

# Paint Branch Subwatershed Action Plan



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# Section 1

## Vision and Existing Conditions

The Paint Branch Subwatershed Action Plan (SWAP) is intended to be an integrated summary document for the Paint Branch Subwatershed Environmental Baseline Conditions Report and the Paint Branch Subwatershed Provisional Restoration Projects Inventory. Based on a planning level analysis and evaluations, various activities or actions have been identified as part of a 10-year comprehensive restoration plan for the Anacostia River watershed. In addition, the layout of the report is intended to follow as closely as possible the EPA nine key elements to develop a watershed plan to improve water quality impairments, and are the minimal requirements to be eligible to receive incremental Clean Water Act Section 319 funding (EPA, 2008).

### **Need and Purpose**

The Anacostia River watershed lies in a heavily populated urban landscape substantially altered from natural conditions. Urbanization causes many environmental changes. Among these, impervious surfaces cause excessive runoff, a reduction in groundwater recharge, a reduction in water quality through the transport of pollutants, a loss of riparian areas, and ultimately a degradation of the watershed's ecological habitat. The increase in impervious areas has disrupted the natural hydrologic cycle and ultimately affected the environmental health of the Anacostia River and its tributaries.

While urbanization and impervious surfaces are the primary stressors for the overall Anacostia River watershed, there is regional variation throughout the watershed and as such, the extent and source of the environmental stressors as well as potential restoration actions will be evaluated on a subwatershed basis. As part of the Anacostia Restoration Plan (ARP) study, each of the 14 primary subwatersheds and the Tidal Anacostia River reach were evaluated in order to determine problems and opportunities at the subwatershed scale for environmental or ecological restoration, and present this information in such a way that would be beneficial to several different audiences. In addition, for each of the 14 primary subwatersheds and the Tidal Anacostia River reach, a SWAP, an environmental baseline conditions report, and a subwatershed provisional restoration project inventory was generated.

The purpose of the Paint Branch SWAP is to provide a vision statement and targets for restoration within the subwatershed by the year 2020, identify and describe specific problems within the subwatershed, discuss methodologies used to evaluate potential restoration opportunities, and present a prioritized list of restoration opportunities for implementation.

The identification of restoration opportunities and potential projects were based on the following selected strategies:

1. Stormwater Management Retrofits
2. Stream Restoration
3. Wetland Creation and Restoration
4. Fish Blockage Removal/Modification
5. Riparian Reforestation, Meadow Creation, Street Tree, and Invasive Species Management
6. Trash Reduction
7. Toxic Remediation
8. Parkland Acquisition

Building upon the preceding eight restoration strategies, the following 2020 restoration objectives align with and expand upon the existing Anacostia River watershed restoration goals and requirements established by the Anacostia Watershed Restoration Partnership (AWRP):

1. **Stormwater Management:** Implement stormwater retrofits or Best Management Practices (BMPs) to reduce pollutant loading and increase flow regime stability. Increase use of homeowner BMPs throughout the subwatershed.
2. **Wetland Creation and Restoration:** Increase wetland habitat throughout the subwatershed.
3. **Riparian Corridors:** Increase the health of riparian corridors so as to both improve wildlife habitat connectivity and reduce the number of invasive plant problem sites. Also, increase overall tree canopy coverage throughout the subwatershed.
4. **Aquatic Community:** Increase the health of the aquatic community; specifically increase the number of resident fish species and providing for a healthier macroinvertebrate community food base. Restore migratory fish usage of Paint Branch.
5. **Trash Reduction:** Dramatically reduce trash loads in Paint Branch.
6. **Outreach:** Increase participation of residents, businesses, and school-age children in activities that are beneficial to the watershed.
7. **Parkland Acquisition:** Increase parkland and habitat connectivity

## 10-Year Vision

The Paint Branch subwatershed vision is to create, by the year 2020, a more environmentally healthy and sustainable watershed by dramatically reducing stormwater runoff volumes, stream channel erosion problems, trash levels and pollutant loadings; protecting and restoring aquatic and terrestrial habitats and associated biological communities; enhancing watershed recreational opportunities; and fully engaging both public and private sectors through expanded environmental education and incentive-based initiatives. The preceding objectives are a continuation of and expansion on the AWRP's existing Anacostia River watershed goals, leading to the achievement of realistic and attainable restoration targets within the next decade.

## **Paint Branch 2020 Restoration Targets**

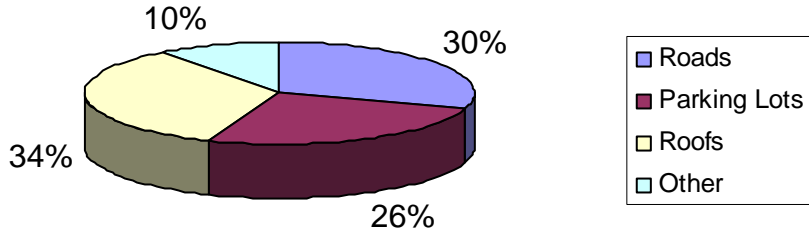
The Paint Branch 2020 Restoration Targets were determined based on the potential implementation of restoration opportunities identified within the Paint Branch subwatershed as part of the ARP, along with realistic expectations of what could be accomplished in ten years to meet the 2020 restoration objectives. These targets are established to ensure that restoration of the subwatershed is proceeding in the right direction and at a continuous, reasonable pace. The analysis presented in this SWAP will help to establish specific target levels of restoration for the subwatershed. Quantitative targets established such as stormwater management, aquatic community, trash reduction, wetland creation/restoration, riparian corridor restoration, and land acquisition, will be based on the potential restoration project inventory and recommend acreages or mileages to be restored, whereas the qualitative targets including environmental programs and public outreach will recommend programmatic actions that will serve to increase public awareness and interest in restoring the Anacostia watershed. The 2020 Restoration Targets are presented in Section 4 of this SWAP.

## **Existing Conditions in the Paint Branch Subwatershed**

The Paint Branch subwatershed, which has a drainage area of 20.5 square miles (or approximately 13,121 acres), is located in the northwestern vicinity of the Anacostia River watershed (Figures 1-2 and 1-3). The Paint Branch subwatershed is located within Montgomery and Prince George's Counties, Maryland. The three largest land uses of the area in the Paint Branch subwatershed are forest cover/open space/parkland/institutional, medium density single family residential, and low density single family residential. There are approximately 10,380 single-family homes. The subwatershed includes three major Federal facilities and one major State facility; the General Services Administration's 787-acre Federal Research Center, the U.S. Army's 23-acre Harry Diamond Laboratory, USDA's 365-acre Beltsville Agricultural Research Center-'South Farm', and the 1,500-acre University of Maryland, College Park Campus. Impervious surfaces make up about 17-percent of the subwatershed. Elevations range from 560 feet at the Paint Branch/Patuxent River watershed divide to 35 feet at the Northeast Branch, with an average gradient of 0.60-percent over 11.4 miles of the main stem. Paint Branch flows from its headwaters in the Piedmont physiographic province, through the Fall Line, into the Coastal Plain. Table 1-1 and Figure 1-1 present a summary of the impervious surfaces within the Paint Branch subwatershed. There are approximately 329 storm drain outfalls in the Paint Branch and only about 19-percent of the impervious surfaces in the subwatershed have stormwater controls (Figure 1-4). Table 1-1 summarizes the current level of stormwater control of impervious areas (by acre) within the Paint Branch subwatershed.

The area located in the northern portion of the watershed north of Randolph Road has been designated a Special Protection Area (SPA) by the Montgomery County Council in order to protect the naturally reproducing brown trout fisheries. The SPA designation includes strict restrictions and conditions for new development, and was followed by an aggressive stream valley conservation park initiative by the Maryland-National Capital Park and Planning Commission (M-NCPPC). It should also be noted that the six-lane Inter County Connector (ICC) is presently under construction and the road's alignment takes it across the most environmentally sensitive portions of the SPA.

Figure 1-1: Impervious Surfaces in the Paint Branch Subwatershed



**Table 1-1: Impervious Surfaces in the Paint Branch Watershed and Existing Level of Control**

	<b>Miles</b>	<b>Acres</b>
<b>Roads</b>	194.0	<b>663.9</b>
State/Federal	20.1	165.0
Local	173.9	498.9
<b>Parking Lots</b>	...	<b>587.8</b>
Public/Institutional	...	183.0
Private	...	404.7
<b>Roofs</b>	...	<b>755.3</b>
Public/Institutional	...	137.6
Private	...	185.1
Single Family	...	432.6
<b>Other</b>	...	<b>229.6</b>
Sidewalks	...	84.3
Single Family Driveways	...	145.3
<b>Total Impervious Acres</b>	388.0	2,239.9
<b>Total Subwatershed Acres</b>		13,121
<b>Avg. % Imperviousness</b>		17.0%
<b>Current Impervious Acreage Controlled</b>		435.1
<b>Current-percent Impervious Acreage Controlled</b>		19.4%
<b>Number of existing BMPs</b>		283



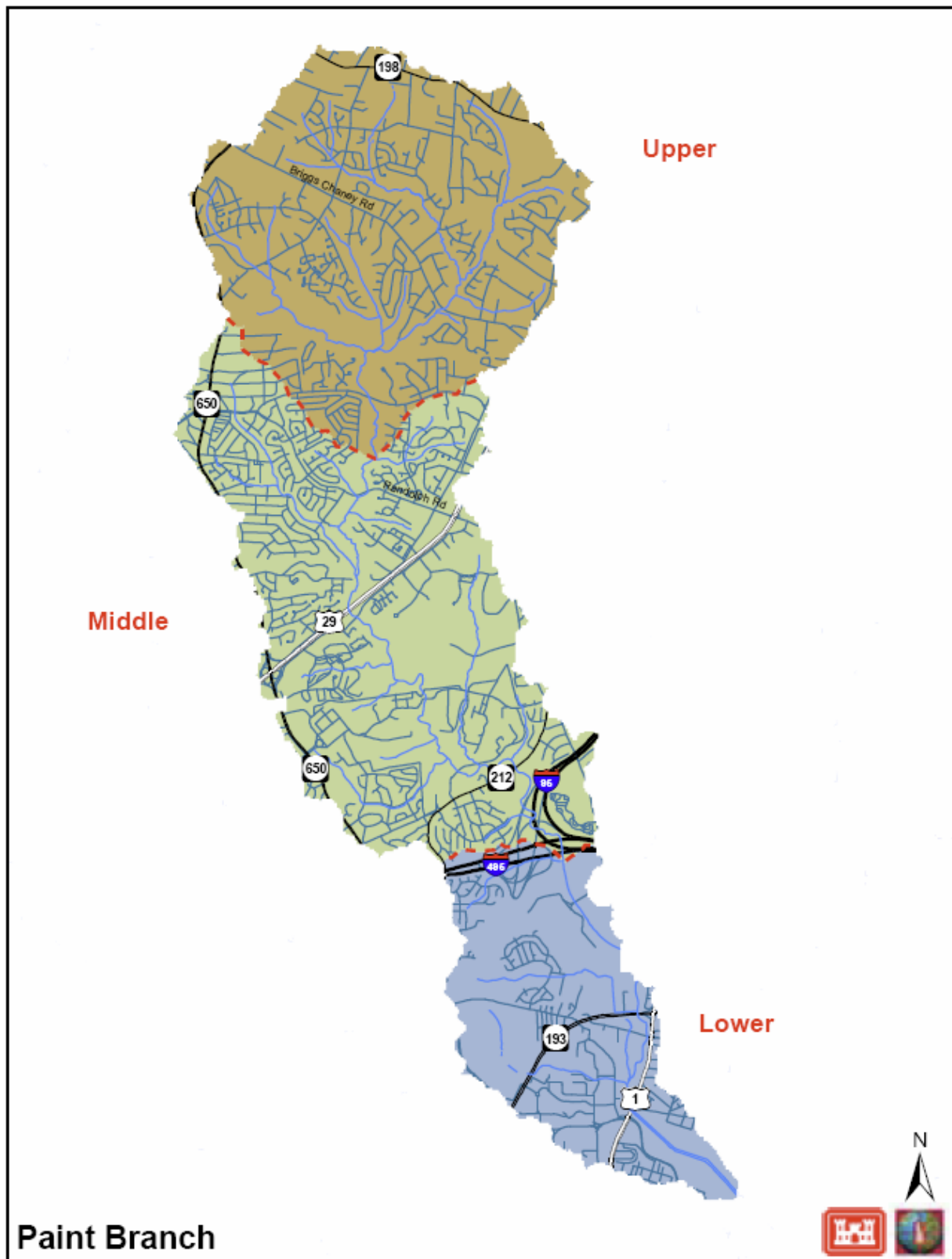


Figure 1-3: Paint Branch Planning Units

In February 2006, the Lower Paint Branch Watershed Restoration Study was completed for Montgomery County Department of Environmental Protection for portions of the subwatershed within Montgomery County only. The objective of this study was to identify and prioritize stormwater management opportunities, including Low Impact Development (LID) opportunities and stream restoration projects. Information from this report was reviewed as part of the Anacostia Restoration Project (ARP) effort to identify restoration opportunities within Paint Branch subwatershed. A separate, complimentary study is currently underway for portions of the Little Paint Branch and Paint Branch subwatersheds in Prince George's County. A separate Paint Branch study is being conducted by the M-NCPPC, Anacostia Watershed Society (AWS), the University of Maryland, and the City of College Park, Maryland. The objective of the study is to identify and prioritize restoration opportunities for mitigation purposes in greater detail than the ARP effort as the lower reach redevelops. A coordination meeting between the stakeholders involved in the study occurred on July 8, 2009.

