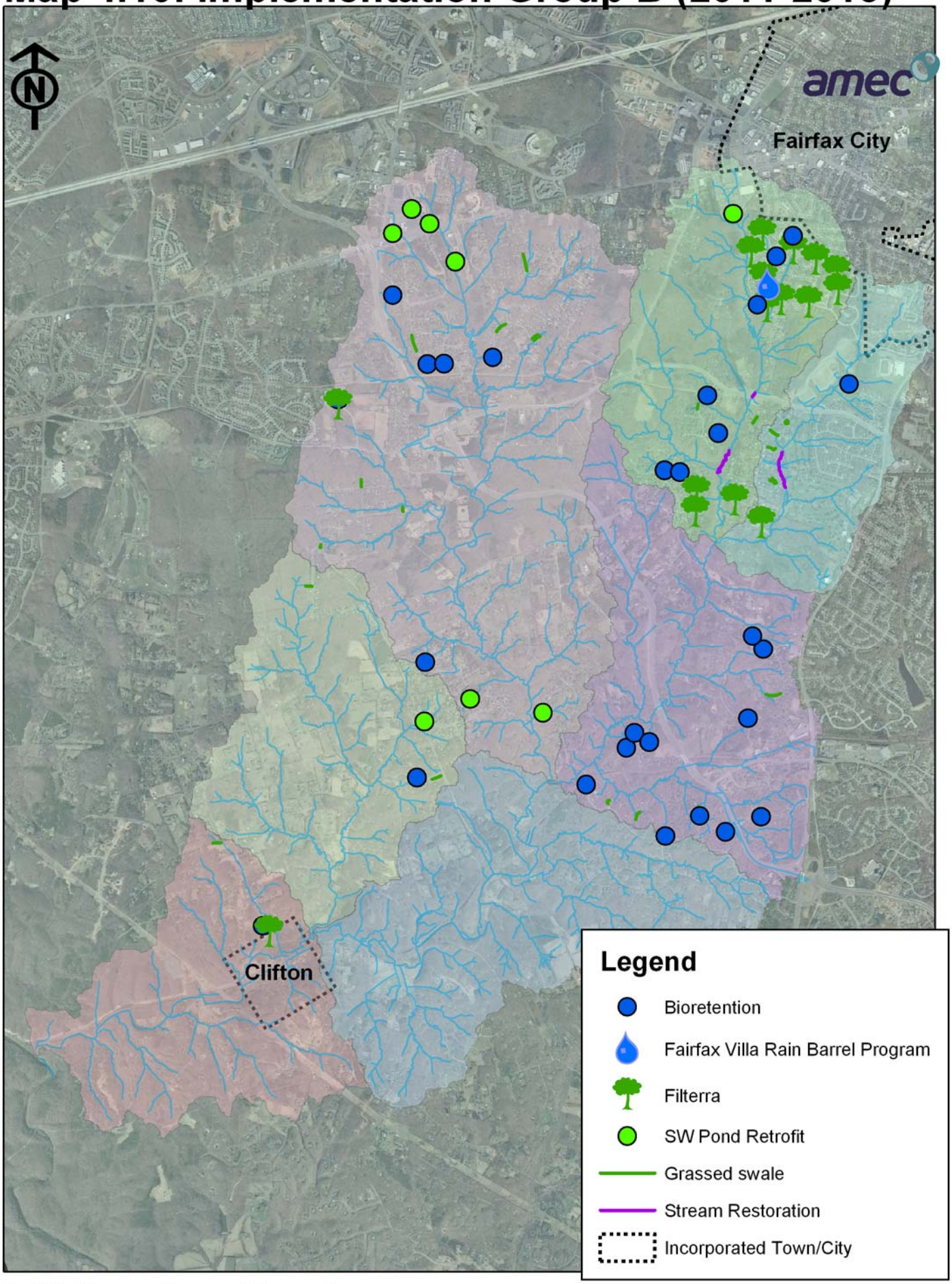
4.6.1 Total Cost of Implementation

The total cost of the proposed structural and non-structural actions in Table 4.13 is approximately $24.6 million. Over the plan's lifespan of 25 years, this will require approximately 1.8 Fairfax County Staff Year Equivalents (SYE) for project management, land acquisition, and construction management, which are factored into the project costs. Actual costs may be reduced by using volunteer organizations to help implement non-structural projects, such as educational campaigns and environmental monitoring.

