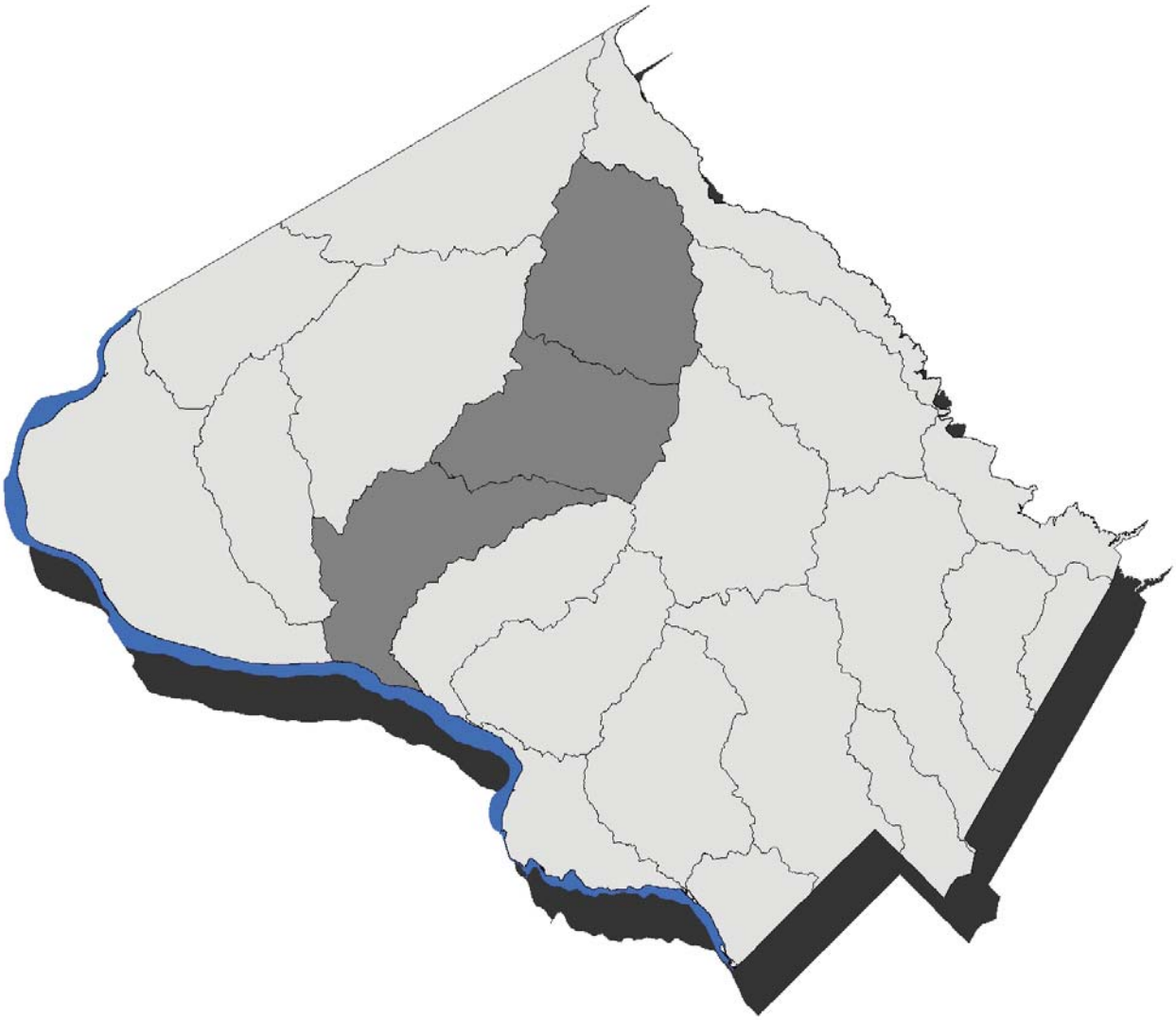
# GREAT SENECA SUBWATERSHED IMPLEMENTATION PLAN

PREPARED FOR:

MONTGOMERY COUNTY

DEPARTMENT OF ENVIRONMENTAL PROTECTION

255 Rockville Pike, Suite 120



January 2012

# Great Seneca Subwatershed Implementation Plan

**January, 2012**

Prepared for:

**Montgomery County Department of Environmental Protection**
255 Rockville Pike, Suite 120
Rockville, MD 20850

Prepared by:

**Horsley Witten Group, Inc.**
90 Route 6A
Sandwich, MA 02563

In collaboration with:

**Biohabitats, Inc.**
2081 Clipper Park Road
Baltimore, MD 21211

**Versar**
9200 Rumsey Rd
Columbia, MD 21045-1934

**Capuco Consulting Services**
914 Bay Ridge Road, Suite 206
Annapolis, MD 21403

**Chesapeake Stormwater Network**
117 Ingleside Avenue
Baltimore, MD 21228

**RESOLVE**
1255 23rd Street, NW, Suite 875
Washington, DC, 20037

# Great Seneca Subwatershed Implementation Plan

## Table of Contents

Acronym List ..... 2
1 Goals and Existing Conditions ..... 3
1.1 Introduction to the Implementation Plan and Watershed Goals ..... 3
1.2 Existing Conditions in the Great Seneca subwatershed ..... 4
1.3 Problems Facing the Great Seneca Subwatershed ..... 11
1.4 Existing Pollutant Loads and Impervious Surfaces ..... 14
2 Inventory of Provisional Restoration Candidates ..... 16
2.1 Types of Restoration Practices ..... 16
2.2 Inventory of Previously Identified Projects ..... 18
3 Evaluation of the Restoration Strategies to Meet MS4 Permit Requirements ..... 20
3.1 Desktop Review of BMP Coverage ..... 20
3.2 Summary of Watershed Treatment Model Scenarios ..... 20
3.3 Preliminary Results of Total Phosphorus Load Reduction Analysis for Clopper Lake ... 30
3.4 Trash Reduction and Other Pollutant Load Tracking ..... 31
4 Action Inventory Implementation Schedule ..... 34
4.1 Summary of Watershed Restoration Strategies Recommended for the Great Seneca subwatershed and Clopper Lake ..... 34
5 References ..... 39
Appendix A – List of High and Low Priority Projects ..... 40

**Notes to Reader:**

1. Throughout this Plan there are text boxes such as this that focus on public outreach and stewardship elements to consider for the Plan. In addition, there are references to Practice Sheets which have been developed that are general strategies that apply countywide but will require some customization on a watershed basis to reflect certain stakeholder demographics and priorities. These practice sheets are included as an appendix to the Countywide Coordinated Implementation Strategy.
2. Environmental Site Design (ESD) is defined within the 2010 Maryland Stormwater Design Manual as the use of small-scale stormwater management practices, nonstructural techniques, and better site planning to mimic natural hydrologic cycling of rainwater and minimize the impact of land development on water resources. The application of the term is focused on new and redevelopment projects, and does not explicitly address or consider retrofit applications where site constraints such as drainage area, utilities, and urban soil quality are significant factors. This watershed implementation plan uses the term ESD in a more flexible manner to include structural practices such as bioretention, vegetated filters, and infiltration that provide distributed runoff management using filtering, infiltration, and vegetative uptake processes to treat the water quality volume to the maximum extent practicable. These practices are also thought of as Low Impact Development (LID) practices.

# Acronym List

BMPs – best management practices

DA – drainage area

DEP – Department of Environmental Protection

DF – discount factor

DU – dwelling unit

EPA – Environmental Protection Agency

ESD – environmental site design

GIS – geographic information systems

HOA – homeowners association

IA – impervious area

IC – impervious cover

LDR – low density residential

LID – low impact development

MDE – Maryland Department of the Environment

MEP – maximum extent practicable

MDP – Maryland Department of Planning

MNCPPC – Maryland National Capital Parks and Planning Commission

MPN – most probable number

MPR – maximum practicable reductions

MS4 – municipal separate storm sewer system

NPDES – National Pollutant Discharge Elimination System

RR – runoff reduction

SPA – Special Protection Area

TFPI – Trash Free Potomac Watershed Initiative

TMDLs – total maximum daily loads

TN – total nitrogen

TP – total phosphorus

TSS – total suspended solids

USACE – Army Corps of Engineers

WLAs – waste load allocations

WQPC – water quality protection charge

WRAP – watershed restoration action plan

WTM – watershed treatment model

# 1 Goals and Existing Conditions

## 1.1 Introduction to the Implementation Plan and Watershed Goals

This Implementation Plan (the Plan) for the Great Seneca subwatershed was developed in order to quantitatively demonstrate compliance with the County's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit. The Plan must meet the MS4 Permit's three major requirements:

- Assigned wasteload allocations (WLAs) for EPA-approved **Total Maximum Daily Loads (TMDLs)**
- Watershed restoration via **runoff management via impervious cover treatment**
- **Trash and litter management** to meet the commitments of the Potomac River Watershed Trash Treaty

**Outreach and Stewardship Strategy**
The primary messages for delivery in this watershed will pertain to activities the County is undertaking to manage runoff, reduce pollutant loads, trash, and litter with an emphasis on total phosphorus (TP) removal.