A U.S. Army Corps of Engineers (USACE) feasibility study for fish passage and ecosystem restoration was completed in September 2006 under Section 206 of the Continuing Authorities Program. The stream restoration project study area extends from U.S. Route 1 upstream to University Boulevard, and is bounded by U.S. Route 1 to the south and east, and Paint Branch Drive to the west. The anticipated construction start is summer 2010 with Prince George's County signing a cost-sharing agreement. Additional stakeholders involved in the study include the University of Maryland and M-NCPPC, which owns the parkland within the stream valley.

In May 2007, the University of Maryland completed the University of Maryland Potential Water Quality Improvement Study. The objective of the study was to identify potential water quality improvement opportunities for the College Park Campus and surrounding campus facilities, including the University of Maryland College Park Golf Course. Information from this report was reviewed as part of the ARP effort to identify restoration opportunities within the Paint Branch subwatershed.

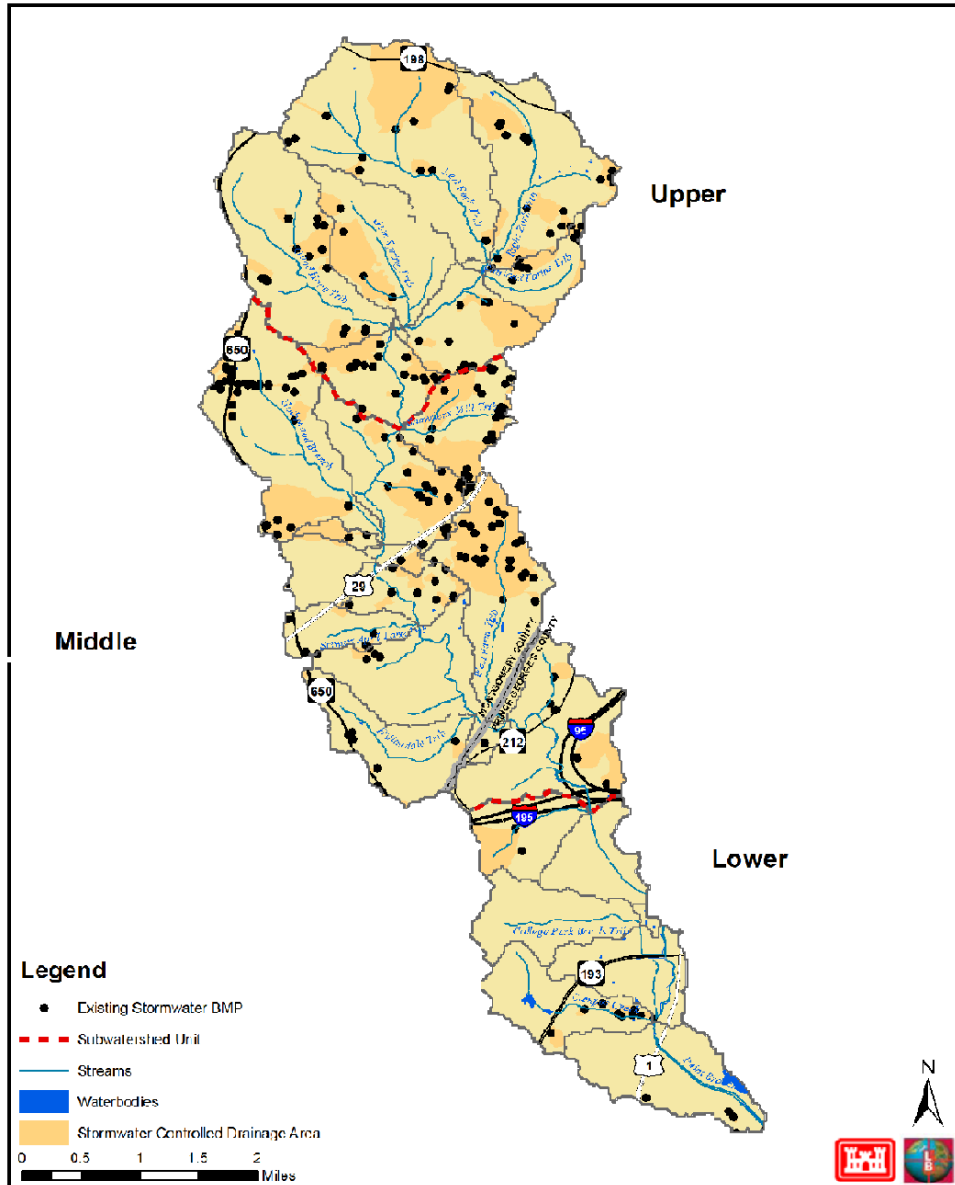


Figure 1-4: Paint Branch Existing BMPs

## **Problems Facing the Paint Branch Subwatershed**

### *Changes to Hydrology*

The development of the Paint Branch subwatershed has altered the hydrology and flow regime, and is a major cause for other problems facing the subwatershed. The change in land cover from forest or agriculture to impervious surfaces (such as roofs, roads, and parking lots) has set up a dynamic in which stormwater runoff increases and infiltration of precipitation into soils decreases. An increase in stormwater runoff increases peak discharge that provides energy necessary to erode stream banks as well as discharging pollutants from overland sources into receiving streams. Moderate to severe stream channel erosion was documented in all three sections of the Paint Branch subwatershed, with the far more extensive erosion areas being located in the lower section, south of the Capital Beltway (Route 495).

### *Poor Aquatic Habitats*

Since the late 1980's many natural resources professionals working in the Anacostia watershed have monitored these communities using an *Index of Biotic Integrity* or IBI approach. The IBI compares the fish and macroinvertebrate communities of urban streams with those of healthy reference streams, incorporating geographical, ecosystem, community, and population, as well as distribution and abundance variables that account for differences in water body size, type, and region of occurrence. While there are still many gaps in the Anacostia macroinvertebrate and fish community IBI databases, available data have proven extremely valuable in the restoration effort. In general, the overall health of the aquatic community in Paint Branch can be characterized as ranging from Poor to Good in the middle and lower basins, and from Good to Excellent in the Upper, less developed basin. Currently about 53-percent of the stream miles have adequate riparian buffers (300 feet total width). There are multiple physical barriers to fish movement in the subwatershed. Many of these blockages are a result of channelization, perched culverts, and exposed utility lines. A total of 35 blockages were field verified. There have been 3 major main stem and two major tributary fish passage projects completed since 1990. The Paint Branch Environmental Baseline Conditions and Restoration Report appendix contains additional information on the locations of the fish barriers and IBI data for the subwatershed.

### *Poor Water Quality*

Water quality also plays a major role in the problems facing the Paint Branch subwatershed. This area was developed prior to the era of mandatory stormwater controls; as such there are 329 storm drain outfalls and only about 20-percent of the subwatershed has stormwater controls. The high level of imperviousness, inadequate numbers of stormwater management controls, old sewer systems, as well as high levels of stream channel erosion have all contributed to the Paint Branch subwatershed total suspended solids (TSS) load. The TSS load is estimated to be approximately 72 tons/square mile/year. The nutrient loading rates associated with this are presented in Table 1-2. The sediment Total Maximum Daily Load (TMDL) analysis for the Anacostia River estimates that approximately 70-percent of the sediment loaded into the tidal estuary originates from the stream banks and channels. Further discussion of Best Management Practices (BMPs) and TMDLs for the Anacostia River watershed can be found in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report.

Toxics, which include trace metals, polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), pesticides, herbicides, enter the surface waters of the subwatershed via runoff (non-point source) and industrial/municipal discharge. There has been minimal data collected to determine the amount and source of the toxics that are present in the Paint Branch subwatershed, as such, the extent of the problem is unknown at this time. There are a total of 119 National Pollutant Discharge Elimination System (NPDES) related discharges in the Anacostia watershed and 13 of them are located within the Paint Branch subwatershed. Figure 1-5 shows the location of NPDES sites in the Anacostia watershed. There are three Resource Conservation and Recovery Act (RCRA) sites located in the Paint Branch subwatershed (2 in the middle basin and one in the lower basin). These sites are shown on Figure 1-6. There are no Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund) sites located within this subwatershed.