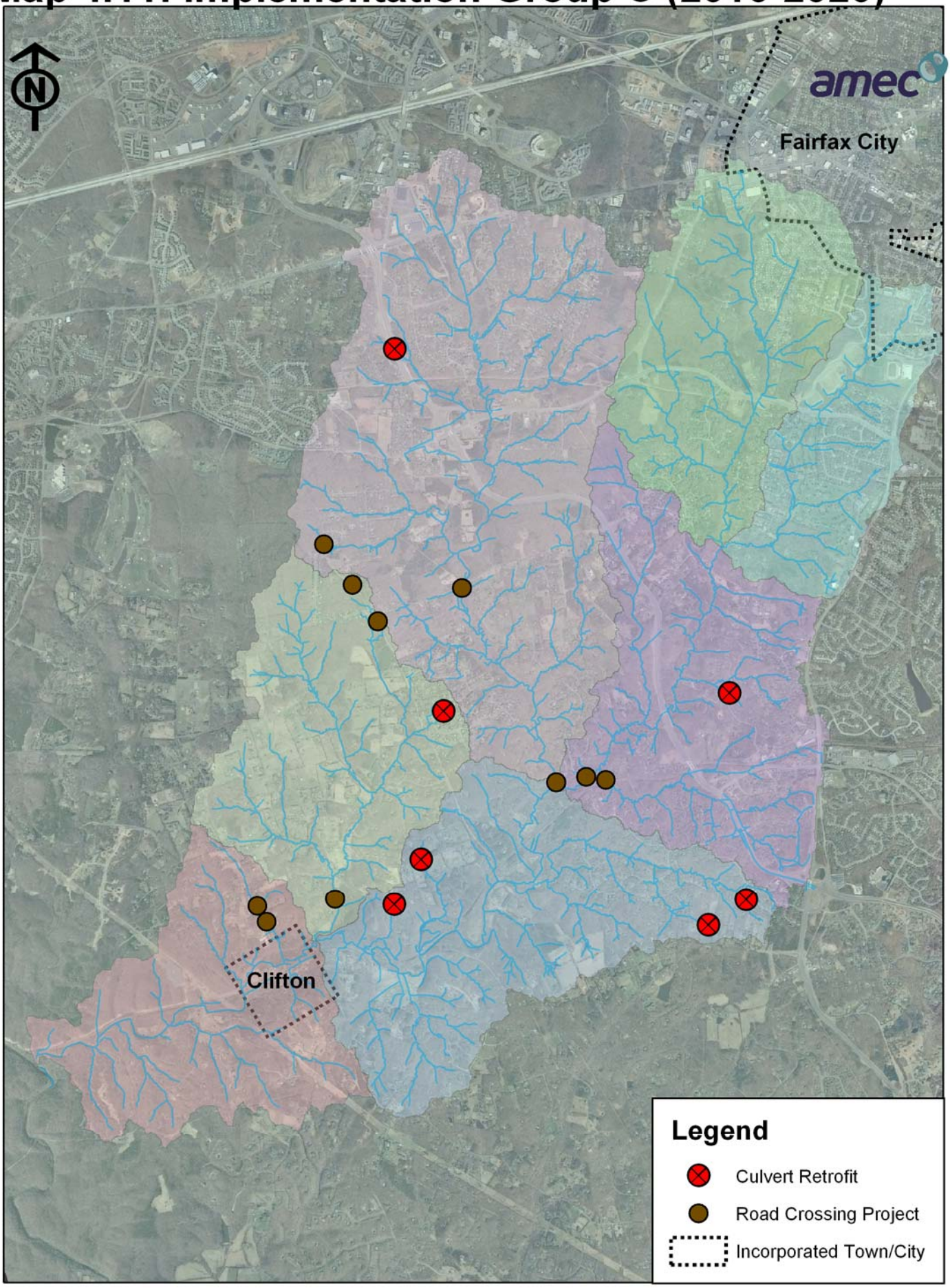
Map 4.9: Implementation Group A (2006-2010)