The Plan outlines a comprehensive roadmap for watershed restoration that targets runoff management, nutrient reduction, and trash and litter management –including information pertinent to effectively include stakeholders in watershed restoration. The Plan provides additional information on the Clopper Lake subwatershed. The County MS4 Permit area comprises 41% of the total Great Seneca subwatershed area and 11%of the Clopper Lake drainage area.

Montgomery County will be working closely with other regulated entities, including City of Gaithersburg, MD State Highway, and the Federal Government to ensure all steps are taken to help meet water quality standards, particularly since only a small portion of the Clopper Lake drainage is within the County MS4 permit area. The Plan focuses on the restoration effort within these MS4 Permit areas. Areas not covered under the County's MS4 Permit include areas of rural zoning, federal and state properties, state roads, and municipalities that have separate MS4 permits, such as the City of Gaithersburg. The County MS4 Permit area has approximately 18% impervious cover within the Great Seneca subwatershed, and has approximately 14% impervious cover within the Clopper Lake subwatershed.

**Total Maximum Daily Loads (TMDLs)**
Great Seneca Creek has been previously listed by the Maryland Department of the Environment (MDE) as impaired for TP, TSS, and biological impacts. However, MDE is proposing to delist the Creek for nutrient impairment. Currently, the NPDES MS4 Permit does not identify any TMDL waste load reductions for the Great Seneca subwatershed, except for the drainage to Clopper Lake. MDE established a TMDL for Clopper Lake in 2002 that provides waste load allocations (WLA) for total phosphorus (TP) and total suspended solids (TSS). The reduction target for TP is set at 45%. There is no required reduction for TSS because it was assumed that the sediment reductions associated with meeting the TP reductions would be sufficient.

While the primary pollutant of concern for Clopper Lake is TP, the Plan addresses and documents nutrient and sediment loading from the County MS4 Permit area for the Great subwatershed as a whole, as well as for Clopper Lake subwatershed, specifically. It also tracks the potential reduction of pollutant loads through the application of various stormwater management retrofits in both the Great Seneca and Clopper Lake areas. In addition, the Plan analyzes an extended suite of other best management practices (BMP) in the County's MS4 permit area of Clopper Lake to meet TP reduction goals of the WLA.

Full implementation of BMPs in the County MS4 permit area with the Great Seneca subwatershed would result in **26%** load reduction for total nitrogen (TN), **26%** for TP, and **29%** for TSS. Full implementation of projects in the Plan can result in **79%** TN, **48%** TP and **17%** TSS reduction in the MS4 Permit area of Clopper Lake. Most of the Clopper Lake drainage area, however, is within the City of Gaithersburg.

**Runoff Management via Impervious Cover Treatment**
During the five-year Permit cycle, the County must add stormwater management for an additional 20% of impervious cover within the County's MS4 Permit area that is not currently managed to the maximum extent practicable (MEP). The baseline year for determining the 20% goal is 2009 since the Permit was issued on February 16, 2010. Full implementation of projects identified through the countywide implementation strategy can provide control of an additional **4,000 acres** of impervious cover not treated to the MEP.

**Trash and Litter Reduction**
The third major permit element is that of trash and litter management to meet the commitments in the Potomac River Watershed Trash Treaty. The County must identify trash and litter reduction measures that are being implemented towards the goal of a Trash Free Potomac by the year 2013. This Plan also documents trash loading from the watershed and proposed reduction methods. An estimated **34%** and **18%** reduction of trash loads over baseline conditions for Great Seneca and Clopper Lake, respectively, is projected based on full implementation of BMPs identified in this plan.

## 1.2 Existing Conditions in the Great Seneca subwatershed

**Introduction to the Great Seneca subwatershed**
The Great Seneca subwatershed (72 square miles) is one of three major drainages within the Seneca Watershed, which is the largest in Montgomery County with a drainage area of approximately 130 square miles. The other two drainages, Dry Seneca (19 square miles) and Little Seneca Creek (38 square miles), are not included in this Plan. A basic profile of the Great Seneca subwatershed is provided in Table 1, a map depicting existing conditions is presented in Figure 1, and a map depicting stream resource conditions is presented in Figure 2.

**Table 1: Great Seneca and Clopper Lake subwatershed Profile**

| *Metric* | *Great Seneca*[2] | | *Clopper Lake* | |
|---|---|---|---|---|
| | *Acres* | *% of Watershed* | *Acres* | *% of Watershed* |
| Watershed Drainage Area | 46,564 | 100% | 2,090 | 100% |
| Impervious Cover | 5,494 | 12% | 590 | 28% |
| Watershed Area Subject to County Permit[1] | 18,861 | 41% | 221 | 11% |
| Impervious Cover Subject to County Permit[1] | 3,452 | 18% (of MS4 permit area) | 32 | 14%(of MS4 permit area) |
| Pervious Cover (e.g., forest, turf, meadow, farm fields)[1] | 15,409 | 82% (of MS4 permit area) | 189 | 86% (of MS4 permit area) |

[1] MS4 permit areas do not include City of Gaithersburg, rural zoning, all MNCPPC lands, Federal and State property, and Federal and State roads.
[2] Inclusive of Clopper Lake

Great Seneca is primarily an urban subwatershed and flows through various commercial, residential, agricultural areas, and various stream valley parks. The Great Seneca headwaters begin as a series of small tributaries south and east of Damascus near Hawkins Creamery Road, that flow through low density residential and agricultural areas, and through the City of Gaithersburg. The Great Seneca rapidly increases in size as other tributaries join it, flowing approximately 25 miles before it enters into the Potomac River. A portion of the Clarksburg Special Protection Area falls within the Little Seneca subwatershed and enters into Great Seneca just upstream of where Route 28 crosses Great Seneca. These SPA areas include a drainage of the Wildcat Branch, a coldwater stream, that enters Great Seneca near Brink Road, and the Upper Little Seneca drainages of Ten Mile Creek, portions of Cabin Branch, and, in general, the Little Seneca Creek above I-270.

Distinct differences exist in the conditions found among the various tributaries. The headwaters of Magruder Branch start in the commercial area of Damascus and are in poor to fair condition. The nearby Wildcat Branch is a high quality, naturally reproducing trout stream. Major tributaries in the middle Great Seneca area all originate in high density residential areas and each has instream impoundments (Lake Whetstone, Gunners Lake, and Clopper Lake). In 2002, TMDLs were established for Clopper Lake to meet dissolved oxygen, TP, and TSS reduction targets. Most of the 2,090 acre Clopper Lake drainage area is outside of the County's MS4 permit area and within the City of Gaithersburg. As

**Outreach and Stewardship Strategy**
**Potential Partners:**
There are a large number of schools in this watershed. Partnerships should be established with those nearest Clopper Lake, for example MLK Jr. Middle School and Watkins Mill HS. There are also several places of worship that merit investigation for partnerships, for example, Kehilat Shalom temple, Gaithersburg Chinese Alliance, Fairhaven United Methodist, and Poplar Grove Baptist.

**Potential Partners**:
The trails and high quality streams in the watershed draw a number of recreational groups to the watershed. Outreach and Stewardship partnerships should be established with groups such as Seneca Valley Trout Unlimited, Izaak Walton League, and paddling, hiking and biking merchants.

part of the County's commitment to improving the overall stream health, the County will be working closely with City of Gaithersburg to improve the health of Clopper Lake's drainage area.

**Outreach and Stewardship Strategy Demographic Snapshot:**
In portions of the Great Seneca watershed there are significant Asian and Latino populations. As a result, outreach efforts in this watershed necessitate going to the places where these stakeholder groups interact and providing information in Spanish and possibly Chinese or Korean.

Currently, a watershed plan for Great Seneca is being developed by the County and US Army Corps (USACE) using the Countywide Stream Protection Strategy and field observations. Using the 2009 Great Seneca/Muddy Branch Ecosystem Restoration plan and preliminary watershed plan by the County and USACE, the following tributaries have been listed as priority tributaries due to channel instability caused by older stormwater management practices and soil type: Magruder Branch, Wildcat Branch, Goshen Branch, Lower Long Draught-Hooker Branch and Quince Orchard. As part of the watershed plan, specific priority stream restoration sites (over 16 miles) and stormwater management pond retrofits have been identified. Additional watershed restoration goals include meeting TMDL reduction targets for Clopper Lake.