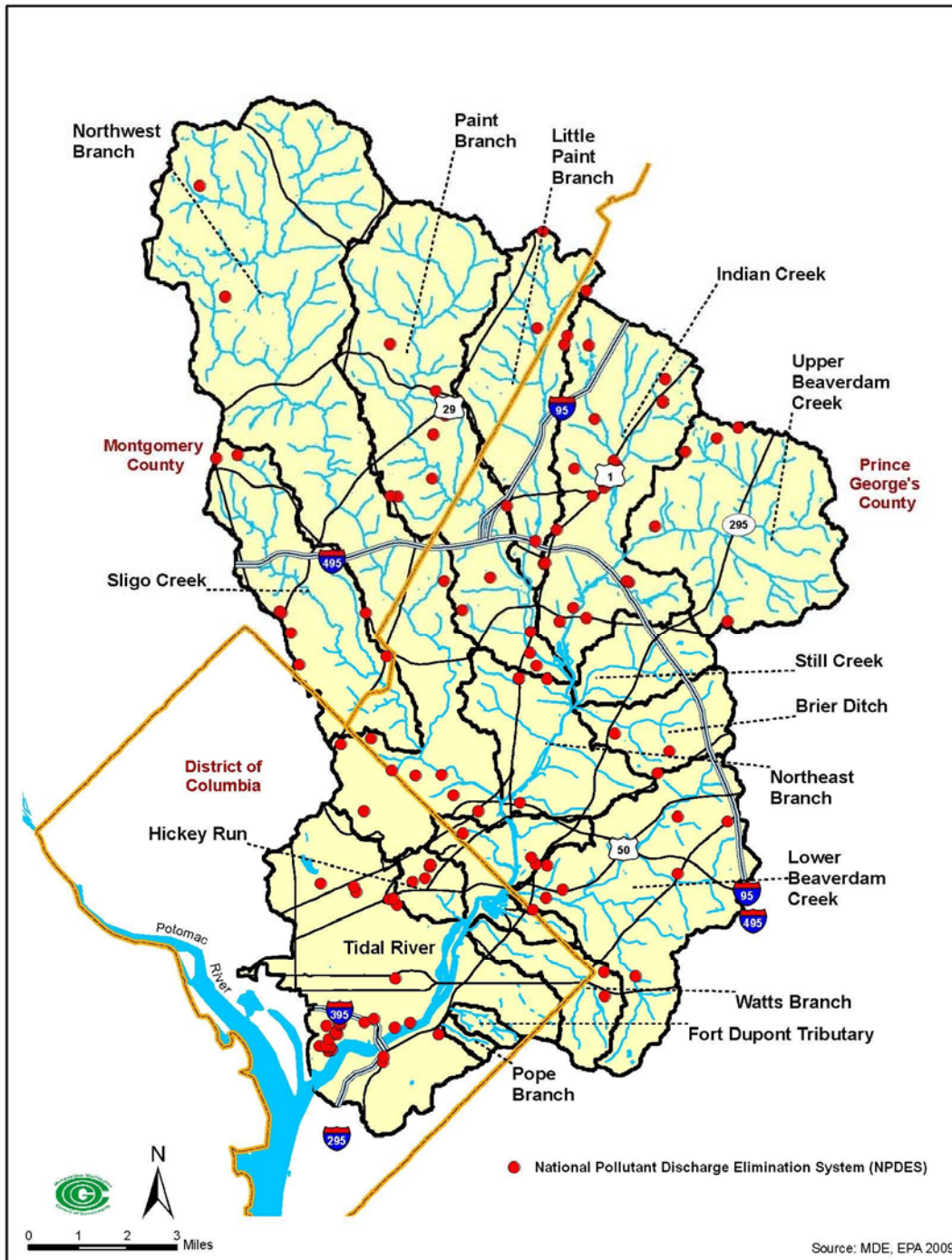


Figure 1-5: NPDES Sites in Anacostia Watershed

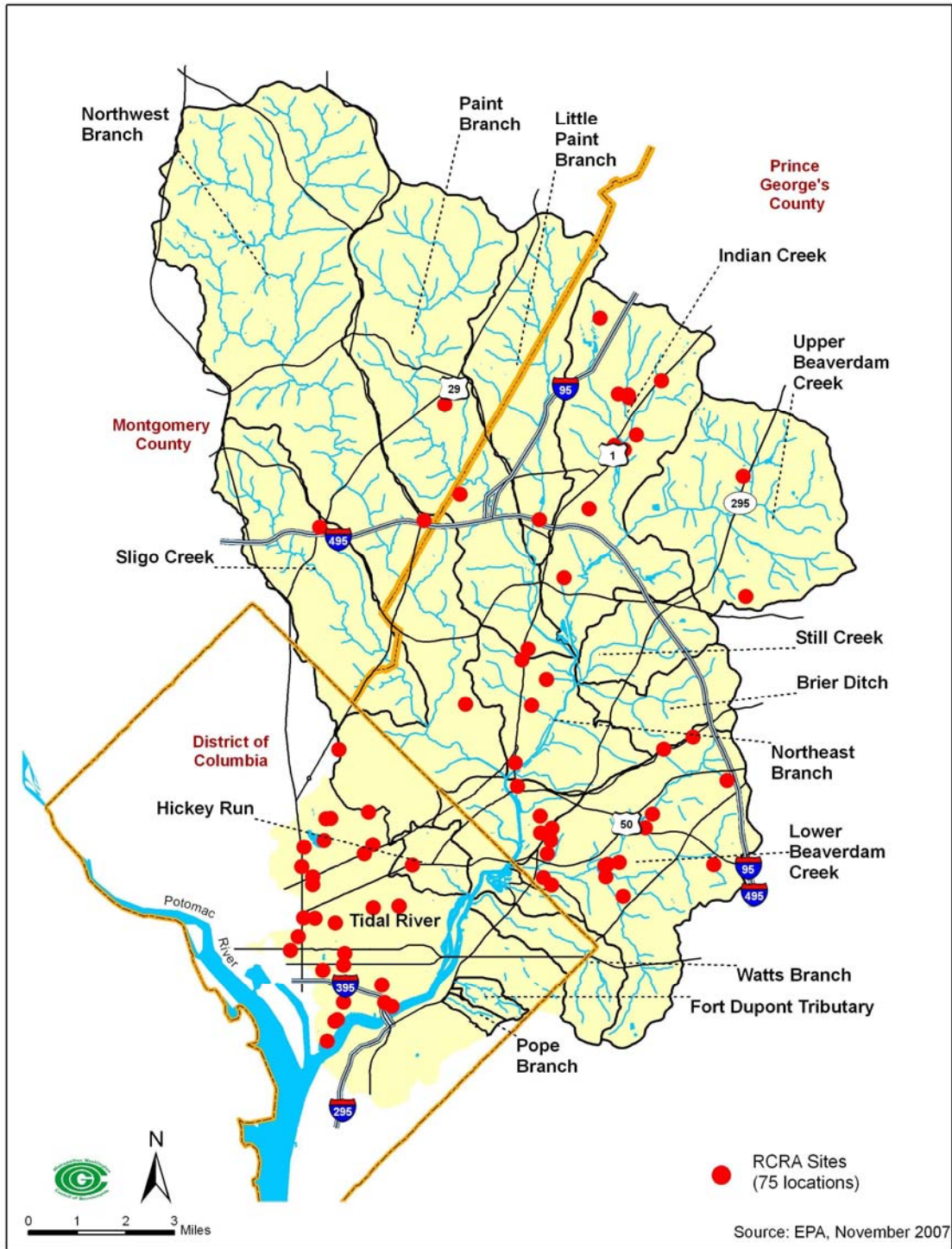


Figure 1-6: RCRA Sites in Anacostia Watershed

The available fecal coliform sampling for Anacostia River watershed suggests that streams in the watershed do not meet established bacterial water quality standards. While this data is not specifically available for Paint Branch, studies done in other subwatersheds of the Anacostia River have shown that bacterial contamination is contributed to the subwatershed by the following sources; Human (9 to 55-percent), domestic animals (24 to 28-percent), livestock (6 to 28-percent), wildlife (12 to 38-percent). As a result of the requirement for Washington Sanitary Sewer Commission (WSSC) to rehabilitate its sewer line system in Maryland and develop a water quality management plan, there are now 17 monitoring stations located in Paint Branch subwatershed

### *Trash*

Trash is another non-point source contaminant entering the system. Trash surveys have indicated that the middle and lower main stem of Paint Branch have one of the highest trash levels in the Anacostia watershed. This is not surprising given the high population density of the subwatershed.

### *Flooding*

Flooding has been a long-standing problem throughout the Anacostia River watershed, particularly in Prince George's County, though areas of Montgomery County and the District of Columbia experience episodic flooding as well. Prince George's County is prone to flooding because the county is located within the Coastal Plain physiographic province, which is generally wider and flatter, and due to development of floodplains prior to the development of stormwater management regulations and controls. Periodic flooding within Paint Branch can occur throughout the watershed in all three sections, but the most frequently flooded areas are in the main stem in the lower section, downstream of the confluence of Little Paint Branch. Further data and discussion regarding the current conditions of the Paint Branch subwatershed can be found in the Anacostia Watershed Environmental Baseline Conditions and Restoration Report prepared by MWCOG.

## **Existing Pollutant Loads**

Existing pollutant loadings for sediment, nitrogen (N), and phosphorous (P) was calculated for the Anacostia River watershed TMDL by MDE. As part of the ARP, the sediment, N, and P loadings were calculated for the Paint Branch subwatershed using the same loading rates per land use for the TMDL in order to estimate the Paint Branch subwatershed's contribution of pollutant load to the overall Anacostia River load (Kim et al, 2007; Mandel et al, 2008). The Anacostia River watershed TMDL identifies a reduction goal for sediment, N, and P as 85-, 79-, and 80-percent, respectively. By knowing the percent reduction necessary for the entire Anacostia River watershed and applying the percent reduction to the Paint Branch subwatershed pollutant loading estimate, the subwatershed loading reduction for Paint Branch necessary to achieve the overall Anacostia River watershed TMDL can be estimated. Additional information is available on the existing pollutant loading calculations is available in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report.

Identifying the existing magnitude of loadings on a subwatershed basis allows for the ability to geographically target and evaluate the scale of restoration needed to reduce N, P, and sediment

inputs within each subwatershed to attain goals. A summary table of Paint Branch subwatershed current loadings and how they compare to the rest of the Anacostia River watershed is found in Table 1-2. The efforts to attain TMDLs are being led by the U. S. Environmental Protection Agency (EPA) and MDE, and as such neither this SWAP nor the ARP are intended to serve as TMDL implementation plans, although data presented here may contribute to that effort. The Plan Formulation appendix of the Anacostia Watershed Restoration Plan and Report provides more details regarding the methodology used to obtain the current loading estimates and presents the results of those analyses. It must be noted that the analyses conducted for the ARP in regards to pollutant reduction only considered overland flow, and does not account for pollutant contribution from the stream channel itself, namely sediment from erosion. Additional detailed modeling would be required to determine sediment transport change associated with reduced runoff volumes from implementation of the stormwater management retrofit projects identified in the ARP.

<b>Table 1-2: Nutrient Loading Estimates for Paint Branch Subwatershed and Comparison Values</b>			
	<b>Nitrogen lbs/sq mi/year</b>	<b>Phosphorus lbs/sq mi/year</b>	<b>TSS tons/sq mi/year</b>
Paint Branch	4,532	336	72
Average Anacostia Subwatershed	5,255	500	99
Completely Forested Watershed	42	8	Value not calculated

<b>Table 1-3: TMDL Reduction Goals</b>			
	<b>Nitrogen lbs/sq mi/year</b>	<b>Phosphorus lbs/sq mi/year</b>	<b>TSS tons/sq mi/year</b>
Anacostia River Watershed TMDL Reduction Goals	79%	80%	85%
Estimated Paint Branch TMDL Loadings	4,532	336	72
Estimated Paint Branch Reduction Goal	3,580	269	61



## Section 2

# Inventory of the Provisional Restoration Candidates

## **Inventory of the Provisional Restoration Candidates**

As part of the ARP study, a systematic process was developed to identify, catalog, and evaluate each restoration opportunity. In addition, the evaluation of restoration projects was completed by using a detailed system to score the various projects and ultimately determine a ranking of projects. The opportunities presented were identified through the compilation of existing data, input from local jurisdictions, GIS analyses, and field observations. The existing data provided by the local municipalities included land use data, public/private ownership information, impervious surfaces data, planning department classifications, digital elevation models, stormwater management data, and aerial photographs. A detailed explanation of the methodology utilized to identify the opportunities can be found in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report.

In addition to the restoration strategies discussed in Section 1, the potential projects identified as part of this analysis are intended to achieve one or more of the following 2020 restoration objectives:

1. Stormwater Management
2. Wetland Creation and Restoration
3. Riparian Corridors
4. Aquatic Community
5. Trash Reduction
6. Outreach
7. Parkland Acquisition

Table 2-1 identifies potential project types per objective, gives a brief description, and states the metric that will be used.

**Table 2-1: 2020 Paint Branch Restoration Objectives**

<b>Objectives</b>	<b>Description of Objective</b>	<b>Metric</b>
<b>Stormwater Management</b>		
Retrofits, ESD, LID	Retrofit current stormwater controls, utilize bioretention, filters, bioswales, wet ponds, wetlands to add controlled acreage to the subwatershed	Acres Controlled and Pounds of N, P, TSS loading reduced
Homeowner BMPs	Include use of Green roofs, disconnects, rain barrels, permeable pavement, and rain gardens	Acres Controlled and Pounds of N, P, TSS loading reduced
<b>Trash</b>		
Implement reduction projects	Reduce trash through use of netting, catching, and grates	Number of Projects Implemented / MWCOG Trash Index Rating
Street Sweeping	Increase street sweeping programs	Acres Swept and Pounds of N, P, TSS loading reduced
<b>Aquatic Community</b>		
IBI Rating for Fish	Restore fish habitat through improved water quality and flow management	Index of Biotic Integrity Rating
IBI Rating for Macroinvertebrate	Restore macroinvertebrate habitat through improved water quality and flow management	Index of Biotic Integrity Rating
Fish Passage	Remove barriers to fish migration	Miles of Stream
<b>Wetland Creation and Restoration</b>		
Create and Restore Acreage	Create new wetlands and vernal pools and restore/expand existing ones	Acreage created or restored
<b>Riparian Corridors</b>		
Invasive Species Management	Removal of invasive species from the corridor	Acres managed
Reforestation	Replanting of the riparian corridor	Acres reforested
Increase Tree Canopy	Tree planting in both urban and non-urban areas	Acres / % increase
<b>Outreach / Public Involvement</b>		
Increase participation of residents and businesses	Educate the public about BMPs and encourage their use of them	Qualitative
Establish Friends of Paint Branch Organization	Establish a subwatershed group to facilitate public involvement	Yes or No
Incentive Programs	Expand current programs and encourage businesses to offer incentives. Assist private owners with measures such as rain barrels.	Expanded or Maintained

A total of 369 potential restoration candidate projects within the Paint Branch subwatershed have been identified as part of the ARP investigation. The complete inventory and description of the 369 proposed projects are included in Project Inventory section of this appendix. The potential restoration projects address five of six restoration strategies identified for the Paint Branch 2020 restoration objectives (does not include projects for increasing participation). The presence of toxic contaminants has been identified in Paint Branch; however, detailed studies have not been completed to identify the exact sources and extent of the problem, and thus there are no provisional restoration candidate projects that address toxics in the report. It is recommended that further studies regarding the source and extent of toxic contamination should be undertaken by the appropriate authorities. In addition to illicit discharges, historic dump sites may be sources of toxic contaminants in the system. A diagram of these sites and current NPDES sites can be found in Section 1 of this subwatershed action plan on Figures 1-3 and 1-4.

Tables 2-2, 2-3, and 2-4 provide a summary of the proposed restoration project types, quantity, and the estimated cost of implementation. It should be noted that the development of the NPDES MS4 permit by the three local jurisdictions may or may not include provisional restoration projects presented in the SWAP or Subwatershed Provisional Restoration Projects Inventory.

<b>Candidate Project Type</b>	<b>Number of Projects</b>	<b>Estimated Cost (\$)</b>	<b>Impervious Acreage Newly Controlled (ac)</b>	<b>Length (mi)</b>	<b>Acreage (Ac)</b>
Stormwater Retrofit	239	122,006,000	885.5	-	-
Stream Restoration	58	15,169,700	-	9.2	-
Wetland Creation / Restoration	17	360,500	-	-	7.5
Fish Blockage Removal / Modification	14	5,120,000	-	5.9	-
Riparian Reforestation/Buffer/Meadow/ Invasive Management	20	286,500	-	-	49.6
Trash Reduction	8	43,700	-	-	-
Sediment Remediation	-	-	-	-	-
Parkland Acquisition	13	5,350,000	-	-	53.5
<b>Total</b>	<b>369</b>	<b>148,336,400</b>	<b>885.5</b>	<b>15.1</b>	<b>110.6</b>

<b>Table 2-3: Proposed Restoration by Type in the Paint Branch Subwatershed</b>					
<b>Project Type</b>	<b>Watershed Area</b>				
	<b>Upper</b>	<b>Middle</b>	<b>Lower</b>	<b>Total</b>	<b>Total New</b>
Wetland and Wet Pond Stormwater (acres)*	68.4	80.5	7.1	155.6	10.5
Bioretention (acres)*	150.8	330.7	152.1	633.5	629.3
Bioswales (acres)*	35.6	37.5	1.0	74.0	73.4
Swale Mod (acres)*	1.4	0.0	0.0	1.4	0.0
Permeable Pavement (acres)*	3.4	6.3	6.8	16.5	16.5
Filter (acres)*	12.2	51.9	13.4	77.5	42.6
Green Roof (acres)*	2.8	8.1	23.3	34.2	34.2
Downspout Disconnects (acres)*	6.8	22.0	0.9	29.8	29.8
Rain Barrels (acres)*	2.2	8.8	1.0	11.9	11.9
Rain Garden (acres)*	5.4	23.1	2.9	31.4	31.4
Dry Pond (acres)*	4.6	0.0	0.0	4.6	0.0
Infiltration Practices (acres)*	0.0	4.5	0.0	4.5	4.5
Invasive Species Management (acres)	0.1	39.7	0.1	39.9	NA
Wetland Restoration (acres)	0.4	2.7	2.5	5.6	NA
Vernal Pools Restoration/Creation (acres)	1.5	0.3	2.5	4.3	NA
Reforestation (acres)	3.5	3.5	0.2	7.2	NA
Land Acquisition (acres)	0.0	42.7	10.8	53.5	NA
Meadow Creation (acres)	0.0	2.5	0.0	2.5	NA
Stream Restoration (miles)	2.6	4.0	2.6	9.2	NA
Fish Passage (miles)	0.8	3.5	1.6	5.9	NA
Trash Reduction (number of projects)	4	2	2	8	NA

\*Note: Acreage shown represents the total acreage controlled by the project. A portion of these are retrofits and upgrades, therefore the acreage is not representative of 'new' acreage controlled but represents new and current acreage controlled by the proposed project. The newly controlled acreage is in the last column.

