4 Watershed Restoration Strategies

4.1 Subwatershed Strategies

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

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

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

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

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

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

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

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

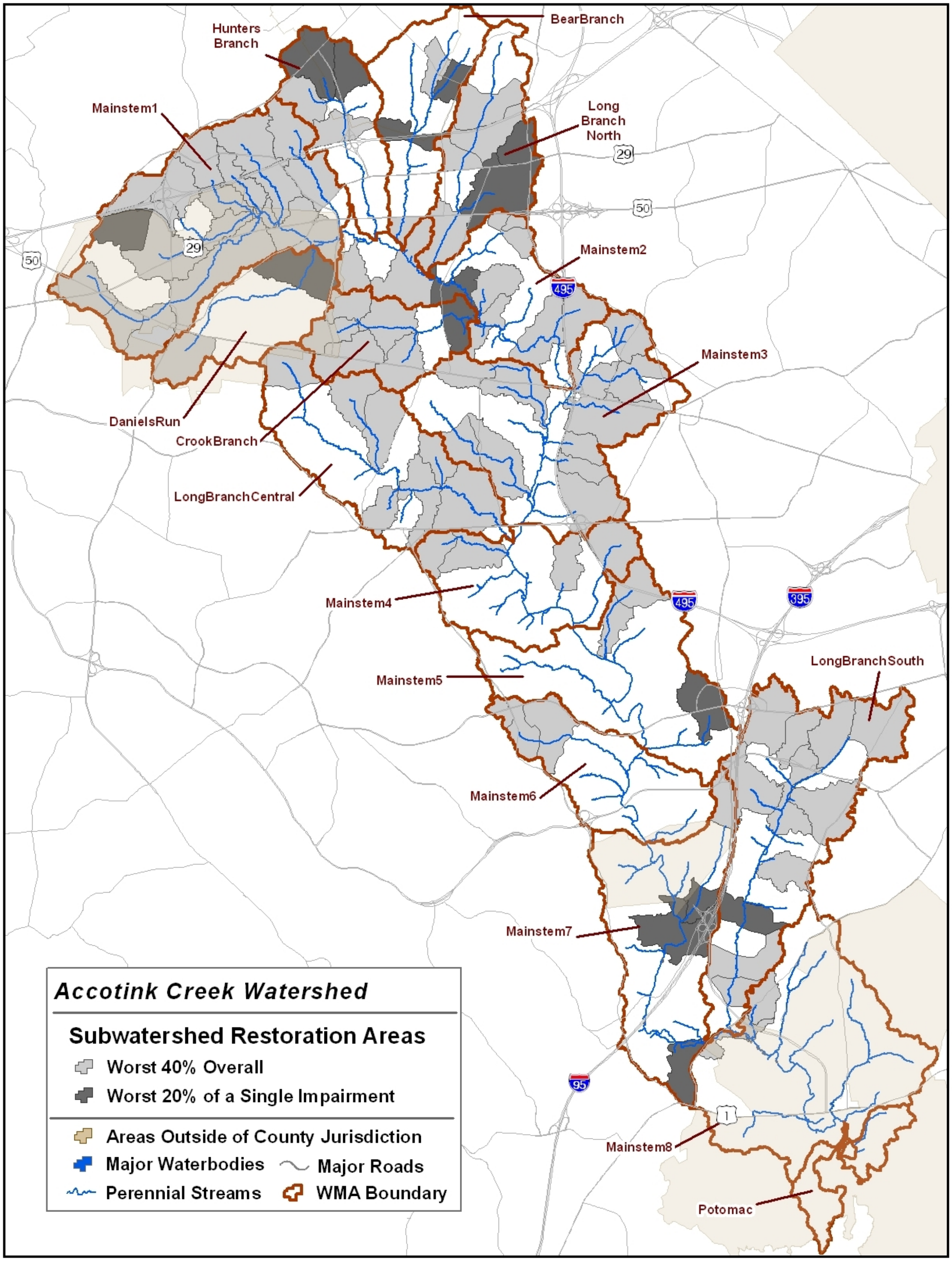
3. Habitat Health: These indicators describe conditions of the natural resources that contribute to habitat quality such as forest cover, wetlands and riparian buffers.