## Watershed Land Use

Land use within the MS4 permit watershed area is displayed in Table 2. Residential land use is the dominant land use in the watershed, covering about 59% of the watershed. This is followed by forest at 15% and rural at 10%. The watershed has few commercial/industrial land uses, with less than 5% identified. More than 75% of the Clopper Lake area is residential.

**Outreach and Stewardship Strategy Potential Partnerships:**
The watershed's high number of residential areas necessitates that home owner associations (HOA) become a key outreach and education partner for information dissemination. Potential partners in the low density residential areas also include 4-H and master gardeners. County offices such as DEP Solid Waste, Consumer Protection, the Commission of Common Ownership Communities (CCOC) and business groups such as real estate brokers will also be good partners as they have residential customer bases.

**Table 2: County MS4 Land Use Breakdown**

| *Maryland Department of Planning 2002 Land Cover/Land Use* | *Great Seneca*[6] | | *Clopper Lake* | |
|---|---|---|---|---|
| | *Watershed Acres* | *Percent of Total (%)* | *Watershed Acres* | *Percent of Total (%)* |
| **Low Density Residential (<1 du/acre)** | 4,448 | 24% | 69.6 | 32% |
| **Medium Density Residential (1-4 du/acre)** | 5860 | 31% | 53.6 | 24% |
| **High Density Residential (>4 du/acre)** | 732 | 4% | 47.2 | 21% |
| **Commercial** | 523 | 3% | 1.8 | 1% |
| **Industrial** | 219 | 1% | 0 | 0% |
| **Municipal/Institutional- Intensive**[1] | 781 | 4% | 5.7 | 3% |
| **Municipal/Institutional- Extensive**[2] | 371 | 2% | 10.4 | 5% |
| **Roadway**[3] | 1,117 | 6% | 7.8 | 4% |
| **Rural**[4] | 1,859 | 10% | 3.2 | 1% |
| **Forest**[5] | 2,852 | 15% | 21.5 | 10% |
| **Open Water** | 98 | 1% | 0 | 0% |
| **Bare Ground** | 2 | 0% | 0 | 0% |
| **Total Watershed** | 18,861 | 100% | 220.6 | 100% |

[1] Institutional land use (churches, schools, municipal buildings)
[2] Open Urban Land and Bare Rock land use (parks, cemeteries, and golf courses)
[3] Combined County and private roads (excludes Federal and State roads)
[4] Orchards, Vineyards, Horticulture, Feeding Operations, Cropland, Pasture, and Agricultural Buildings land use
[5] 2002 Land Use Data.
[6] Inclusive of Clopper Lake

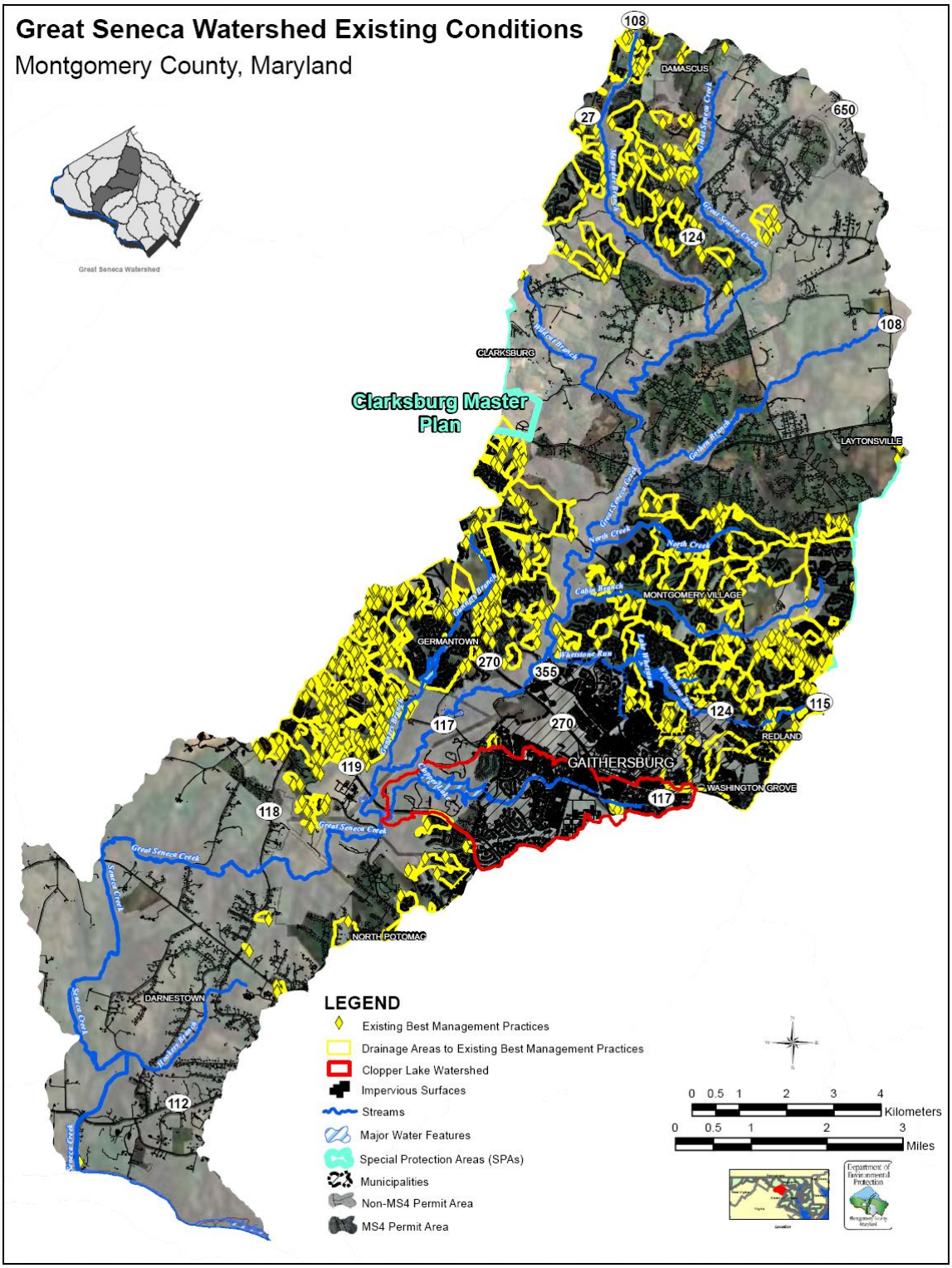



**Figure 1: Existing Conditions and BMP Locations for the Great Seneca subwatershed. The Clopper Lake Subwatershed is also highlighted.**