<b>Table 2-4: Provisional Restoration Project Estimated Unit Costs</b>		
<b>No.</b>	<b>Practice</b>	<b>Approximate Unit Cost (\$)</b>
<b>Stormwater Retrofit</b>		
1	Existing Stormwater Management Pond/Wetland Retrofitting	\$1,000-\$3,000/acre of drainage
2	New Stormwater Management Pond/Wetland Construction	\$3,000-\$5,000/acre of drainage
3	LID-Bioretention with Under Drain System	\$100,000/impervious acre
4	LID-Curbside/Street Planter	\$100,000/impervious acre
5	LID tree box filter	\$54,450-\$65,340/impervious acre
6	LID-Green Roof	\$42/square foot
7	LID-Single Family Home Rain Garden	\$5,000 per individual garden
8	LID-Single Family Home Rain Barrel	\$200/barrel (typically two per house)
9	Sand Filter	\$20,000 to \$25,000 per impervious acre
10	Underground Pipe Storage	\$15,000/impervious acre
11	Permeable Pavement	\$4.0/square foot
<b>Stream Restoration/Fish Passage Blockage Removal or Modification</b>		
12	Stream Restoration	\$300/linear foot
13	Concrete Stream Channel Removal	\$1,000/linear foot
14	Stream Day Lighting	\$2,000/linear foot
15	Fish Passage/Riffle Grade Control Structure	\$150,000/one foot barrier height
16	Wetland Creation	\$50,000/acre
<b>Trash Reduction/Water Quality</b>		
17	Fresh Creek Trash Netting System	\$1,000/acre of drainage
18	End-of-Pipe Trash Catching System	\$4,000/acre of drainage
19	Street Sweeping	\$50/curb mile
20	Storm Drain Trash Grate	\$500/inlet

## **Results of the Evaluation and Scoring of Restoration Actions in Paint Branch Subwatershed**

To recommend restoration action and to determine the sequence for implementation, the quantitative scoring scheme was used to evaluate the 369 provisional restoration candidate projects. This common scoring system allowed for comparison of candidates across as well as within the restoration strategies. The scores for all 369 projects ranged from 88 to 49 points out of a possible 100. To prioritize among projects based on benefits, the scores were divided into three tiers based on the distribution of the scores, with Tier I projects being those anticipated to provide the greatest potential benefits. Tier I includes projects that scored an 80 or above, Tier II includes projects that scored anywhere from 79 to 65, and Tier III includes those that scored 64 or below. Further discussion on the scoring system for the proposed projects can be found in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report.

The scoring scheme for the provisional stormwater management candidate projects was subsequently further adjusted. The tier system was retained, but the tier boundaries were refined based on distribution of the adjusted score as described in the stormwater management subsection below.

The following tables present the scores and overall rank of the provisional restoration actions for the Paint Branch subwatershed separated by restoration strategy.

### **Stormwater Management**

To provide for better differentiation for potential benefits that would be produced by the 239 potential stormwater management candidate projects and aid the local communities in prioritization for implementation, the scoring system used for project candidates in this restoration strategy were adjusted from the common scoring system. Variables representing two additional factors unique to stormwater management were incorporated into the scoring system: unit imperviousness and existing stormwater control. Data for these variables was obtained from MWCOG and is presented in the Paint Branch Environmental Baseline Conditions and Restoration Report. In the adjusted scoring system for the stormwater projects, Tier I includes projects above 100, Tier II includes projects that are between 89 and 99, Tier III are those scored 88 and below, and Tier IV are those projects that did not meet the minimum requirements to be included in the adjusted scoring system but could still be considered as restoration opportunities in the future. Further explanation of the basis for the adjusted scoring can be found in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report. The top 20 stormwater retrofit candidate projects (Tiers I, II, and III) are listed in Table 2-5. Additional information and project descriptions can be in the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

**Table 2-5: Top 20 Potential Stormwater Retrofit Projects within the Paint Branch Subwatershed**

Project ID	Jurisdiction*	Project Name	Adjusted Score	Overall Rank based on Original Scoring	Estimated Cost (\$)
PB-M-01-S-9	PG	Stormwater outfall approximately 200 feet from the end of Deakins Hall Drive, Hyattsville, MD	107.6	15	1,890,000
PB-M-01-S-52	MC	Outfall at the northern end of Montclair Drive, Silver Spring, MD	106.6	23	1,500,000
PB-L-01-S-52	PG	Parking areas 2a, 2g, SS2, and SS3, University of Maryland, College Park, MD	106.1	15	403,000
PB-L-01-S-62	PG	Research greenhouses, University of Maryland, College Park, MD	106.1	15	840,000
PB-L-01-S-63	PG	North side of the Comcast Center, University of Maryland, College Park, MD	106.1	15	980,000
PB-M-01-S-12	MC	White Oak Garden Apartments, 11600 Lockwood Drive, Silver Spring, MD	105.1	7	67,000
PB-M-01-S-48	MC	Oak Hill Apartments, Silver Spring, MD	104.8	23	640,000
PB-M-01-S-43	MC	Renick Lane between Jackson Road and Nora Drive, Silver Spring, MD	104.6	42	1,700,000
PB-L-01-S-54	PG	Clarence Smith Performing Arts Center, University of Maryland, College Park, MD	104.0	42	6,694,000
PB-M-01-S-4	MC	Seventh Day Adventist Church World Headquarters, 12501 Old Columbia Pike, Silver Spring, MD	103.6	56	300,000
PB-M-01-S-77	MC	Jackson Road Elementary School and athletic fields, 900 Jackson Road, Silver Spring, MD	102.8	42	1,370,000
PB-M-01-S-45	MC	White Oak Middle School and athletics fields, 12201 New Hampshire Avenue, Silver Spring, MD	102.7	56	2,100,000
PB-L-01-S-44	PG	Cherokee Lane Elementary School, 9000 25th Avenue, Hyattsville, MD	102.4	23	472,000
PB-U-01-S-1	MC	Langside Street neighborhood, Silver Spring, MD	102.2	32	630,000
PB-U-01-S-7	MC	Neighborhood of Holly Spring Drive and Kaywood Lane, Silver Spring, MD	102.2	32	974,000
PB-U-01-S-9	MC	Neighborhood bounded by Seibel Drive, Timberlake Drive, Redmiles Drive, and Donna Drive, Silver Spring, MD	102.2	32	960,000
PB-M-01-S-53	MC	Outfall at the corner of Eastbourne Place and Montclair Drive, Silver Spring, MD	102.1	23	803,000
PB-M-01-S-5	MC	Meadows II Commercial Center, 12520 Prosperity Drive, Silver Spring, MD	101.8	56	794,000
PB-M-01-S-40	MC	January Drive, Silver Spring, MD	101.8	56	600,000
PB-U-01-S-27	MC	Fairland Road between Paint Branch and Hobart Drive, and the residential neighborhood on Castle Cliff Way .	101.6	8	578,000
<b>TOTAL</b>					<b>24,295,000</b>

\*PG=Prince George's County, Maryland  
 MC=Montgomery County  
 Scoring Tier = Tier I, Tier II, Tier III

In order to allow for more regional prioritization, the top five stormwater projects for each of the planning units in the subwatershed (Upper, Middle, Lower) are in Tables 2-6, 2-7, and 2-8.

**Table 2-6: Top 5 Potential Stormwater Retrofit Projects within the Upper Paint Branch Subwatershed**

Project ID	Jurisdiction*	Project Name	Adjusted Score	Overall Rank based on Original Scoring	Estimated Cost (\$)
PB-U-01-S-1	MC	Langside Street neighborhood, Silver Spring, MD	102.2	32	630,000
PB-U-01-S-7	MC	Neighborhood of Holly Spring Drive and Kaywood Lane, Silver Spring, MD	102.2	32	974,000
PB-U-01-S-9	MC	Neighborhood bounded by Seibel Drive, Timberlake Drive, Redmiles Drive, and Donna Drive, Silver Spring, MD	102.2	32	960,000
PB-U-01-S-27	MC	Fairland Road between Paint Branch and Hobart Drive, and the residential neighborhood on Castle Cliff Way south of Castle Cliff Place, Silver Spring, MD	101.6	8	578,000
PB-U-01-S-62	MC	Tamarack Road, Lemontree Lane, Crestline Road, and Northcrest Drive, Colesville, MD 20904	99.3	56	620,000
<b>TOTAL</b>					<b>3,762,000</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = Tier I, Tier II, Tier III					

**Table 2-7: Top 5 Potential Stormwater Retrofit Projects within the Middle Paint Branch Subwatershed**

Project ID	Jurisdiction*	Project Name	Adjusted Score	Overall Rank based on Original Scoring	Estimated Cost (\$)
PB-M-01-S-9	PG	Stormwater outfall approximately 200 feet from the end of Deakins Hall Drive, Hyattsville, MD	107.6	15	1,890,000
PB-M-01-S-52	MC	Outfall at the northern end of Montclair Drive, Silver Spring, MD	106.6	23	1,500,000
PB-M-01-S-12	MC	White Oak Garden Apartments, 11600 Lockwood Drive, Silver Spring, MD	105.1	7	67,000
PB-M-01-S-48	MC	Oak Hill Apartments, Silver Spring, MD	104.8	23	640,000
PB-M-01-S-43	MC	Renick Lane between Jackson Road and Nora Drive, Silver Spring, MD	104.6	42	1,700,000
<b>TOTAL</b>					<b>5,797,000</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = Tier I, Tier II, Tier III					

**Table 2-8: Top 5 Potential Stormwater Retrofit Projects within the Lower Paint Branch Subwatershed**

Project ID	Jurisdiction*	Project Name	Adjusted Score	Overall Rank based on Original Scoring	Estimated Cost (\$)
PB-L-01-S-52	PG	Parking areas 2a, 2g, SS2, and SS3, University of Maryland, College Park, MD	106.1	15	403,000
PB-L-01-S-62	PG	Research greenhouses, University of Maryland, College Park, MD	106.1	15	840,000
PB-L-01-S-63	PG	North side of the Comcast Center, University of Maryland, College Park, MD	106.1	15	980,000
PB-L-01-S-54	PG	Clarence Smith Performing Arts Center, University of Maryland, College Park, MD	104.0	42	6,694,000
PB-L-01-S-44	PG	Cherokee Lane Elementary School, 9000 25th Avenue, Hyattsville, MD	102.4	23	472,000
<b>TOTAL</b>					<b>9,389,000</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = Tier I, Tier II, Tier III					

### Stream Restoration

The top 5 out of 58 potential stream restoration candidate projects are presented in Table 2-9. The projects range in length from 150 feet to 2,700 feet and include projects addressing stream channel morphology, in-stream habitat, and regenerative stormwater conveyance. Additional project description information can be found the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

**Table 2-9: Top 5 Potential Stream Restoration Projects within the Paint Branch Subwatershed**

Project ID	Jurisdiction*	Project Name	Score	Overall Rank	Estimated Cost (\$)
PB-M-02-SR-8	MC	Paint Branch Park directly east of January Drive, Silver Spring, MD	76	42	74,000
PB-L-02-SR-2	PG	Northeast of Moon River Court and Muskogee Street, approximately 240 feet southwest of culvert under I-495, Hyattsville, MD	76	42	45,000
PB-L-02-SR-13	PG	Stormwater outfall, south of Marlborough Way and St. Andrews Place, College Park, MD	76	42	74,000
PB-L-02-SR-14	PG	Dead end of Marlborough Way near intersection with Bridgewater Street, College Park, MD	76	42	55,500
PB-U-02-SR-5	MC	At end of Fireside Drive, Silver Spring, MD	74	72	810,000
<b>TOTAL</b>					<b>1,058,500</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = Tier I, Tier II, Tier III					

### Wetland and Vernal Pool Creation and Restoration

The potential wetland restoration candidate projects are presented in Table 2-10. These projects include wetland creations/restorations that range from 0.1 acres to 3.5 acres in size and vernal pool creations from 0.03 acres to 0.5 acres in size. Additional project description information can be found in the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