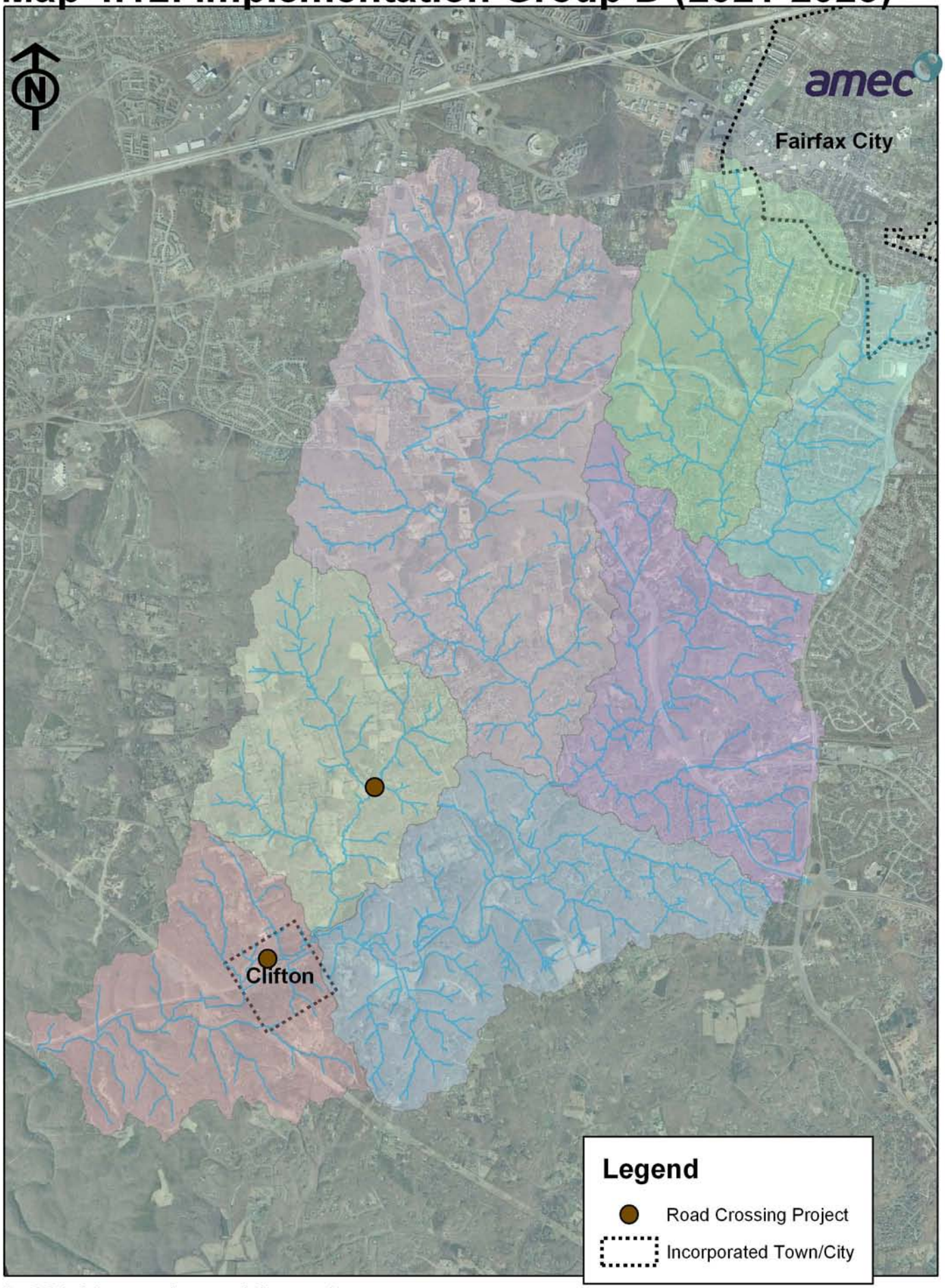
Map 4.10: Implementation Group B (2011-2015)