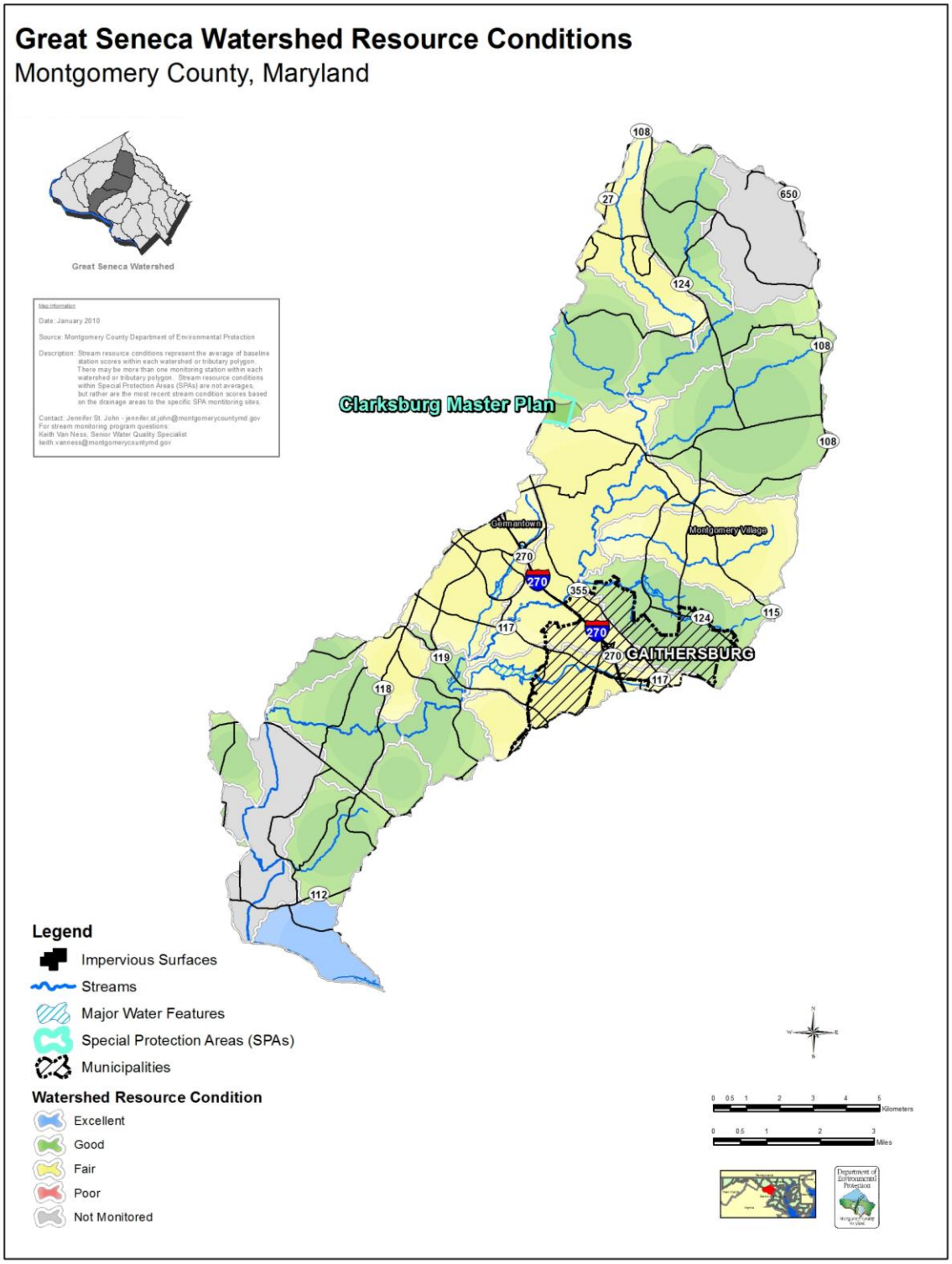



**Figure 2: Stream Resource Conditions for the Great Seneca subwatershed**

## Existing Stormwater Best Management Practices (BMPs)

There are 548 structural stormwater BMPs within the Great Seneca MS4 Permit area, each capturing drainage areas that vary from almost 400 acres for regional pond BMPs to less than 0.1 acre for small, on-site BMPs. The current inventory of BMPs was categorized according to design era and historic performance criteria. Performance metrics were used to group the BMPs into the five categories as shown in Table 3. The BMPs are classified according to their performance code as established in Appendix B of the Guidance Document.

**Table 3: Existing Stormwater Management**

| *BMP Performance Code[1]* | *Great Seneca[3]* | | | *Clopper Lake* | | |
|---|---|---|---|---|---|---|
| | *Count* | *Acres of Treatment* | | *Count* | *Acres of Treatment* | |
| | | *Drainage Area* | *Total IA in Drainage Area* | | *Drainage Area* | *Total IA in Drainage Area* |
| (4) Environmental Side Design (ESD) BMPs | 62 | 545.3 | 162.7 | 0 | 0.0 | 0.0 |
| (3) Effective BMPs | 149 | 4,999.8 | 1,369.6 | 0 | 0.0 | 0.0 |
| (2) Under-performing BMPs | 46 | 234.3 | 82.8 | 1 | 0.1 | 0.0 |
| (1) Non-performing BMPs | 134 | 2,382.8 | 580.6 | 3 | 10.8 | 3.6 |
| (0) Pretreatment & Unknown[2] | 157 | 253.9 | 134.3 | 0 | 0.0 | 0.0 |
| Total | 548 | 8,416.2 | 2,329.9 | 4 | 10.9 | 3.7 |

[1]For drainage areas with more than one BMP, the maximum performance code was taken after deleting pretreatment BMPs (Code 0).
[2]Drainage area not associated with a specific BMP type
[3] Inclusive of Clopper Lake

## 1.3 Problems Facing the Great Seneca Subwatershed

**Biological and Habitat Conditions**

The most recent countywide, five-year monitoring cycle was completed in 2010. In 2009, 19 tributaries in the Great Seneca subwatershed were sampled for benthic invertebrates, fish species, and habitat metrics in order to assess the stream conditions. Results of the survey are in Table 4, summarized by both stream miles and drainage area. The survey data can be used to classify both instream conditions and overall water quality from the watershed. Therefore, the stream miles summary can be interpreted as an indicator of the current instream resource conditions. The drainage area summary can be used to indicate the condition of water quality draining from the watershed.

**Outreach and Stewardship Strategy**

**Potential Partnerships:**
Outreach and education activities should be closely coordinated with local governments such as the City of Gaithersburg to ensure that there is no duplication of effort, the messages are consistent, and to combine resources.

Currently, the majority of the stream resource conditions in Great Seneca were assessed as 'Fair', with 35% 'Good,' and no 'Excellent' streams. The higher quality streams were found in the Upper and Lower Great Seneca subwatershed. In contrast, Middle Great Seneca received the majority of 'Fair' ratings, which can mostly be attributed to the increased development around Gaithersburg.

**Table 4: Great Seneca Stream Resource Condition Survey Results by Stream Miles and Drainage Area**

| *Resource Condition* | *Length (miles)* | *%* | *Area (Acres)* | *%* |
|---|---|---|---|---|
| Excellent | 0.0 | 0% | 0.0 | 0% |
| Good | 102.4 | 48% | 6,116.1 | 35% |
| Fair | 85.9 | 41% | 8,642.5 | 50% |
| Poor | 0.0 | 0% | 0.0 | 0% |
| Not Accessed | 23.6 | 11% | 2540.3 | 15% |
| Total | 211.9 | 100% | 17,299.0 | 100% |

## Water Quality and Trash Issues

As part of its environmental enforcement program, the County tracks citizen complaints regarding water quality and illegal solid waste dumping. Table 5 summarizes the number and type of citizen complaints recorded for Rock Creek during the five year cycle from 2004 to 2009. The overwhelming majority of the complaints received were related to stormwater pollutant discharge. Table 6 includes the same complaints summarized by location and general zoning type. For some properties there were multiple complaints. The majority of complaints recorded were in residential, commercial, and industrial zoning. These locations were given 'hotspot' identification in the pollutant loading model, discussed further in Section 3. None of the water quality complaints were recorded in the Clopper Lake drainage area.

**Outreach and Stewardship Strategy Education Project:**
To reduce trash hot spots, stakeholder outreach is recommended in partnership with HOAs and county recycling offices. Educating watershed residents on the importance of proper trash can maintenance, keeping playing fields clean, and dumpster maintenance is recommended for success. Implementation details are in the Practice Sheet entitled Anti-Littering Outreach and Stewardship Campaign.

Solid waste trash dumping sites were also logged by the County to identify trash hotspots. Table 7 includes a summary of the complaint database by complaint type. The majority of complaints were recorded as residential dumping or dumpster management. Table 8 identifies the general zoning type at the site of the complaint. One residential dumping site was logged in the Clopper Lake Watershed on a 0.4-acre site. As with Tables 5 and 6, for some properties there were multiple complaints noted in Tables 7 and 8.

**Table 5: Recorded Water Quality Complaints[1]**

| Watershed | Total # of cases | Number by Water Quality Complaint Type | | | |
|---|---|---|---|---|---|
| | | Stormwater-Pollutant Discharge | Surface Water-Chemical Discoloration/ Unknown | Surface Water-Sewage | Surface Water-Petroleum Product in Water |
| Great Seneca | 63 | 56 | 4 | 3 | 0 |
| Clopper Lake | 0 | 0 | 0 | 0 | 0 |

[1] From WQCases2004_2009_Locations.shp

**Table 6: Water Quality Complaints in Great Seneca by Zoning[1]**

| General Zoning Type[2] | Great Seneca[3] | | Clopper Lake | |
|---|---|---|---|---|
| | Acres | Total # of Properties | Acres | Total # of Properties |
| Apartments | 7.4 | 1 | 0 | 0 |
| Residential | 29.6 | 35 | 0 | 0 |
| Commercial | 68.6 | 11 | 0 | 0 |
| Industrial | 1.1 | 1 | 0 | 0 |
| Unzoned | 0.0 | 0 | 0 | 0 |

[1] From SWCases2004_2009_locations.shp ; [2] From County PROPERTIES.shp
[3] Inclusive of Clopper Lake