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

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

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

Map 4-1: Priority Subwatershed Restoration Areas



4.2 Description of Watershed Restoration Practices

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

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

4.2.1 Structural Practices

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

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

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

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

New Stormwater Management Pond

Description

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

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

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

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

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

Design Considerations

Ponds can be categorized into three main categories:

1. Dry ponds, which are quantity controls to capture rapidly flowing runoff and release it slowly over a longer time period;
2. Wet ponds, which have a permanent pool that allows for sedimentation along with an level of storage above the pool to provide extended detention like a dry pond; and
3. Stormwater wetlands, which function similarly to a wet pond but are landscaped to provide better treatment of dissolved nutrients and aquatic habitat for a wider variety of species.

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

Stormwater Management Pond Retrofit

Description

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

Design Considerations

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

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

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

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

Other approaches involve adding new features to the pond:

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

Stream Restoration

Description

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

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

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

Design Considerations

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

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

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

Culvert Retrofit

Description

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

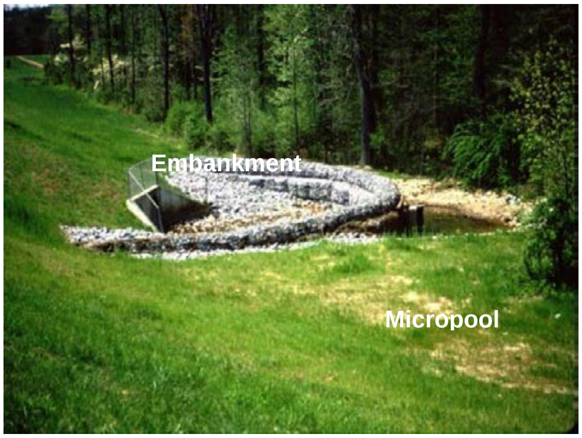


Figure 4-6: Culvert retrofit, flow right to left (Source: Center for Watershed Protection)

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

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

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

Design Considerations

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

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

The best situations for culvert retrofits occur when:

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

Best Management Practice / Low Impact Development

Description

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

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

Design Considerations

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

Runoff reduction:

- surface ponding
- infiltration
- evapotranspiration

Pollutant removal:

- sedimentation
- filtration
- vegetative uptake

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

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

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

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

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

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

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

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

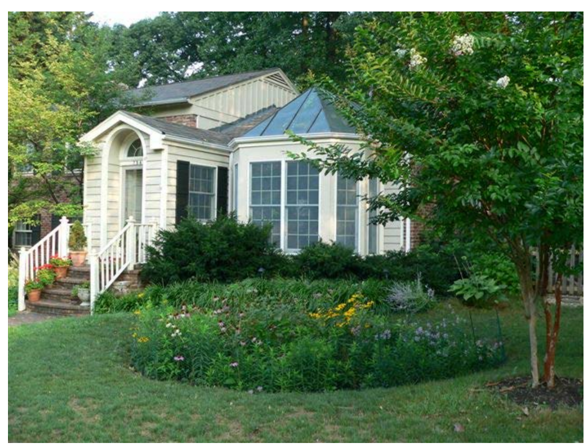


Figure 4-12: Residential rain garden (Source: Fairfax County)

Area-Wide Drainage Improvement

Description

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

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

Design Considerations

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

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

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

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

Flood Protection / Mitigation

Description

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

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

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

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

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

Design Considerations

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

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

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

Outfall Improvement

Description

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

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

Design Considerations

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

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

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

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

4.2.2 Non-Structural Practices

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

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

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

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

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

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

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

Stream Buffer Restoration

Description

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

Design Considerations

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

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

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

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

Dumpsite/Obstruction Removal

Description

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

Design Considerations

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

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

Impervious Disconnection and Rain Barrel Programs

Description

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

Design Considerations

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

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

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

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

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

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

Community Outreach/Public Education

Description

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

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

Design Considerations

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

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

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

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

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

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

Inspection/Enforcement Enhancement Project

Description

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

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

Design Considerations

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

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

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

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

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

Street Sweeping Program

Description

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

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

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

Design Considerations

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

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

4.2.3 Structural Project Prioritization

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

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

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

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

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

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

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

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

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

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

4.2.4 Non-Structural Project Prioritization

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

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

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

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

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

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

- Effect on Impact Indicators 60%
- Implementability 40%

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

Table 4-1: Non-structural Project Prioritization

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

4.3 Status of Regional Ponds

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

Table 4-2: Regional Ponds in Accotink Creek

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

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

C=complete; I=Inactive, not funded;