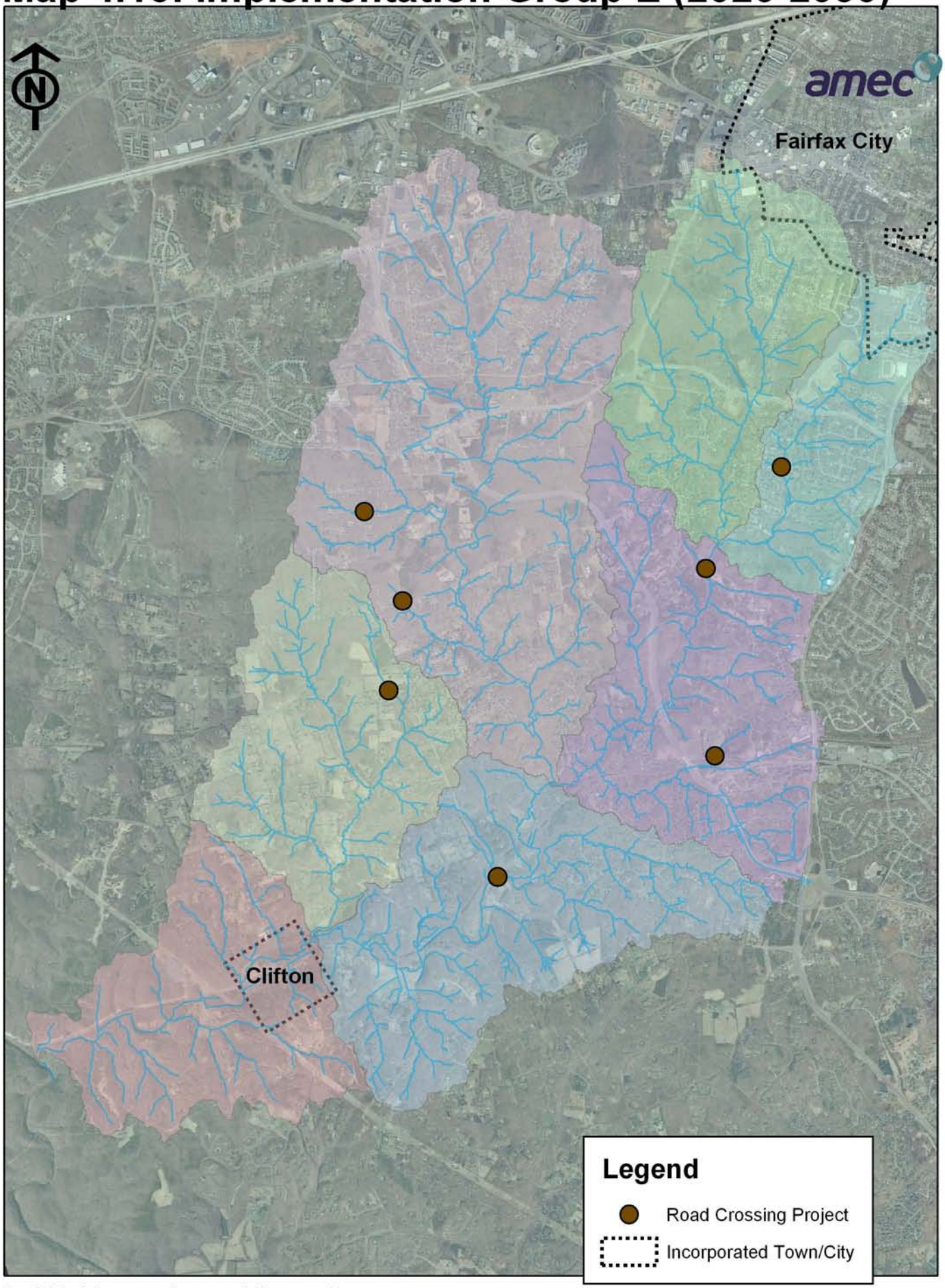
Map 4.11: Implementation Group C (2016-2020)