**Table 7: Solid Waste Trash Dumping Sites[1]**

| Watershed | Total # of cases | Number per Solid Waste Type | | | |
|---|---|---|---|---|---|
| | | Farm Land | Residential | Public Land | Dumpster |
| Great Seneca | 133 | 3 | 79 | 17 | 34 |
| Clopper Lake | 1 | 0 | 1 | 0 | 0 |

[1] From SWCases2004_2009_locations.shp

**Table 8: Solid Waste Trash Dumping Sites by Zoning[1]**

| General Zoning Type[2] | Great Seneca[3] | | Clopper Lake | |
|---|---|---|---|---|
| | Acres | Total # of Properties | Acres | Total # of Properties |
| Apartments | 55.3 | 5 | 0 | 0 |
| Residential | 76.3 | 64 | 0.4 | 1 |
| Commercial | 49.1 | 10 | 0 | 0 |
| Industrial | 6.8 | 4 | 0 | 0 |
| Unzoned | 167.3 | 9 | 0 | 0 |

[1] From SWCases2004_2009_locations.shp; [2] From County PROPERTIES.shp
[3] Inclusive of Clopper Lake

## 1.4 Existing Pollutant Loads and Impervious Surfaces

**Existing Phosphorus and Sediment Loads per the TMDL**

MDE prepared the "TMDL for Phosphorus and Sediment for Clopper Lake, Montgomery County, MD, January 31, 2002." This document establishes a load reduction requirement for TP in the Clopper Lake watershed, which is only partly within Montgomery County; most of the watershed is in the City of Gaithersburg. There is no required reduction for TSS. The baseline load and WLA for the subwatershed area subject to the County MS4 permit area is displayed in Table 9.

Table 9: TP Baseline Loading Estimates for Clopper Lake and Comparison Values from MDE

| *Parameter* | *Date* | *Baseline Montgomery County MS4 load* | *Montgomery County WLA % Reduction* | *Target Montgomery County MS4 load* |
|---|---|---|---|---|
| Total Phosphorus | 2002 | 101 lbs/yr | 45.4% | 55 lbs/yr |

In addition to TP reductions in Clopper Lake, there is a need for the County to track and understand other pollutants in Clopper Lake and the overall Great Seneca subwatershed. Great Seneca has been listed as impaired for nutrients and sediment. Also, it is expected that MDE will provide WLAs for nutrients to meet the Bay-wide nutrient TMDL in 2011. This Plan establishes some initial estimates for load reductions from baseline conditions for nutrients and sediment.

**Impervious Surfaces**

Impervious cover in the watershed, as derived from County GIS, is summarized in Table 10. In Great Seneca, County and private roads and private parking lots account for the largest percentage of impervious cover in the watershed at just over 45% combined. In Clopper Lake, single family roofs comprise the largest portion of impervious cover at 27%.

**Existing Trash Loads**

The Potomac River Watershed Trash Treaty outlines the agreement between local and state elected officials to commit to a Trash Free Potomac by 2013. The agreement includes three major commitments:

- Support and implement regional strategies aimed at reducing trash and increasing recycling;
- Increase education and awareness of the trash issue throughout the Potomac Watershed; and
- Reconvene annually to discuss and evaluate measures and actions addressing trash reduction.

**Outreach and Stewardship Strategy Education Project:**
To reduce stormwater pollution on private property, stakeholder outreach is recommended explaining the need for watershed stakeholders to capture some of the precipitation that falls on their roof and allow for groundwater recharge hence slowing the flow of surface waters and potential erosion impacts. It is recommended that this can be accomplished by expanding existing County programs such as RainScapes, as described in the Practice Sheet entitled Roof Runoff Reduction Outreach and Stewardship Campaign.

In general, trash reduction strategies fall into four categories: (1) Structural; (2) Educational; (3) Municipal; and (4) Enforcement. Structural stormwater BMPs will be assigned 95% removal credit for trash from the contributing drainage area. BMPs, while not specifically designed to capture trash, are also not very good at passing trash, and debris is prone to build up in forebays, around plants and interior elements, and around the outlet structures. This Plan estimates the reduction in trash for Great Seneca and Clopper Lake using structural BMPs.

In addition to trash removal by structural stormwater BMPs, programmatic practices (i.e., educational, municipal, and enforcement) can provide trash prevention and control. These programmatic practices are specially aimed at reducing trash inputs to roads and streams, including educationally focused programs such as reduce, reuse and recycle campaigns; dumpster management and storm drain marking; and programs tied to operations such as littering and illegal dumping enforcement; stream cleanups; and street sweeping. These programmatic practices are further explored in the countywide strategy.

**Table 10: County MS4 Permit Area Impervious Cover Breakdown (as of 2009)**

| | ***Great Seneca[10]*** | | ***Clopper*** | |
|---|---|---|---|---|
| ***Impervious Cover Type*** | *Impervious Acres* | *Within Watershed* | *Impervious Acres* | *Within Watershed* |
| 1. Roads | | | | |
| a. Low Density Residential[1] | 327.4 | 9.5% | 5.7 | 18.0% |
| b. Other[2] | 789.8 | 22.9% | 2.1 | 6.6% |
| 2. Parking Lot | | | | |
| a. County Small Lots (<1 acre) [3] | 27.1 | 0.8% | 0.0 | 0.0% |
| b. County Large Lots (>=1 acre) [3] | 99.6 | 2.9% | 0.0 | 0.0% |
| c. Private | 753.2 | 21.8% | 7.2 | 23.0% |
| 3. Roofs | | | | |
| a. County[4] | 89.5 | 2.6% | 0.0 | 0.0% |
| b. Single Family Homes[5] | 626.3 | 18.1% | 8.4 | 26.7% |
| c. Other | 558.5 | 16.2% | 6.1 | 19.4% |
| 4. Sidewalks[6] | 154.8 | 4.5% | 1.9 | 6.0% |
| 5. Other | | | | |
| a. Schools[7] | 119.1 | 3.4% | 0.0 | 0.0% |
| b. Recreational[8] | 25.9 | 0.8% | 0.1 | 0.3% |
| **Total Impervious Acres from GIS[9]** | 3,452.2 | 100.0% | 31.5 | 100.0% |

[1]All roads in RE2 or R200 property zoning.
[2]Includes County and private roads.
[3]Parking lots located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.
[4]Buildings located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.
[5]Buildings located on single family home parcels, derived using MDP_pnts from the County's PROPERTY geodatabase and selecting only single-family dwelling types.
[6]Sidewalks in jurisdiction. Does not include all residential sidewalks or driveways.
[7]Impervious cover located in public school parcels, derived using pubsch points from the County's LOCATIONS geodatabase. Some overlap with other impervious.
[8] Impervious cover identified as Recreational in geodatabase. Some overlap with other impervious.
[9] Sum of all GIS impervious. Excludes overlaps in schools and recreational.
[10] Inclusive of Clopper Lake

# 2 Inventory of Provisional Restoration Candidates

## 2.1 Types of Restoration Practices

Table 11 summarizes seven groups of watershed restoration practices evaluated for the Great Seneca subwatershed and Clopper Lake. All restoration practices differ in the mode and manner by which they will be delivered in the watershed (capital budgets, water quality protection charge, regulation, etc.). Multiple delivery mechanisms are needed to implement enough watershed restoration practices to meet the watershed treatment and pollutant reduction targets set forth in the County's MS4 permit, the TMDL, and the Potomac River Watershed Trash Treaty.