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

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

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

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

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

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

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

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

4.4 Summary of Proposed Projects

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

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

Map 4-2: Proposed Projects in Supervisor Districts

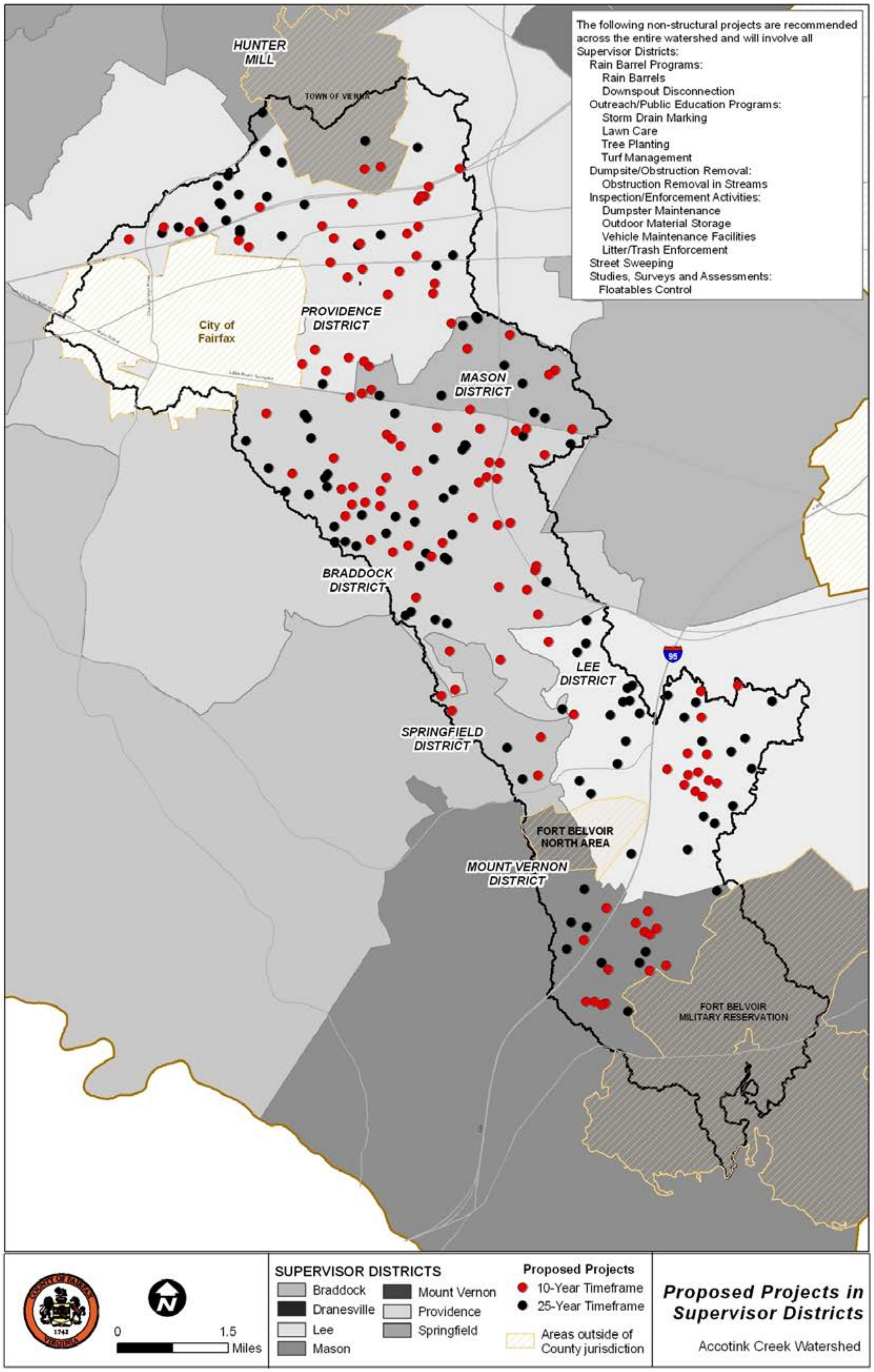


Table 4-3: Master Project List

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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