Map 4.12: Implementation Group D (2021-2025)



Map 4.13: Implementation Group E (2026-2030)



4.7 Monitoring Plan

This section describes the monitoring actions and targets for determining the success or failure of the future structural and non-structural plan actions. The monitoring will help to determine if the plan actions should be modified in the future because of a low success rate or as watershed conditions change.

Action A1.1 Retrofit suitable existing stormwater management facilities and BMPs to make them more effective. Retrofitting these facilities is intended to exceed the performance criteria or standards that were used to design the facility. The increased performance and/or coverage area will improve water quality in the watershed. Fairfax County will coordinate with VDOT, Fairfax County Park Authority, and private pond owners to implement the pond retrofit projects.

Monitor: Number of retrofit projects designed and completed.

Target: Initiate 33% of retrofit projects during Implementation Group A. Complete all retrofit projects during Implementation Group B.

Action A1.2: Install new BMP and LID facilities in areas that do not have existing stormwater management facilities, or in areas where retrofitting existing facilities is not feasible.

Monitor: Number of LID facilities designed and completed.

Target: Complete installation of all LID facilities during Implementation Group B.

Action A2.1: Program to facilitate and encourage homeowners and developers to disconnect impervious areas.

Monitor: Number of homeowners and developers who install rain barrels and sign maintenance agreements; number of disconnected downspouts.

Target: Install rain barrels in 10% of properties in the Fairfax Villa subdivision during Implementation Group A. Install rain barrels in 25% of properties in the Fairfax Villa subdivision during Implementation Group B. Install rain barrels in 50% of properties in the Fairfax Villa subdivision during Implementation Group C.

Action A2.2: Monthly street sweeping program for parking lots throughout the watershed and residential streets in the Fairfax Villa subdivision.

Monitor: Frequency of street sweeping; total volume of sediment collected by street sweeping trucks.

Target: Street sweeping should occur at least once every month. Total sediment load shall be recorded to monitor progress.

Action A3.1*:* The county and community groups shall perform stream restoration projects in the areas identified as good candidates.

Monitor: Number, length, and location of stream restoration projects initiated and completed.

Target: Implement 50% of stream restoration projects during Implementation Group A. Complete all stream restoration projects during Implementation Group B provided that the necessary upstream quantity reduction measures have been implemented.

Action A3.2*:* Retrofit existing road culverts to reduce flooding and erosion at road crossings.

Monitor: Number of culvert retrofit projects initiated and completed.

Target: Implement all culvert retrofit projects during Implementation Group C.

Action A3.3: Replace road crossings that overtop and flood.

Monitor: Number of road crossing projects initiated and completed.

Target: Implement 33% of road crossing projects during Implementation Group C. Complete all remaining road crossing projects during Implementation Group E.

Action A3.4*:* Remove dumpsites and obstructions from stream corridors.

Monitor: Number of dumpsites and stream obstructions removed.

Target: Complete all debris removal projects during Implementation Group A. Record quantity and type of debris removed from stream corridors.

Action A4.1: Plant native vegetation next to streams in areas that are identified as good candidates for buffer restoration.

Monitor: Number of buffer restoration projects initiated and completed.

Target: Implement 50% of buffer restoration projects during Implementation Group A. Complete all remaining buffer restoration projects during Implementation Group B.

Action A4.2: Monitor the condition of restored and existing riparian buffer with annual stream walks to evaluate the condition and areas needing improvement.

Monitor: Number of stream walks performed in each subwatershed; number of citizen volunteers.