**Table 11: Restoration Practices Evaluated in Great Seneca subwatershed Implementation Plan**

| ***Description of Practice*** | ***Application in the Great Seneca Watershed /Clopper Lake*** |
|---|---|
| **ESD Practices** | |
| New ESD Retrofit Practices - These include small scale ESD practices applied to County- owned or privately owned buildings, streets and parking lots and rights of way. Examples include rainwater harvesting, green roofs, upland reforestation, soil compost amendments, rooftop disconnection "green street" retrofits and converting swales to dry swales. | Public ESD Retrofits |
| ESD Upgrades - This category includes retrofit ESD practices within existing publicly-owned or privately-owned stormwater infrastructure, so that their hydrologic and pollutant reduction performance is upgraded. | Code 1 and 2 BMP Upgrades (see WTM 3.0) |
| Impervious Cover Reduction - This category involves cases where un-needed impervious cover is removed, soils amended and vegetation restored primarily on County schools, streets and parking lots. | Not applicable |
| Voluntary LID Implementation - ESD practices that are installed as a result of County education and incentive programs. | Private ESD Retrofits |
| **Programmatic and Operational Practices** | |
| MS4 Programmatic Practices – This category deals with reduced pollutants that can be attributed and quantified through MS4 stormwater education (e.g., lawn care), pollution prevention improvements at municipal hotspots, and better housekeeping on County land and facilities. Also includes any pollutant reductions due to product substitution, such as imposing restrictions on N or P content in fertilizer, increased pet waste enforcement, trash prevention and control. | Residential Lawn Care Education; Pet Waste Education |
| Hotspot Pollution Prevention – This category credits enhanced structural and non-structural practices employed at non-publicly owned stormwater hotspots that are identified through land use analysis. | Not applicable |

| ***Description of Practice*** | ***Application in the Great Seneca Watershed /Clopper Lake*** |
|---|---|
| Enhanced County Street Sweeping - This category includes any pollutant reduction that can be attributed to more intensive and targeted street sweeping in the subwatersheds conducted by the County. | Not applicable |
| Trash Prevention and Control - This category includes a wide range of programs and practices specially aimed at reducing trash inputs to stream, including reduce, reuse and recycle campaigns, littering and illegal dumping enforcement, dumpster management, storm drain marking, storm drain inlet devices, stream cleanups, instream controls to trap and remove trash, etc. These measures are in addition to any trash trapped and removed by other restoration practices which are computed separately. | Not applicable |
| **Structural Practices** | |
| Traditional Retrofits - This is the traditional retrofit scale where large-scale, non-ESD retrofits are constructed on larger parcels of public or private land as discovered through analysis of MCDEP BMP inventory. | New Ponds |
| BMP Maintenance Upgrades - Credit for improvement in current permit cycle for major maintenance upgrades of failed stormwater practices that result in significant improvement in hydraulic function and increased treatment capacity using existing County maintenance budget. Credit can only be taken for increased load reduction due to upgrades that significantly rehabilitate BMP function from its installation baseline. (e.g., increase capacity, lengthen flow path, reduce short-circuiting, eliminate design failures). | Code 1 and 2 BMP Upgrades<br>(see WTM 3.0) |
| Habitat Restoration - This category includes any pollutant reduction or volume reduction that can be attributed to specific stream restoration or riparian reforestation projects planned for construction in the watershed for the permit cycle. | Riparian Reforestation |

## 2.2 Inventory of Previously Identified Projects

Potential restoration strategies for the watershed set forth in this Plan were drawn from the 2009 Great Seneca/Muddy Branch Ecosystem Restoration plan, the preliminary County and USACE watershed plan, and the County's restoration sites database. Previously identified restoration projects identified are presented in Figure 3.

In addition to the BMPs listed above, there are 33 potential stream restoration projects identified in the County jurisdictional area of Great Seneca that identify the need for restoration of 19.5 linear miles of stream. The County is coordinating their efforts with City of Gaithersburg, State of Maryland, and the Federal government to improve the identified stream reaches at the same time. The County's jurisdictional permit area upstream of Clopper Lake is comprised of approximately 0.5 miles of stream and was not identified as a high priority for stream restoration in the preliminary Great Seneca Watershed Plan. There is an older County completed stream restoration site within the County jurisdictional area of Clopper Lake (west of Golden Post Lane) that entailed placing rip-rap along a portion of the stream to protect the streambanks. The City of Gaithersburg and the State of Maryland have completed some stream restoration projects outside of the County MS4 permit area.

**Outreach and Stewardship Strategy Education Project:**
Although not in the Clopper Lake drainage area, to help watershed stakeholders understand why stream restoration is needed, stakeholder outreach such as installing educational signage at stream restoration sites is recommended. This can be accomplished through partnerships with organizations such as Seneca Creek Watershed Partners. Messaging should focus on the importance of healthy streams as described in the Practice Sheet entitled Innovative Stormwater Management Outreach and Stewardship Campaign.

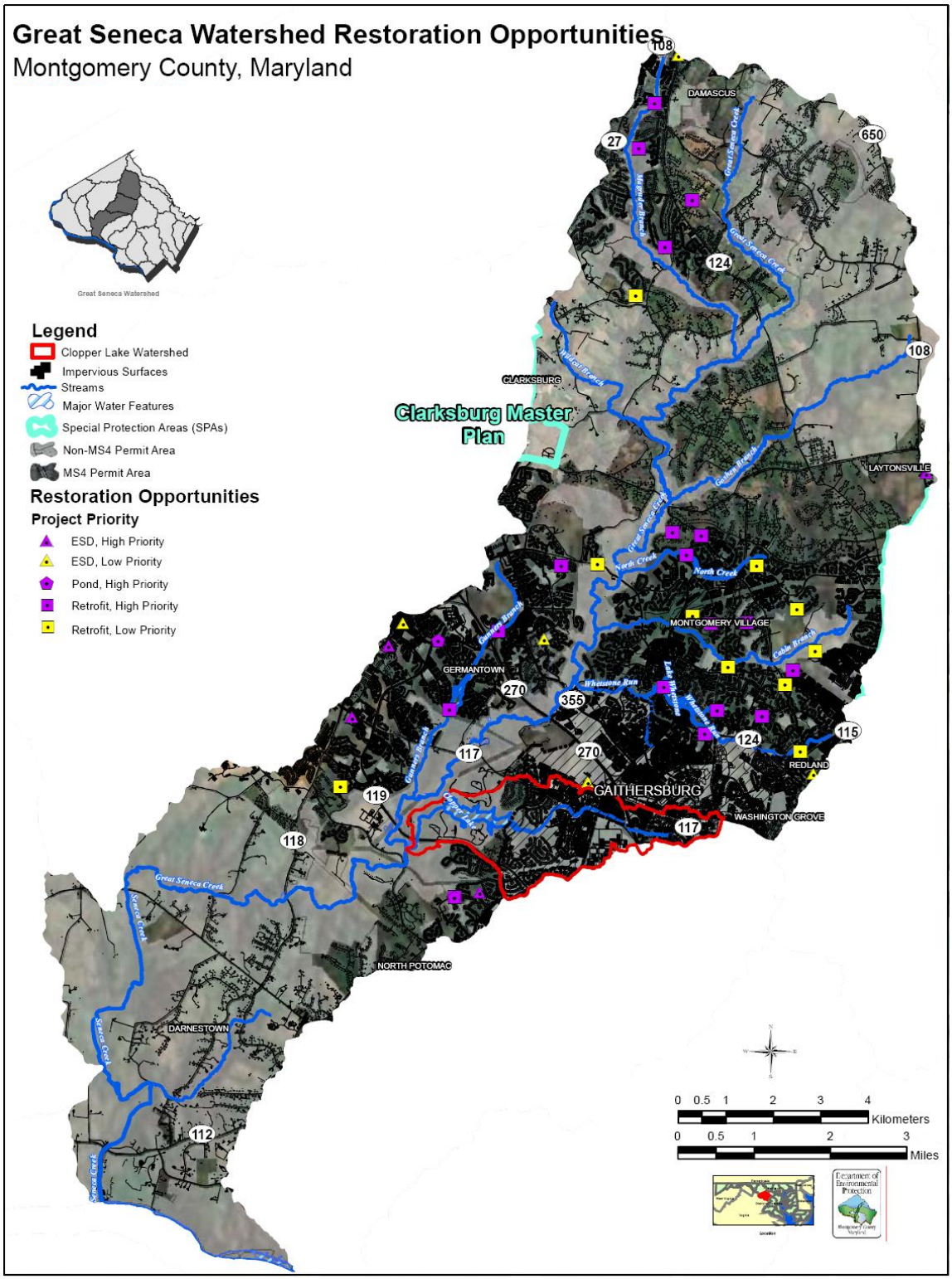



Figure 3: Identified Restoration Opportunity Locations for the Great Seneca subwatershed

# 3 Evaluation of the Restoration Strategies to Meet MS4 Permit Requirements

This section of the Plan describes an analysis of existing BMPs and potential load reductions for the MS4 permit area of the Great Seneca subwatershed and for Clopper Lake. A land use-based model was used in this Plan to develop a primary source load of sediment, nutrients, and trash using 2002 Maryland Department of Planning (MDP) land use data for consistency with the countywide coordinated implementation strategy. Further information on land use loading rates can be found in the Plan Guidance Document, Section 2.

## 3.1 Desktop Review of BMP Coverage

A desktop review of BMP coverage was used to analyze the existing BMP coverage and proposed County restoration sites inventory of potential retrofit projects. The BMPs were classified according to their performance code as shown in Table 12. The relative performance of each practice type was based on comparative reviews of pollutant reduction and runoff reduction performances of practices from around the country (CWP, 2007; and CWP and CSN, 2008) or performance studies on individual practices (Schueler, 1998). The composite efficiencies were also compared to recent research values and assumptions used in local models (USACE, 2008; Chesapeake Bay Program, 2008; and MDE, 2009) to further justify the performance coding. A summary of the BMP modeling assumptions are in Table 12.