**Table 2-10: Potential Wetland Creation or Restoration Projects within the Paint Branch Subwatershed**

Project ID	Jurisdiction	Project Name	Score	Overall Rank	Estimated Cost (\$)
PB-U-03-W-2	MC	Approximately 400 feet northwest of the terminus of Williston Road, Silver Spring, MD	80	8	25,000
PB-U-03-W-3	MC	Approximately 300 feet north of the intersection of Rainbow Drive and Tindlay Street, Silver Spring, MD	80	8	25,000
PB-U-03-W-4	MC	Approximately 420 feet north-northeast of intersection of Peach Orchard Road and Banbury Ridings Drive, Silver Spring, MD	77	32	5,000
PB-M-03-W-6	MC	Approximately 60 feet west of I-95, and approximately 950 feet southeast of Powder Mill Community Park baseball diamond, Hyattsville, MD	76	42	13,000
PB-M-03-W-3	MC	South floodplain of perennial tributary at 1302-1304 Downs Drive, Silver Spring, MD	74	72	50,000
PB-M-03-W-5	MC	Approximately 300 feet west of I-95, and approximately 700 feet southeast of Powder Mill Community Park baseball diamond, Hyattsville, MD	73	91	5,000
PB-L-03-W-1	PG	South of Campus Creek, north of the parking lot at University of Maryland Outdoor and Recreation Center, Ellicott Drive, College Park, MD	72	111	75,000
PB-U-03-W-5	MC	Approximately 400 feet west-southwest of the intersection of Route 198 and Oursler Road, Burtonsville, MD	70	153	2,000
PB-U-03-W-6	MC	Approximately 350 feet northwest of the intersection of Rainbow Drive and Tindlay Street, Silver Spring, MD	66	275	5,000
PB-U-03-W-7	MC	Approximately 350 feet east-northeast of the intersection of Rainbow Drive and Tindlay Street, Silver Spring, MD	66	275	5,000
PB-U-03-W-1	MC	Approximately 700 feet east-northeast of the intersection of Old Barn Court and Piping Rock Drive, Silver Spring, MD	64	315	10,000
PB-M-03-W-4	MC	Floodplain of intermittent tributary on the east bank of Paint Branch, approximately 550 feet south of Randolph Road, Silver Spring, MD	61	345	45,000
PB-M-03-W-1	MC	Forested area approximately 700 feet southeast of Collingwood Terrace and Collingwood Lane, directly northeast of PDWT # 2392, Silver Spring, MD	60	355	22,000
PB-M-03-W-2	MC	Valley north of the northern dead end of Caplinger Road and south of the Tanley Drive and Sarah Road intersection, Silver Spring, MD	60	355	5,000
PB-M-03-W-7	MC	Approximately 500 feet west of I-95, and approximately 650 feet southeast of Powder Mill Community Park baseball diamond, Hyattsville, MD	58	358	16,000
PB-M-03-W-8	MC	Riparian forest located south of Hidden Valley Lane and west of Falling Creek Road, Silver Spring, MD	55	366	2,500
PB-L-03-W-2	PG	Paint Branch mainstem, approximately 1000 feet upstream from Paint Branch Parkway Railroad Crossing, north of bike path, College Park, MD	49	369	50,000
<b>TOTAL</b>					<b>360,500</b>

\*PG=Prince George's County, Maryland  
 MC=Montgomery County  
 Scoring Tier = Tier I, Tier II, Tier III

### Fish Blockage and Removal or Modification

The 14 potential fish blockage removal or modification candidate projects are presented in Table 2-11. These fish blockage removals range from 300 feet to 1.5 miles in length. Additional information regarding the project descriptions is available in the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

<b>Table 2-11: Potential Fish Blockage Removal or Modification Projects within Paint Branch Subwatershed</b>					
<b>Project ID</b>	<b>Jurisdiction</b>	<b>Project Name</b>	<b>Score</b>	<b>Overall Rank</b>	<b>Estimated Cost (\$)</b>
PB-M-04-F-4	MC	Stream reach approximately 535 feet northeast of MD-212 and Bond Road, Hyattsville, MD	70	153	20,000
PB-U-04-F-1	MC	Paint Branch tributary on Rainbow Drive, west of Langside Street, Silver Spring, MD	65	293	75,000
PB-M-04-F-3	MC	Perennial stream crossed at Laurie Drive culvert, Silver Spring, MD	65	293	750,000
PB-M-04-F-7	PG	Approximately 300 feet upstream from exit 25B of I-95 North to I-495 East, College Park, MD	65	293	150,000
PB-L-04-F-1	PG	Prince George's County Site 758110, approximately 500 feet northwest of the intersection of Route 1 and Lakeland Road, College Park, MD	64	315	300,000
PB-L-04-F-2	PG	Campus Creek area north of the parking lot at University of Maryland Outdoor and Recreation Center, Ellicott Road, College Park, MD	64	315	75,000
PB-M-04-F-1	MC	Perennial tributary at the Serpentine Way crossing immediately upstream of the culvert, approximately 420 feet south of Serpentine Way and Aquamarine Terrace, Silver Spring, MD	61	345	600,000
PB-M-04-F-6	PG	Under exit 25B from I-95 North to I-495 East, College Park, MD	61	345	150,000
PB-U-04-F-2	MC	Paint Branch tributary bisected by Rainbow Drive, east of Valencia Street, Silver Spring, MD	59	357	600,000
PB-M-04-F-9	PG	Approximately 1,520 feet east, southeast of the intersection of Deakin Hall Road and Tullymore Road at culvert that goes under I-95, Silver Spring, MD	58	358	750,000
PB-M-04-F-5	PG	Approximately 235 feet east from where the on ramp of I-95 North connects to I-495 East, College Park, MD	57	361	300,000
PB-M-04-F-8	PG	Approximately 930 feet northeast of the intersection of Deakin Hall Road and Tullymore Road east of the I-95 and I-495 ramp, Silver Spring, MD	57	361	750,000
PB-M-04-F-2	MC	Approximately 900 feet north-northwest of the intersection of Powder Mill Road and Bond Road, Hyattsville, MD	56	364	150,000
PB-L-04-F-3	PG	Approximately 380 feet southwest of De Pauw Place and St. Andrews Place, College Park, MD	54	367	450,000
<b>TOTAL</b>					<b>5,120,000</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = <b>Tier I</b> , <b>Tier II</b> , <b>Tier III</b>					

### Riparian Reforestation, Meadow Creation, and Invasive Species Management

All of the 20 potential riparian reforestation, meadow creation, and invasive species management candidate projects are presented in Table 2-12. The reforestation projects range from 0.1 to 1.8 acres, the invasive species management projects from 0.1 to 15.4 acres, and the meadow creation project is for 2.5 acres. Additional information regarding the project descriptions is available in the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

**Table 2-12 Potential Riparian Reforestation, Meadow Creation, Street Tree, and Invasive Species Management Candidate Projects within the Paint Branch Subwatershed**

Project ID	Jurisdiction	Project Name	Score	Overall Rank	Estimated Cost (\$)
PB-M-05-R-12	MC	Across the street from 2320 Broadbirch Drive, Silver Spring, MD	88	1	7,500
PB-M-05-R-1	MC	Forested area near the baseball fields in Fairland Park, 2201 Fairland Road, Silver Spring, MD	83	3	23,000
PB-M-05-R-3	MC	Riparian area located between Carters Grove Drive and Staley Manor Drive, Silver Spring, MD	83	3	77,000
PB-M-05-R-4	MC	Riparian area of the tributary located between Priscilla Drive and Featherwood Street, Silver Spring, MD	83	3	43,000
PB-U-05-R-3	MC	Approximately 300 feet southeast of intersection of Good Hope Road and Hopefield Road, Silver Spring, MD	80	8	5,400
PB-U-05-R-5	MC	West of Veitch Lane, approximately 160 feet north of intersection with Spencerville Road, Spencerville, MD	80	8	13,000
PB-M-05-R-6	MC	2001 East Randolph Road, southeast of the Southern Asian Seventh Day Adventist Church, Silver Spring, MD	80	8	22,500
PB-U-05-R-2	MC	Existing wet detention pond PDWT #888, approximately 600 feet south of Cradock Street.	78	23	500
PB-M-05-R-2	MC	Approximately 450 feet east of the Laurie Drive / Montclair Drive intersection, Silver Spring, MD	78	23	2,000
PB-M-05-R-9	MC	Riparian forest located east of Falling Creek Road, Silver Spring, MD	78	23	38,000
PB-L-05-R-2	PG	Approximately 100 feet southwest of intersection of Route 1 and Lakeland Road on north side of bridge, College Park, MD	78	23	500
PB-U-05-R-1	MC	PB-TIC-27, across street from Wembrough Park, 15400 Wembrough Street, Silver Spring, MD	75	56	4,500
PB-U-05-R-4	MC	PB-MC-41 (T41), in Paint Branch Park approximately 475 feet east of intersection of Collingwood Terrace and Lemontree Lane, Silver Spring, MD	75	56	9,000
PB-M-05-R-5	MC	Residential neighborhood on Angelwing Drive, Statford Garden Drive, and Withan Drive, Silver Spring, MD	75	56	16,000
PB-M-05-R-10	MC	Tributary located south of Parallel Lane, Silver Spring, MD	73	91	6,300
PB-M-05-R-7	MC	Riparian forest located south of Hidden Valley Lane and west of Falling Creek Road, Silver Spring, MD	71	137	7,000
PB-M-05-R-8	MC	South riparian area of stream located at 2400-2412 Falling Creek Road, Silver Spring, MD	70	153	4,000
PB-M-05-R-11	MC	Riparian area approximately 875 feet northwest of intersection of Plum Orchard Drive and Broadbirch Drive, Silver Spring, MD	70	153	4,500
PB-M-05-R-13	MC	U.S. Army laboratory complex, Adelphi, MD	68	216	1,000
PB-L-05-R-1	PG	Campus Creek north bank, west of Regents Drive, College Park, MD	68	216	1,800
<b>TOTAL</b>					<b>286,500</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = Tier I, Tier II, Tier III					

## Land Acquisition

The provisional land acquisition candidate projects are presented in Table 2-13. The size of the acquisition sites range from 0.4 acres to 19.8 acres. Additional information regarding the project descriptions can be found in the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

**Table 2-13: Potential Land Acquisition Projects within the Paint Branch Subwatershed**

Project ID	Jurisdiction	Project Name	Score	Overall Rank	Estimated Cost (\$)
PB-L-08-L-1	PG	0000 Tulsa Drive	74	72	1,083,000
PB-M-08-L-6	PG	3118 Powder Mill Road	73	91	74,000
PB-M-08-L-7	PG	3030 Powder Mill Road	72	111	500,000
PB-M-08-L-8	PG	3120 Powder Mill Road	72	111	347,000
PB-M-08-L-11	PG	10020 Riggs Road	72	111	486,000
PB-M-08-L-10	PG	00000 Powder Mill Road	69	179	1,982,000
PB-M-08-L-1	PG	2924 Powder Mill Road	68	216	39,000
PB-M-08-L-2	PG	10921 Bond Road	67	239	146,000
PB-M-08-L-3	PG	3010 Powder Mill Road	67	239	155,000
PB-M-08-L-4	PG	3108 Powder Mill Road	67	239	139,000
PB-M-08-L-5	PG	3112 Powder Mill Road	67	239	139,000
PB-M-08-L-9	PG	3202 Powder Mill Road	67	239	123,000
PB-M-08-L-12	PG	3207 Cherry Mill Road	67	239	137,000
<b>TOTAL</b>					<b>5,350,000</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = Tier I, Tier II, Tier III					

### Trash Reduction

The provisional trash reduction candidate projects are presented in Table 2-14. The projects include trash removal, inlet grates, signage, trash trap, and outreach. Additional information regarding the project descriptions can be found in the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

Table 2-14: Potential Trash Reduction Projects within the Paint Branch Subwatershed					
Project ID	Jurisdiction	Project Name	Score	Overall Rank	Estimated Cost (\$)
PB-U-06-T-2	MC	Dead end of Kaywood Lane, Silver Spring, MD	74	72	5,000
PB-L-06-T-1	PG	Approximately 450 feet northwest of culvert under Falling Brook Terrace and Silver Lake Court, Hyattsville, MD	74	72	3,700
PB-L-06-T-2	PG	Approximately 500 feet north of Ellicott Road and Valley Drive, directly north of parking lot, College Park, MD	74	72	2,000
PB-U-06-T-4	MC	Approximately 500 feet northeast of the eastern terminus of Kaywood Lane, Silver Spring, MD	72	111	20,000
PB-U-06-T-3	MC	Dead end of Apple Tree Lane, Silver Spring, MD	71	137	2,000
PB-U-06-T-1	MC	Approximately 900 feet southeast of the intersection of Route 198 and Peach Orchard Road, Silver Spring, MD	67	239	7,000
PB-M-06-T-1	MC	Outfall located approximately 250 feet north of Carters Grove Drive, Silver Spring, MD	66	275	1,000
PB-M-06-T-2	MC	North riparian area of the tributary located approximately 300 feet south of Loft Lane, Silver Spring, MD	64	315	3,000
<b>TOTAL</b>					<b>43,700</b>
*PG=Prince George's County, Maryland MC=Montgomery County Scoring Tier = Tier I, Tier II, Tier III					

### Summary of Recommended Restoration Actions

The Recommended Restoration Actions are those that could potentially be implemented and a roll-up of these projects is presented in Table 2-15. Additional information on the descriptions and details of the potential actions can be found in the Paint Branch Subwatershed Provisional Restoration Projects Inventory.