Target: Perform one stream walk per year in each subwatershed. Record number of plant species found on stream walk, and if they are native or invasive species and compare to previous years' data. Increase citizen participation by 10% each year.

Action A5.1**:** Facilitate the acquisition and donation of conservation easements by community groups for riparian buffer and stream protection, and public/private open space for the environmental quality corridors described in the *Fairfax County Comprehensive Plan.*

Monitor: Number of acres protected by conservation easement.

Target: Increase number of acres protected by conservation easement by 10% every five years.

***Action A6.1**:* Post official County signage that publicizes the existence of the Resource Protection Areas (RPAs) and states that ATV and other uses that destroy vegetation and cause erosion are not permitted in the RPA.

Monitor: Number of complaints and costs related to ATV trespassing and damage. This can be monitored during stream walks from Action A4.2.

Target: Reduce ATV-related complaints by 10% every year.

Action A6.2: Coordinate with the Fairfax County Police to target areas with significant ATV impacts for enforcement of existing laws and ordinances (e.g. trespassing and environmental regulations).

Monitor: Number of complaints and costs related to ATV trespassing and damage. This can be monitored during stream walks from Action A4.2.

Target: Reduce ATV-related complaints by 10% every year.

Action A7.1: Conserve land and water ecosystems to provide high quality habitat for wildlife.

Monitor: Number of acres protected by conservation easement.

Target: Increase number of acres protected by conservation easement by 10% every five years.

***Action A7.2**:* Preserve large blocks of forest to prevent further fragmentation.

Monitor: Number of acres protected by conservation easement that have continuity or increase existing forest corridors.

Target: Increase number of acres protected by conservation easement by 10% every five years.

Action B1.1: Support the formation of a "Friends of Popes Head Creek" group composed of local citizens.

Monitor: Number of citizens who participate; number of meetings convened per year, and activities performed.

Target: Convene two meetings per year. Increase participation by 10% every year.

Action B1.2: Establish a group of volunteer stream monitors and monitoring sites.

Monitor: Number of citizens who participate; number of samples collected per year.

Target: Conduct sampling at least four times per year at Stream Protection Strategy sites. Increase participation by 10% every year.

Action B2.1*:* Develop and distribute educational materials that describe beneficial landscaping techniques for homeowners.

Monitor: Number of brochures distributed.

Target: Distribute 300 brochures to homeowners every year in different parts of the watershed to blanket the entire watershed.

Action B2.2: Develop and distribute educational materials that describe beneficial landscaping techniques to landscaping companies and suppliers.

Monitor: Number of brochures distributed

Target: Distribute 200 brochures to landscaping companies and suppliers every year.

Action B2.3: Distribute educational materials about appropriate horse care and grazing management in the Resource Protection Area.

Monitor: Number of brochures distributed.

Target: Distribute 100 brochures to veterinarians and the Clifton Horse Society every year.

Action B2.4: Distribute educational materials to private pond owners that describe proper maintenance.

Monitor: Number of brochures distributed.

Target: Distribute 100 brochures to private pond owners every year.

Action B2.5: Develop and distribute educational materials for proper ATV usage in the watershed.

Monitor: Number of brochures distributed.

Target: Distribute 300 brochures to ATV dealers every year.

Action B2.6*:* Develop and distribute educational materials that describe the benefits of wildlife, such as beavers, in the watershed.

Monitor: Number of brochures distributed.

Target: Distribute 300 brochures to landowners every year.

Action C1.1: Install new LIDs and BMPs or enhance the performance of existing stormwater management facilities to reduce sediment and phosphorus loading in stormwater runoff.

Monitor: Number of new LID and BMP facilities initiated and completed.

Target: Complete installation of all LID facilities during Implementation Group B.

Action C1.2: Manage large existing areas of lawn at institutional and commercial properties to minimize nutrient loading to streams.

Monitor: Review maintenance plan and landscaping plan to ensure proper usage of fertilizer and other equipment for landscaping.

Target: Reduce total amount of fertilizer used by 5% every five years.