**Table 12. Composite Runoff Reduction, Effectiveness Factor, and Pollutant Reduction by BMP Performance Code**

| *Performance Code* | *Description* | *TSS[1] (%)* | *TN[2] (%)* | *TP[3] (%)* | *FC[4] (%)* | *DF[5] (%)* |
|---|---|---|---|---|---|---|
| **1** | **Non-performing BMPs** | 5 | 0 | 0 | 0 | 0.05 |
| **2** | **Underperforming BMPs** | 20 | 5 | 5 | 10 | 0.15 |
| **3** | **Effective BMPs** | 80 | 40 | 50 | 65 | 0.75 |
| **4** | **ESD Practices** | 90 | 65 | 65 | 75 | 1.0 |

[1] TSS: Sediment reduction rate
[2] TN: Total Nitrogen reduction Rate (Mass)
[3] TP: Total Phosphorus reduction Rate (Mass)
[4] FC: Fecal coliform reduction, see rationale in Guidance Document, Section 5.5
[5] DF: Discount Factor: Fraction of contributing impervious acres effectively treated to the Water Quality Volume, used to rate BMP treatability

## 3.2 Summary of Watershed Treatment Model Scenarios

The Watershed Treatment Model (WTM) was used to estimate pollutant sources and treatment options for Great Seneca and Clopper Lake. The spreadsheet used was an updated version of the publically available v3.1, which included an expanded runoff volume reduction component (personal correspondence, Deb Caraco, 2009). The WTM was used to track a progression of restoration strategies across the watershed to illustrate the effectiveness of each strategy in reducing pollutant loads and ultimately meeting the TMDL load reduction targets. Targeted strategies range from specific restoration sites identified by the County to less well defined

nonstructural strategies tied to stakeholder participation and involvement. The specific layers of analysis are presented below, following the nomenclature of WTM 1.0 – WTM 5.0.

A summary of the model scenarios evaluated using the Watershed Treatment Model are provided in Table 13 below and described in more detail in the following sections.

Table 13. Summary of WTM Scenarios

| *Implementation Phase* | *Description* |
|---|---|
| **WTM Baseline Conditions** *(Great Seneca and Clopper Lake)* | The WTM was run under existing conditions approach with the MDP year 2002 land use/land cover data and existing BMPs. A rough calibration to the MDE TMDL baseline load was conducted for Clopper Lake. |
| **WTM 2.0 Completed as of 2009, High Priority, Low Priority and Other Potential Projects** *(Great Seneca and Clopper Lake)* | The WTM was run with a series of future management practices, which were proposed projects from the County inventory of restoration sites. These practices cover new ponds, retrofits of existing facilities, and ESD practices from the County's restoration projects list. |
| **WTM 3.0 ESD Strategies and Other Structural BMPs** *(Clopper Lake)* | The remaining inventory of BMPs, which have reduced treatment efficiency, were reviewed for retrofit opportunities and potential increased pollutant reduction efficiencies. In addition, the County's inventory for other project types that include public properties (e.g., libraries and parking lots), public schools, and open section roads available for ESD retrofits was reviewed. Finally, a neighborhood analysis was performed to summarize areas for private property ESD retrofits. |
| **WTM 4.0 Habitat Restoration** *(Clopper Lake)* | Other projects on public lands and other practices that are identified in Appendix B of the Guidance Document were explored. For Rock Creek this focused on habitat restoration related to riparian buffer reforestation. |
| **WTM 5.0 MS4 Programmatic Practices** *(Clopper Lake)* | Other MS4 programmatic practices that are identified in Appendix B of the Guidance Document were examined. For Rock Creek, this was limited to pet waste education, since the TMDL pollutant is bacteria |

It should be noted that a variety of other restoration alternatives were modeled for Clopper Lake in order to estimate potential load reductions to meet the 45% TP reduction target established in the TMDL. These include other structural BMPs (WTM 3.0), habitat restoration (WTM 4.0), and MS4 programmatic activities (WTM 5.0). Because there is no existing TMDL for the overall Great Seneca subwatershed, this analysis was not conducted at this time.

**WTM 1.0 – Baseline Conditions**

The WTM was used to establish existing total nitrogen (TN), total phosphorus (TP), total suspended solids (TSS), and trash loads based on a land use/land cover as the primary source for the Great Seneca and Clopper Lake subwatershed. 2002 MDP land use data was used for consistency with the Countywide Implementation Plan (see Table 2). Further information on land use loading rates for TN, TP, TSS, and trash can be found in the Implementation Plan Guidance Document, Section 2 and Appendix B and E.

The model was calibrated for the Clopper Lake analysis to better approximate baseline TP load estimates used in the TMDL. MDE established the TMDL for TP in Clopper Lake using the Chesapeake Bay Program, Phase 4.3 phosphorus loading coefficients to estimate the loading rates from agricultural and forested areas. MDE used the MDP 2000 land use/land cover information. The loading rate for "developed area" was provided by Montgomery County. The WTM calibration involved applying an area-weighted adjustment to account for differences in the 2002 and 2000 land use information. In addition runoff concentrations used in the WTM for TP loading per land use type were replaced with the actual concentrations used in the TMDL model, which were 0.643 lb/acre for developed land, 1.24 lb/acre for Ag, and 0.029 lb/acre for Forest. With these adjustments, the WTM generated base load estimates comparable to TMDL base loads.

Table 14 summarizes the number of existing BMPs by performance code, their collective drainage areas, total impervious areas captured in the Great Seneca subwatershed and Clopper Lake, and the estimated impervious area treated based on the discount factor listed in Table 13.

**Table 14: Existing BMP Inventory for Great Seneca and Clopper Lake**

| *BMP Performance Category* | *Great Seneca*[1] | | | *Clopper Lake* | | |
|---|---|---|---|---|---|---|
| | *Count* | *Total DA (acres)* | *Total IA (acres)* | *Count* | *Total DA (acres)* | *Total IA (acres)* |
| ESD Practices (Code 4) | 62 | 545.3 | 162.7 | 0 | 0.0 | 0.0 |
| Effective BMPS (Code 3) | 149 | 4,999.8 | 1,369.6 | 0 | 0.0 | 0.0 |
| Underperforming BMPs (Code 2) | 46 | 234.3 | 82.8 | 1 | 0.1 | 0.0 |
| Non-performing BMPs (Code 1) | 134 | 2,382.8 | 580.6 | 3 | 10.8 | 3.6 |
| Pretreatment facilities (Code 0) | 157 | 253.9 | 134.3 | 0 | 0.0 | 0.0 |
| **TOTAL** | | | **2,330** | | | **3.6** |

DA: Drainage Area; IA: Impervious Area

[1] Inclusive of Clopper Lake

**WTM 2.0- Completed as of 2009, High Priority, Low Priority and Other Potential Retrofit Projects**

The WTM was run with a series of future management practices for Great Seneca, which were proposed projects from the County inventory of restoration sites. These practices cover new ponds, retrofits of existing BMPs, and ESD projects from the proposed projects as summarized in Table 15. Drainage area (DA), impervious area (IA), total length, and total cost were all determined from engineering designs or estimated based on the running average per practice values from the County DEP Restoration Sites Database.

No completed or proposed restoration sites were identified in Clopper Lake, and thus, no analyses conducted for Clopper Lake, specifically.