<b>Table 2-15: Summary of Recommended Potential Restoration Actions</b>		
<b>Candidate Project Type</b>	<b>Number of Projects</b>	<b>Estimated Cost</b>
<b>Stormwater Retrofits</b>		
Tier I	25	32,891,000
Tier II	71	57,439,000
Tier III	6	1,540,000
Tier IV	137	30,136,000
<b>Stream Restoration</b>		
Tier I	0	0
Tier II	42	10,534,700
Tier III	16	4,635,000
<b>Wetland Creation / Restoration</b>		
Tier I	2	50,000
Tier II	8	160,000
Tier III	7	150,500
<b>Fish Blockage Removal / Modification</b>		
Tier I	0	0
Tier II	4	995,000
Tier III	10	4,125,000
<b>Riparian Reforestation, Meadow Creation, and Invasive Management</b>		
Tier I	7	191,400
Tier II	13	95,100
Tier III	0	0
<b>Trash Reduction</b>		
Tier I	0	0
Tier II	7	40,700
Tier III	1	3,000
<b>Parkland Acquisition</b>		
Tier I	0	0
Tier II	13	5,350,000
Tier III	0	0
<b>TOTAL</b>	<b>369</b>	<b>148,336,400</b>
<b>*Tiers for the Stormwater Projects Reflect the Adjusted Scoring System</b>		

## Implementation Type of Potential Restoration Actions

Restoration opportunities identified as part of the ARP require additional study, design, or policy change prior to implementation. Table 2-16 provides a summary of the number of projects that fall under each of the four implementation types. The 2007 Water Resources Development Act provides authority for USACE to complete design/build projects in the Anacostia Watershed. However, design/build projects could also be implemented by local jurisdictions, state agencies, or non-profit organizations. Feasibility Study projects would require additional detailed studies prior to the design phase. The projects requiring feasibility studies like stream restoration or wetland creation likely would be projects USACE could implement following the appropriate Civil Works authority, budgeting cycle, and protocol. Projects requiring a programmatic element prior to implementation may require governmental policy changes, or authority to purchase land. Finally, stewardship projects are likely those potential projects to be completed by volunteers from local churches, schools, or community watershed groups.

Additional information regarding specific projects can be found in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report

<b>Table 2-16: Summary of Potential Restoration Actions.</b>		
<b>Implementation Type</b>	<b>Number of Projects</b>	<b>Estimated Cost (\$)</b>
Design/Build	239	122,006,000
Feasibility Study	89	20,650,200
Stewardship	28	330,200
Programmatic	13	5,350,000
<b>TOTAL</b>	<b>369</b>	<b>148,336,400</b>

# Section 3

## Evaluation of the Restoration Strategies

## Evaluation of Proposed Restoration Strategies

The proposed restoration projects were evaluated using the approach described in the main report of the ARP. The first step in the evaluation consisted of assessing the potential of the restoration actions to control pollutant loads. As described in the Anacostia Watershed Environmental Baseline Conditions and Restoration Report, the TMDL modeling efforts of Interstate Commission on the Potomac River Basin (ICPRB) and MDE were used to provide the existing pollutant loads, and the Watershed Treatment Model (WTM) was used to estimate the potential pollution reduction achieved by the proposed restoration strategies. The Plan Formulation Appendix lists the efficiencies of the various BMPs included in the WTM. It should be noted that the list of stormwater management practices listed in the WTM was expanded to include LID practices. The LID practices included green roofs, rooftop disconnection, rain barrels and cisterns, soil amendments, sheet flow to open space, bioretention, and rain gardens.

The potential restoration strategies were individually evaluated using the WTM to estimate the pollutant reduction benefit the project could provide. The full WTM user guide is available online from the Center for Watershed Protection (CWP) at [www.cwp.org](http://www.cwp.org).

There are several large federally owned tracts of property located in this subwatershed. It is imperative that these tracts remain as undeveloped and open as possible. The areas located along stream corridors are essential for habitat connectivity throughout the area.

## Potential to Reduce Stormwater Pollutant Loads

The proposed restoration projects would provide additional stormwater controls to 884 impervious acres in the Paint Branch subwatershed. This represents a 40-percent increase in the acres of impervious surfaces controlled by stormwater management, bringing the total impervious acres controlled by stormwater management up to approximately 1,319 or 59-percent of the total impervious acres. Table 3-1 summarizes the improvements in stormwater controls after implementation of the proposed projects.

<b>Table 3-1: Level of Stormwater Control in Paint Branch Subwatershed After Implementation of All Proposed Stormwater Projects</b>					
<b>Total Impervious Acres</b>	<b>Existing Stormwater Controls</b>		<b>Potential Future Stormwater Controls</b>		<b>Increase in Impervious Acreage Controlled by Stormwater Projects</b>
	<b>Acres</b>	<b>% of Impervious Total</b>	<b>Acres</b>	<b>% of Impervious Total</b>	
2,239	435	19%	1,319	59%	40%

<b>Impervious Acreage Controlled</b>	<b>Pollutants Load Reduction Potential</b>				<b>Increase in Impervious Acreage Controlled by Stormwater Projects</b>
	<b>N</b>	<b>P</b>	<b>TSS</b>	<b>Bacteria</b>	
	(lbs/yr)	(lbs/yr)	(tons/yr)	(billions cfu/yr)	
59% (proposed projects)	11,887	1,605	333	197,367	40%

\* Current Stormwater Control Levels are at 19%

Using the distribution of projects included in the provisional inventory, several future control levels were evaluated using the WTM to estimate potential pollution reduction. Table 3-2 identifies the maximum control level evaluated (as percent impervious acres controlled) as well as the associated pollution reduction potential. The Plan Formulation appendix of the Anacostia Restoration Plan and Report provides the characteristics of each BMP type included in the provisional inventory.

To fully evaluate the benefits of providing different levels of stormwater control, the existing pollutant load and the pollution reduction potential in the watershed must be considered in terms of the existing Anacostia River TMDLs for nutrients and TSS (Kim et al., 2007; Mandel et al., 2008). The TSS TMDL calls for an 85-percent reduction in existing TSS loading to the Anacostia River watershed. The nutrient TMDL established a necessary reduction of 79-percent for nitrogen and 80-percent for phosphorus. Table 3-3 summarizes the overall Anacostia River TMDL reduction goals, the Paint Branch existing pollutant loadings, and the ability of the various stormwater control levels to address the pollution reduction in the Paint Branch subwatershed to help meet the Anacostia River TMDLs. The implementation of all of the proposed stormwater projects reduces the pollutant load between 14 and 25-percent. Given that the TMDL goals for the Anacostia River are between 79 and 85-percent reduction, stormwater controls alone will not be able to address the contribution from Paint Branch.

<b>Table 3-3: Ability of Stormwater Control Levels to Address TMDL Goals in Paint Branch Subwatershed</b>			
<b>Impervious Control Level</b>	<b>Pollutant Reduction Achieved</b>		
	<b>N</b>	<b>P</b>	<b>TSS</b>
Reduction Goal for Paint Branch as Pro-Rated Share of Anacostia TMDL	69,528 lbs/yr (79%)	5,222 lbs/yr (80%)	1,191 tons/yr (85%)
Estimate of Existing Pollutant Loads in Paint Branch	88,010 lbs/yr	6,527 lbs/yr	1,401 tons/yr
Maximum Reduction Potential from Proposed Projects	11,887 lbs/yr (14%)	1,605 lbs/yr (25%)	333 tons/yr (24%)

It should be noted that the load reduction estimates of Table 3-3 do not account for reductions in stream channel erosion, which is another benefit of stormwater management. The following section addresses the potential reduction in stream channel erosion following the implementation of the proposed restoration actions.

### **Potential to Reduce Peak Flow Discharge**

The TSS TMDL for the Anacostia River estimates that about 70 to 75-percent of the sediment delivered from the watershed to the tidal estuary comes from stream bank and channel erosion. Estimating the reduction of stream channel sediment loads that would result from controlling urban stormwater runoff is very challenging. A peak flow reduction analysis is used as a surrogate measure to give insight into the potential for reducing in-stream channel erosion loads. In fact, erosion of the stream channel is directly related to the increase in stream energy associated with the peak flow. Reducing the peak flow at the outlet of the watershed will lead to the reduction in erosive shear stress on the stream banks. Therefore, it is logical to assume potential reduction in stream bank erosion by quantifying the reduction in peak flows associated with the levels of stormwater control. Table 3-4 contains the results of that quantification. The CWP has an Impervious Cover Model (ICM) which classifies the ability of watersheds to support aquatic life based on the percentage of their surface covered with manmade impervious materials. The ICM describes watersheds having an impervious surface cover between 0 to 10-percent as ‘sensitive’, 10 to 25-percent as being ‘impaired’, those having 25 to 60-percent impervious cover as ‘non-supporting’, and those with 60 to 100-percent impervious cover as ‘urban drainage’. With its 17-percent impervious cover, Paint Branch, with would be classified as ‘impaired’ by the ICM. The watersheds analyzed in preparation of the ICM were not segregated based on stormwater management, and a substantial number of those analyzed had minimal stormwater management. Recent studies of watersheds in nearby Montgomery County, Maryland, where stormwater management and other watershed restoration measures have been implemented strongly indicate that such watersheds can support much higher aquatic organism health than can watersheds lacking these management practices.

Accordingly, the expectation for the Paint Branch subwatershed is generally that if stormwater management is improved and other watershed restoration measures implemented aquatic ecosystem health will also improve. This is an area of active ongoing investigation by scientists and engineers, and the relationship between watershed restoration and stream aquatic ecosystem health is impacted by many factors as was discussed earlier in this document. Although it is not possible to confidently predict the magnitude of aquatic ecosystem improvement that can be generated by watershed restoration measures, the effective resultant impervious cover that a combination of watershed restoration features installed within a given watershed would provide would be the maximum likely response.

The peak discharges are estimated using regression equations developed by the Maryland Hydrology Panel in support of the Maryland State Highway Administration (MSHA). The equations are used in the estimate of flood discharges for the design of culverts and bridges (Molgen, 2007). Details on the peak flow reduction potential analysis are given in the Plan Formulation appendix of the Anacostia Watershed Restoration Plan and Report.

Table 3-4: Peak Flow Analysis Results for Paint Branch Subwatershed**								
	No Treatment	Current Treatment	Impervious Area Treated with Storm Water Controls					
	0% Treated	22.4% Treated	25% Treated	30% Treated	40% Treated	50% Treated	70% Treated	100% Treated
Effective Percent Impervious	17.7	14.5	14.1	13.4	12.0	10.6	7.8	3.5
Peak Flow (cfs)	914	830	820	800	758	715	619	443
Peak Flow per square mile (cfs)	29	27	26	26	24	23	20	14
Peak Flow in gpd per square mile	18,992,809	17,243,620	17,033,414	16,617,136	15,755,340	14,849,119	12,867,050	9,202,799
(cfs) = cubic feet per second			(gpd) = gallons per day			Conversion: 1 cfs = 646,316.883 gpd		
**Flow rate includes Little Paint Branch with flows into Paint Branch								

The Paint Branch subwatershed spans both the piedmont and coastal plan geographic provinces, as such the peak discharges were estimated using a weighted average of the following two regression equations:

**(Equation 1 – Coastal)**                       $Q_{1.25} = 18.62 * DA^{0.611} * (IA+1)^{0.419} * (SD + 1)^{0.165}$

**(Equation 2 – Piedmont Urban)**         $Q_{1.25} = 17.85 DA^{0.652} * (IA+1)^{0.635}$

The Q1.25 indicates that the peak discharges are associated with a rainfall event that has the likelihood of occurring once every 1.25 years. In addition, DA represents drainage area in square miles, IA represents percentage of impervious area, and SD represents percentage of group D soils, which are soils with a high runoff potential and slow infiltration rate. Although these regression equations have limitations, which are discussed in the Plan Formulation appendix of the Anacostia Watershed Restoration Plan and Report, they provide a reasonable initial measure of the potential for reducing peak discharges as a function of different amounts of stormwater management.

Among the limitations of this analysis, one is of particular importance. The peak discharge analysis should be interpreted with caution. Although the peak flow at the outlet of a watershed is used as a simple yardstick, reducing the peak flow is not a guarantee of reduced stream channel erosion throughout the watershed. Detailed hydrologic and hydraulic analyses are necessary to determine hydrograph timing to avoid inadvertently increasing channel erosion.

### **Potential to Reduce Pollutant Loads Using Street Sweeping**

Street sweeping is included in the provisional project inventory as a trash control, but street sweeping can also serve as an effective pollutant removal technique if the right equipment and the right techniques are employed (Montgomery County 2002). Particles that accumulate on road surfaces such as road grit, sand, and dirt; heavy metals including copper, lead, and zinc; and nitrogen and phosphorus can all be removed to some extent by street sweeping. The highest concentration of pollutants is associated with the smallest particles of road grit (EPA, 1983). Of the three technologies available for street sweeping, regenerative air sweepers and vacuum assisted sweepers provide the greatest pollutant removal. Mechanical broom sweepers do the least to remove the small particles associated with most pollutants.

Decisions such as frequency of sweeping, type of road swept (residential or mixed use, etc.), whether cars are permitted to be parked in the roadway, and training of personnel performing the street sweeping affects the efficiency of the practice. Ideally, street sweeping is most effective when pollutants are permitted to accumulate and then the area is swept prior to a rain event. However, this situation is logistically difficult. The WTM is capable of estimating removal of N, P, and TSS by street sweeping. Evaluations with the WTM identify that weekly sweeping can remove 67-percent more N, P, and TSS than monthly sweeping.

The benefit of street sweeping was evaluated for the roads within the Paint Branch subwatershed. (Table 3-5). Information regarding the methodology and assumptions made in the analysis can be found in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report.

<b>Table 3-5: Pollutant Reduction Estimate of Weekly Street Sweeping (Streets Only)</b>							
<b>Other Roads</b>		<b>Annual Pollutant Reduction</b>			<b>Percent Reduction</b>		
<b>Percent of Roadway Treated</b>	<b>Miles</b>	<b>N (lbs/yr)</b>	<b>P (lbs/yr)</b>	<b>TSS (tons/yr)</b>	<b>N</b>	<b>P</b>	<b>TSS</b>
5	3.4	189	15	3	0.2%	0.2%	0.2%
10	6.8	378	31	6	0.4%	0.5%	0.4%
15	10.3	568	46	9	0.6%	0.7%	0.6%
20	13.7	757	61	11	0.9%	0.9%	0.8%
25	17.1	946	76	14	1.1%	1.2%	1.0%
50	34.2	1,892	153	28	2.1%	2.3%	2.0%
75	51.3	2,838	229	43	3.2%	3.5%	3.0%
100	68.4	3,784	306	57	4.3%	4.7%	4.1%
<b>Residential Roads</b>		<b>Annual Pollutant Reduction</b>			<b>Percent Reduction</b>		
<b>Percent of Roadway Treated</b>	<b>Miles</b>	<b>N (lbs/yr)</b>	<b>P (lbs/yr)</b>	<b>TSS (tons/yr)</b>	<b>N</b>	<b>P</b>	<b>TSS</b>
5	6.3	655	55	6	0.7%	0.8%	0.4%
10	12.6	1,310	111	12	1.5%	1.7%	0.9%
15	18.8	1,964	166	18	2.2%	2.5%	1.3%
20	25.1	2,619	222	24	3.0%	3.4%	1.7%
25	31.4	3,274	277	30	3.7%	4.2%	2.1%
50	62.8	6,548	554	60	7.4%	8.5%	4.3%
75	94.2	9,822	831	90	11.2%	12.7%	6.4%
100	125.6	13,096	1108	120	14.9%	17.0%	8.5%

The benefits of street sweeping on pollutant removal can also be considered for parking lots. Parking lots accumulate trash and pollutants that eventually wash into the stormwater system during rain events. The results of the parking lot analysis are displayed in the Table 3-6. The benefit of sweeping parking lots does not appear to be great, but once accumulated over the entire watershed this practice has the potential to not only contribute to reaching trash reduction goals, but also pollutant removal goals if implemented on a large scale.

<b>Table 3-6: Pollutant Reduction Estimate of Weekly Sweeping of Parking Lots</b>							
<b>Parking Lots</b>		<b>Annual Pollutant Reduction</b>			<b>Percent Reduction</b>		
<b>Percent of Parking Lots Swept</b>	<b>Acres</b>	<b>N (lbs/yr)</b>	<b>P (lbs/yr)</b>	<b>TSS (tons/yr)</b>	<b>N</b>	<b>P</b>	<b>TSS</b>
5	29.4	51	3	1	0.06%	0.05%	0.06%
10	58.8	101	7	2	0.1%	0.1%	0.1%
15	88.2	152	10	2	0.2%	0.2%	0.2%
20	117.6	203	13	3	0.2%	0.2%	0.2%
25	146.9	254	17	4	0.3%	0.3%	0.3%
50	293.9	507	34	8	0.6%	0.5%	0.6%
75	440.8	761	51	12	0.9%	0.8%	0.8%
100	587.8	1,015	67	16	1.2%	1.0%	1.1%

The full benefit of an enlarged street sweeping program would reflect the pollution reduction gained from sweeping residential and ‘other’ roads, as well as parking lots. Table 3-7 contains the totals for sweep all three types of areas swept. The data indicates that fairly substantial reductions can be realized once the percentage of roads swept weekly get above 50-percent.

<b>Table 3-7: Total Pollutant Reduction Estimate of Weekly Sweeping of All Streets and Parking Lots</b>							
<b>Streets and Parking Lots</b>		<b>Total Annual Pollutant Reduction</b>			<b>Total-percent Reduction</b>		
<b>Percent Swept</b>	<b>Acres</b>	<b>N (lbs/yr)</b>	<b>P (lbs/yr)</b>	<b>TSS (tons/yr)</b>	<b>N</b>	<b>P</b>	<b>TSS</b>
5	62.6	895	74	10	1.0%	1.1%	0.7%
10	125.2	1,789	148	19	2.0%	2.3%	1.4%
15	187.8	2,684	222	29	3.0%	3.4%	2.1%
20	250.3	3,579	296	38	4.1%	4.5%	2.7%
25	312.9	4,474	370	48	5.1%	5.7%	3.4%
50	625.8	8,947	741	96	10.2%	11.3%	6.9%
75	938.8	13,421	1,111	144	15.2%	17.0%	10.3%
100	1,251.7	17,895	1,482	192	20.3%	22.7%	13.7%
<b>Paint Branch Subwatershed Reduction Goals as Pro-Rated Share of Anacostia TMDL</b>		69,528	5,222	1,191	79%	80%	85%

As discussed previously, sweeping may be logistically difficult. Stormwater retrofits to the road network within the Paint Branch subwatershed, including green streets, bioswales, or pervious pavement, in conjunction with street sweeping would increase the amount of pollutants removed from the system. These green streets initiatives would require programmatic or policy changes

to local ordinances. These road network stormwater retrofits are further described in the Anacostia Watershed Restoration Plan and Report and associated Plan Formulation appendix.

### **Pollutant Reduction of Homeowner Stormwater Management**

Provisional stormwater restoration projects implemented by governmental agencies alone are only one piece of the strategy needed to control stormwater and the pollutants carried into the Anacostia River watershed. Implementing every stormwater project outlined in this inventory will account for an approximate 40-percent increase in the impervious acres controlled by stormwater management within the Paint Branch subwatershed. However, with approximately 10,400 residential homes in the subwatershed, there is also the need to involve private homeowners in the stormwater control effort. Homeowner efforts would target stormwater from the roofs, driveways, and sidewalks. A number of stormwater control treatments, or homeowner BMPs, are available for application: green roofs, rain gardens, rain barrels, permeable pavement, and downspout disconnects. Additional information on homeowner BMPs can be found in the Plan Formulation appendix to the Anacostia Watershed Restoration Plan and Report.

Table 3-8 summarizes the number of residential homes throughout Paint Branch subwatershed and the related impervious acreage. The impervious acreage that is occupied by single family homes, on-single family homes, single family driveways, and sidewalks equals approximately 847 acres of the 2,239 total impervious acres, or 38-percent within the subwatershed. Stormwater management controls on this acreage could contribute significantly to reducing pollutant and stormwater inputs throughout the watershed.

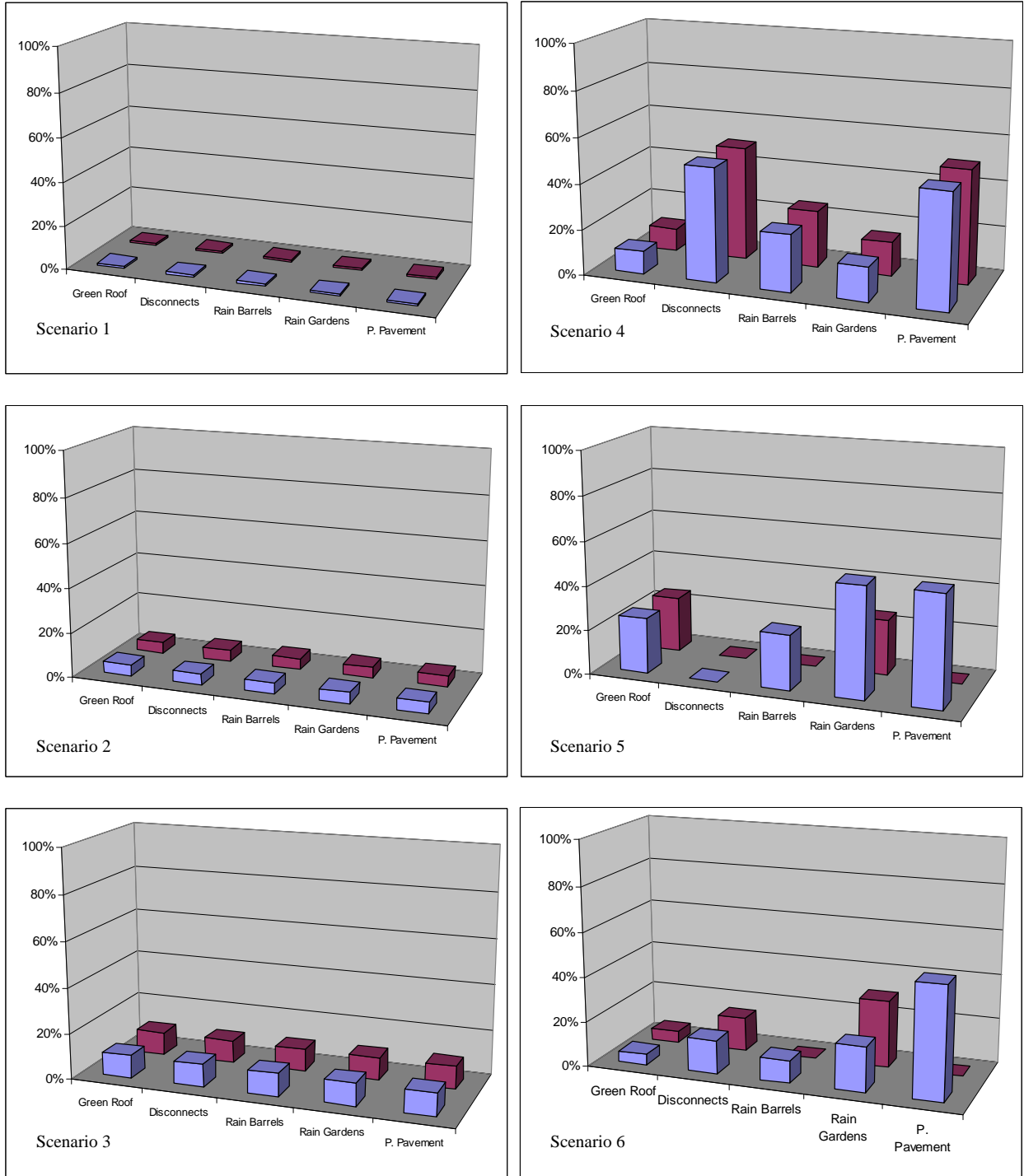
<b>Table 3-8 : Paint Branch Subwatershed Impervious Acres Analysis of Residential Homes</b>					
		<b>Impervious acres</b>			
<b>Watershed Area</b>	<b>Number of Residential Homes</b>	<b>Single Family Homes</b>	<b>Private (non-single family)</b>	<b>Single Family Driveway</b>	<b>Sidewalks</b>
<b>Upper Watts</b>	4,354	172.6	13.4	61.0	28.1
<b>Middle Watts</b>	4,807	215.7	142.9	67.3	44.4
<b>Lower Watts</b>	1,219	44.4	28.8	17.1	11.8
<b>TOTAL</b>	10,380	432.6	185.1	145.3	84.3

An evaluation was performed, using the WTM, to investigate the potential of the homeowner BMPs to control the stormwater inputs produced by residential homes within the subwatershed. Four of the practices are focused on rooftop runoff: green roofs, rain barrels, rain gardens, and downspout disconnects. The fifth practice directly applies to sidewalks and driveways. Six scenarios of various combinations of the five BMPs were evaluated.

1. Control 1-percent of the impervious acreage with green roofs, 1-percent with downspout disconnections, 1-percent with rain barrels and 1-percent with rain gardens. Control 1-percent of the sidewalk and drive way impervious acreage with permeable pavement.
2. Control 5-percent of the impervious acreage with green roofs, 5-percent with downspout disconnections, 5-percent with rain barrels, and 5-percent with rain gardens. Control 5-percent of the sidewalk and drive way impervious acreage with permeable pavement.
3. Control 10-percent of the impervious acreage with green roofs, 10-percent with downspout disconnections, 10-percent with rain barrels, and 10-percent with rain gardens. Control 10-percent of the sidewalk and driveway impervious acreage with permeable pavement.
4. Control 10-percent of the impervious acres with green roofs, 50-percent with downspout disconnections, 25-percent with rain barrels, and 15-percent with rain gardens. Control 50-percent of the sidewalk and driveway impervious acreage with permeable pavement.
5. Control half of the acreage of private, multi-family residences by treating 25-percent of the impervious acreage with rain gardens and 25-percent with green roofs. Control half of the single-family driveways and sidewalks with permeable pavement, and control all of the single-family home impervious roof acreage by treating 25-percent with rain barrels, 25-percent with green roofs, and 50-percent with rain gardens.
6. Control half of the acreage of private, multi-family residences by treating 30-percent of the impervious acreage with rain gardens, 15-percent with downspout disconnections, and 5-percent with green roofs. Control half of the single-family driveways and sidewalks with permeable pavement, and control all of the single-family home impervious roof acreage by treating 10-percent with rain barrels, 5-percent with green roofs, 15-percent with downspout disconnections and 20-percent with rain gardens.

Figure 3-1 illustrates the 6 scenarios of homeowner BMPs were analyzed.

Figure 3-1: Homeowner BMP Scenarios



Single Family  Multi-Family

The efficiencies used by the WTM for pollutant reduction estimates when evaluating the first four scenarios of homeowner BMPs are presented in Table 3-9

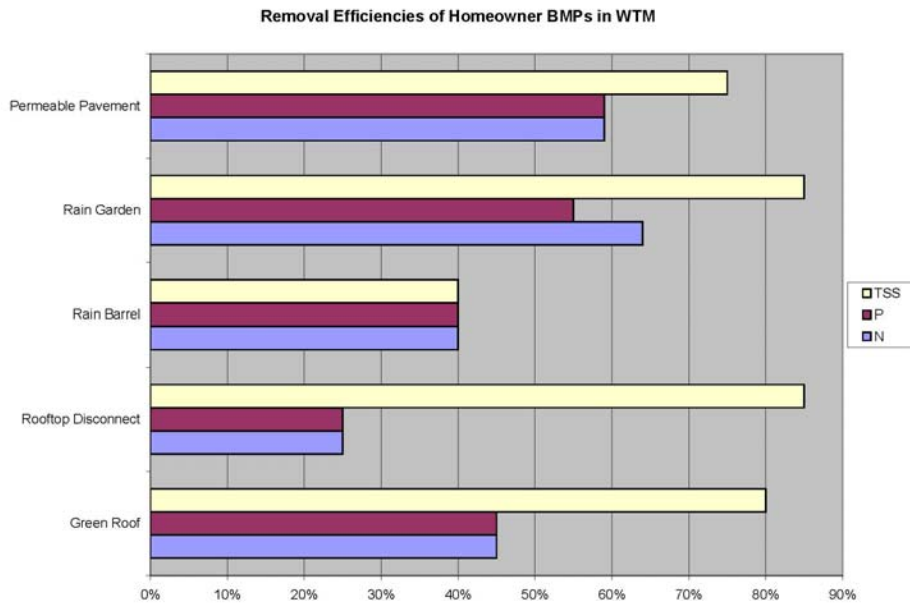


Figure 3-2: Removal Efficiencies

Table 3-9: Removal Efficiencies of Homeowner BMPs in WTM				
	Pollutant Removal Efficiencies of WTM			
	N	P	TSS	Bacteria
Green Roof	45%	45%	80%	0%
Rooftop Disconnect	25%	25%	85%	0%
Rain Barrel	40%	40%	40%	0%
Rain Garden	64%	55%	85%	90%
Permeable Pavement	59%	59%	75%	0%

Based on the removal efficiencies, rain gardens provide the greatest pollutant removal capability for treating rooftop run-off; however, implementation of this may be problematic in areas where there are large numbers of apartments or townhouses rather than single homes. For treating sidewalks and driveways, permeable pavement provides similar capabilities to rain gardens, except there is no reduction for bacteria. Plans that incorporate these two practices on residential properties would make the greatest pollutant removal contributions.

These scenarios evaluate potential plans that could be set as targets for homeowner participation in stormwater control programs. Tables 3-10 and 3-11 provide an estimate of the potential for each of these scenarios to reduce the current pollutant loadings to Paint Branch.

<b>Scenario</b>	<b>N (lbs/yr)</b>	<b>P (lbs/yr)</b>	<b>TSS (tons/yr)</b>	<b>Bacteria (billions cfu/yr)</b>
1	485	38	10	4,560
2	2,424	191	48	22,800
3	4,847	382	96	45,600
4	11,768	945	263	68,400
5	13,959	1,076	232	193,835
6	8,532	663	160	104,865

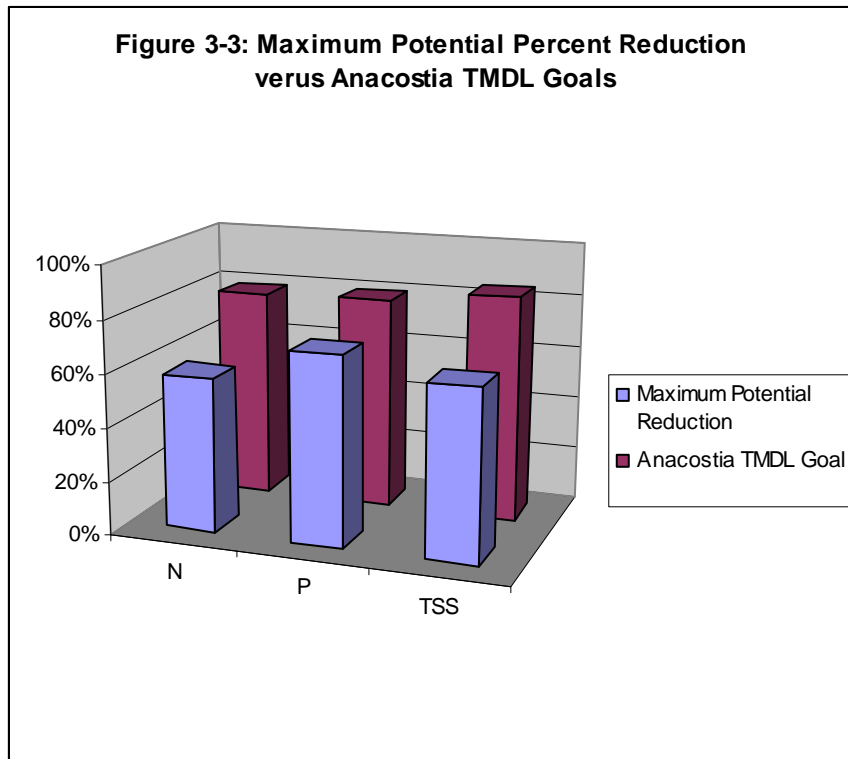
<b>Scenario</b>	<b>N</b>	<b>P</b>	<b>TSS</b>	<b>Impervious Acreage Controlled</b>	<b>Percent of Residential Impervious Acreage Controlled</b>
1	1%	1%	1%	44.3	5.2%
2	3%	3%	3%	135.0	15.9%
3	6%	6%	7%	270.1	31.9%
4	13%	14%	19%	732.6	86.5%
5	16%	16%	17%	640.0	75.5%
6	10%	10%	11%	423.7	50.0%

A significant fraction of pollutants could be controlled if homeowner stormwater controls were implemented over a large portion of the subwatershed. In order to achieve this, an effort needs to be put forth to increase public awareness and participation, so that all the citizens of the subwatershed are working together toward the common goal. Local governments can encourage this through significant outreach, coordination, technical assistance, and funding to extensively apply a homeowner’s stormwater management control program. If implemented, such programs have the potential to greatly reduce the pollutant loads to the subwatershed, particularly when implemented alongside provisional stormwater management projects implemented by local governments.

Table 3-12 and Figure 3-3 presents a summary of the potential pollutant load reductions that could be achievable by implementing the aforementioned projects, and compares them to the TMDL reductions goals that were established for the Anacostia River. The numbers presented here, however, do not necessarily account for the interactions of the projects with one another and are clearly subject to some double-counting of reductions. Therefore the numbers in Table 3-12 should not be considered in any further calculations, but rather taken in more relative terms of what is achievable. This double counting of reductions is likely attributed to double coverage of residential acreage through homeowner BMPs, green streets in residential areas, and sweeping of residential streets, because all three of these potential project types were considered independently when in reality they would affect the same physical acreage on a map. Likewise, the combining of stormwater retrofit projects with other practices would lead to same reductions being accounted for in multiple projects. The Plan Formulation appendix of the main document addresses this occurrence in more detail.

Therefore, when considering the results of this analysis, it should be viewed not from the standpoint of whether or not a certain level of reductions can be achieved in 10 years, but rather what significant contributions can be made toward creating a healthier Anacostia River watershed. The data presented in this report is an encouraging indicator that it is not too late to take the steps necessary to improve the environmental conditions in the Anacostia River. The projects recommended in this report are a great start down that path, but they need to be supplemented with increased community involvement, a strong education effort, and more environmentally friendly policies. The goal should be to look back in 10 years and see the progress that has been made in restoring the Anacostia River and its subwatersheds.

<b>Table 3-12: Maximum Potential Pollutant Reduction for Stormwater Controls, Homeowner BMPs, and Street Sweeping</b>			
	<b>N (lbs/yr)</b>	<b>P (lbs/yr)</b>	<b>TSS (tons/yr)</b>
<b>Current Paint Branch Loading</b>	<b>88,010</b>	<b>6,527</b>	<b>1,401</b>
<b>Paint Branch Reduction Goals as Pro-Rates Share of Anacostia TMDL</b>	<b>69,528 (79%)</b>	<b>5,222 (80%)</b>	<b>1,191 (85%)</b>
<b>Maximum Possible Reduction</b>			
Stormwater Controls (59% of Impervious Acreage Controlled)	11,887	1,605	333
LID Green Streets	10,082	716	163
Homeowner BMPs (Scenario 5)	13,959	1,076	232
Street Sweeping (75% of roads and 50% of lots)	15,344	1,215	169
<b>Total Maximum Possible Reduction</b>	<b>51,272</b>	<b>4,612</b>	<b>897</b>
<b>% Total Reduction in Paint Branch Loading</b>	<b>58%</b>	<b>71%</b>	<b>64%</b>





# Section 4

## Targets and Milestones

## **Paint Branch 10-Year Targets and Milestones**

The Paint Branch 2020 Restoration Targets were determined based on the potential implementation of restoration opportunities identified within the Paint Branch subwatershed as part of the ARP, along with realistic expectations of what could be accomplished in ten years to meet the 2020 restoration objectives, and as such the target numbers do not necessarily represent the implementation of every project in the potential inventory. These targets are established to ensure that restoration of the subwatershed is proceeding in the right direction and at a continuous, reasonable pace.

### **Stormwater Management**

Using LID, ESD and other stormwater management techniques, stormwater retrofit projects should be implemented to increase control to a total of approximately 1,300 acres of existing impervious surfaces. This represents a 40-percent increase of controlled impervious surfaces.

Operate and maintain existing stormwater management facilities, stormwater drainage systems, and water and wastewater systems.

### **Aquatic Community**

Increase the general Index of Biotic Integrity (IBI) scores to “Fair Range” for both fish and macroinvertebrate communities in the middle basin, and to “Good” for the upper and lower basin. This represents an improvement of one tier in each basin.

Remove or modify fish passage barriers to open approximately 6 miles of Paint Branch and tributaries for the movement of both residents and migratory fish.

### **Trash Reduction**

Using the MWCOCG Trash Index for reference, reduce trash levels one tier from High to Moderate near Route 29 in the middle basin and Moderate to Light in the lower basin near Route 1. Implement all 8 of the trash reduction projects from the recommended list by 2020.

Increase existing street sweeping programs to sweep approximately 20 to 25 additional curb miles weekly of residential and other roads. Additionally, increase sweeping of parking lots up to approximately 130-140 acres.

### **Wetland Creation and Restoration**

Create or restore approximately 5.6 acres of permanent wetlands, and approximately 1.8 acres of vernal pools.

### **Riparian Corridors, Meadow Planting and Invasive Species Management**

Reforest approximately 7 acres riparian buffer and upland forest, manage invasive species for approximately 40 acres, and create approximately 2.5 acres of meadow.

Based on the Anacostia Watershed Forest Management and Protection Strategy and the Center for Watershed Protection recommended tree canopy cover as a percentage of land area, increase the overall tree canopy over 40-percent.

### **Land Acquisition and Management**

Acquire approximately 25 acres of land to increase parkland and improve habitat connectivity.

Work to ensure that large federally owned tracts remain as open and undeveloped as possible. Areas adjacent to stream corridors should especially be maintained as undisturbed as is practical.

### **Environmental Restoration Programs**

Consider the implementation or expansion of programs designed to assist private property owners in controlling impervious surfaces with measures such as rain barrels and rain gardens.

### **Outreach and Public Participation**

Increase both the outreach and education programs for schools and private businesses on the restoration and protection of Paint Branch subwatershed.

Launch a new membership drive for Friends of Paint Branch.

Promote homeowners and private business restoration incentives, such as reusable grocery bags, rain gardens, rain barrels, and tree planting.

Expand existing programs to provide homeowners with access to BMPs such as rain barrels.

Promote passive uses of exiting parkland and employ more eco-friendly techniques in areas designated for high usage such as unpaved walking paths and higher grass mowing height.