**Table 15:** Three levels of treatment in Great Seneca[1]: Complete, High Priority, Low Priority and Other Potential Projects

| *Restoration Type* | *Count* | *Total Cost* | *Total Length (mi)* | *Total DA (acres)* | *Total IA (acres)* |
|---|---|---|---|---|---|
| **Completed Projects** | | | | | |
| ESD | 0 | - | - | - | - |
| New Pond | 0 | - | - | 0.0 | 0.0 |
| Retrofit of Non-performing BMPs | 1 | $296,487.67 | - | 74.1 | 11.2 |
| Retrofit of Effective BMPs | 1 | $289,827.00 | - | 160.3 | 56.3 |
| Stream Restoration | 0 | - | - | - | - |
| **High Priority Projects** | | | | | |
| ESD | 4 | $1,185,448.37 | - | 9.0 | 6.6 |
| New Pond | 1 | $241,878.15 | - | 60.5 | 23.0 |
| Retrofit of Non-performing BMPs | 10 | $3,611,111.33 | - | 902.8 | 163.6 |
| Retrofit of Effective BMPs | 9 | $13,284,587.28 | - | 3321.1 | 678.1 |
| Stream Restoration | 28 | $21,845,000.00 | 16.5 | - | - |
| **Low Priority and Other Potential Projects** | | | | | |
| ESD | 5 | $2,706,000.00 | - | 14.9 | 13.5 |
| New Pond | 0 | - | - | - | - |
| Retrofit of Non-performing BMPs | 9 | $1,422,270.05 | - | 355.6 | 84.1 |
| Retrofit of Effective BMPs | 7 | $2,708,009.03 | - | 677.0 | 177.8 |
| Stream Restoration | 5 | $4,021,500.00 | 3.0 | - | - |

[1] Inclusive of Clopper Lake

The cumulative pollutant load reduction was computed for Great Seneca. Thus, this step determined how far and at what cost the existing list of restoration projects goes toward meeting impervious cover, trash and other pollutant reduction goals. New Ponds were given effective BMP pollutant reduction efficiency, and ESD practices were given full ESD pollutant reduction efficiency. Retrofits of existing BMPs were reconciled with the existing urban BMP

database and given an incremental increase in pollutant reduction efficiency based on an assumed Code 4 BMP efficiency. The actual drainage area and impervious area from the existing practice was used to calculate pollutant and runoff reduction. In general, the County used the information in Table 16 below to estimate proposed impervious area and costs, where engineering costs were unavailable:

Table 16: Impervious Cover and Cost Estimates used in the Future Management Scenarios

| |
|---|
| • **38% imperviousness per drainage acre** |
| • **New Ponds, $6,000 per drainage acre** |
| • **Retrofit Pond, $4,000 per drainage acre or $12,000 per impervious acre** |
| • **ESD project, $200,000 per impervious acre** |
| • **Wetland, $50,000 per drainage acre** |
| • **Stream Restoration, $250 per linear foot** |
| • **Reforestation, $20,000 per acre** |

It should be noted that the pollutant load reductions and implementation costs associated with the 33 stream restoration projects (over 19 linear miles) identified in the Great Seneca subwatershed were not included in the analysis at this time.

**WTM 3.0 – ESD Strategies and Other Structural BMPs**

The remaining inventory of Code 1 and 2 BMPs, which have reduced treatment efficiency, were reviewed for retrofit opportunities and potential increased pollutant reduction efficiencies in Clopper Lake. In addition, the County's GIS Property database was reviewed for other project types that include public properties (e.g., libraries), public schools, and open section roads available for ESD retrofits. Then the Guidance Document was followed for determining total potential reduction from assumed treatment areas from these four target areas:

a. Code 1 and 2 BMP ESD Retrofits- The remaining Code 1 and Code 2 BMP treatment area was calculated by subtracting the previously targeted retrofits from (WTM 2.0) from the total BMP area (summarized in Table 17). It was then assumed these areas were suitable for retrofits and incrementally increased the performance efficiency of Code 1 and 2 BMPs to the MEP within Future Management Practices. The cost per impervious acre estimate was based on typical County retrofits for large pond BMPs.

Table 17: Underperforming (Code 2) and Non-performing (Code 1) BMPs targeted for retrofit in Clopper Lake

| Target | Count | Total DA (acres) | Total IA (acres) | Cost per IA | Total Cost |
|---|---|---|---|---|---|
| Total Code 2 BMPs | 1 | 0.118 | 0.04 | | |
| -Previously Targeted for Retrofit | 0 | 0 | 0 | | |
| **Remaining Code 2 for Retrofit** | **1** | **0.118** | **0.04** | **$12,000** | **$440** |
| Total Code 1 BMPs | 3 | 10.78 | 3.6 | | |
| -Previously Targeted for Retrofit | 0 | 0 | 0 | | |
| **Remaining Code 1 for Retrofit** | **3** | **10.78** | **3.6** | **$12,000** | **$43,200** |
| | | | | Total | $43,640 |

b. Public properties – Forty percent of the impervious cover from the aggregate area and associated imperviousness from untreated County-owned Large Parking Lots and Rooftops was assigned to future management practices as code 4 (see Table B.4 of Guidance Document, and summary in Table 18 below). The forty percent target for restoration was based on a judgment of the maximum extent practicable considering physical constraints to ESD/LID. The unit cost estimate was based on an equal mix of new ESD retrofits for larger parking lots and rooftops.

c. Public schools – Forty percent of the impervious cover from the aggregate area and associated imperviousness and from untreated Public Schools Parcels was assigned to future management practices as code 4 (see Table B.4 of Guidance Document, and summary in Table 18 below). The restoration target was set similarly to part (b) above.

d. LDR and Other County Roads – Seventy-five percent of the impervious cover from the aggregate area and associated imperviousness from RE2 and R200 roadways was assigned to future management practices as code 4 (see Table B.4 of Guidance Document, and summary in Table 18 below). The restoration target was set similarly to part (b) above. The unit cost estimation was based on an open-section road retrofit. Other County Roads were assigned a forty percent aggregate impervious cover restoration target, and the unit cost was based on a curbed road retrofit.

e. Private Property ESD implementation - In order to identify additional Priority Residential Neighborhoods for private property ESD implementation, a desktop assessment was performed. The criteria used for evaluation included lot size, home ownership, presence or absence of homeowners association (HOA), and presence or absence of existing stormwater management BMPs. Neighborhood areas are then broken into tiers of high, medium, and low based on the points assigned to the various criteria:

**Outreach and Stewardship Strategy**
Expanded marketing of the RainScapes program should occur in the identified high and medium priority neighborhoods through partnership with the HOAs and Commission of Common Ownership Communities (CCOC) as described in the Practice Sheet entitled Roof Runoff Reduction Outreach and Stewardship Campaign.

- SWM Score:
  - Yes = 0; No = 2
- Lot Size Score:
  - > 1.0 acre = 0
  - <= 0.25 BUT <= 1.0 = 3 (High)
  - <= 0.1 BUT <0.25 = 2 (Medium)
  - < 0.1 acre = 1 (Low)
- Home Ownership Score:
  - > 70% = 3 (High)
  - <= 30 BUT <=70 = 2 (Medium)
  - < 30% = 1 (Low)
- HOA Score:
  - Yes = 2 ; No = 0

- Total Priority Score:
  - >=9 = High
  - >=6 BUT <=8 = Medium
  - <= 5 = Low

Thirty percent implementation of site-scale ESD projects in the targeted neighborhoods that meet criteria associated high and median priority was assumed, which equates to 2 acres of impervious area treatment, and a cost of approximately $578,000 assuming $298k per impervious acre (Table 18). Figure 4 shows the priority neighborhoods in Clopper Lake. Table B.7 of the Guidance Document describes the basic approach used to make pollutant reduction and cost decisions.

f. Non-residential Property without Adequate Treatment ESD implementation: These are comprised of commercial properties that are not currently paying into Water Quality Protection Charge. It was assumed that 40% of the impervious cover within these properties will apply ESD practices on site. None of these properties were identified in Clopper Lake for this analysis (Table 18).

**Table 18:** Summary of restoration potential within County owned facilities, schools, and ESD roads options in Clopper Lake.

| ***Land Cover*** | ***Total IA*** | ***Restoration Potential**** | ***Restored IA*** | ***Unit Cost***** | ***Restoration Cost**** |
|---|---|---|---|---|---|
| Type | Acres | % | Acres | $/Acre IA | $ |
| County Large Parking Lots[1] | 0 | 40% | 0 | $317,500 | $0 |
| County Roofs[2] | 0 | 40% | 0 | $508,500 | $0 |
| Schools[3] | 0 | 40% | 0 | $484,000 | $0 |
| Low Density Residential Roads[4] | 6 | 75% | 4 | $137,000 | $582,250 |
| Other County Roads | 2 | 40% | 1 | $200,000 | $166,000 |
| Residential Properties Priority Neighborhoods[5] | 6 | 30% | 2 | $298,000 | $578,120 |
| Non-residential Property without adequate treatment | 0 | 40% | 0 | $298,000 | $0 |
| **Totals** | **14** | | **7** | | **$1,326,370** |

*Restoration target was based on a judgment of the maximum extent practicable considering physical constraints to ESD/LID

**Unit Cost was derived from an equal mix of green roofs, cisterns, permeable paving, and bioretention BMPs according to the Guidance Document.

[1] Parking lots located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.

[2] Buildings located in County-owned parcels, derived using County_pnts from the County's PROPERTY geodatabase.

[3] Impervious cover located in public school parcels, derived using pubsch points from the County's LOCATIONS geodatabase. Some overlap with other impervious.

[4] All roads in RE2 or R200 property zoning.

[5] Rooftop area in High and Medium Priority Neighborhoods

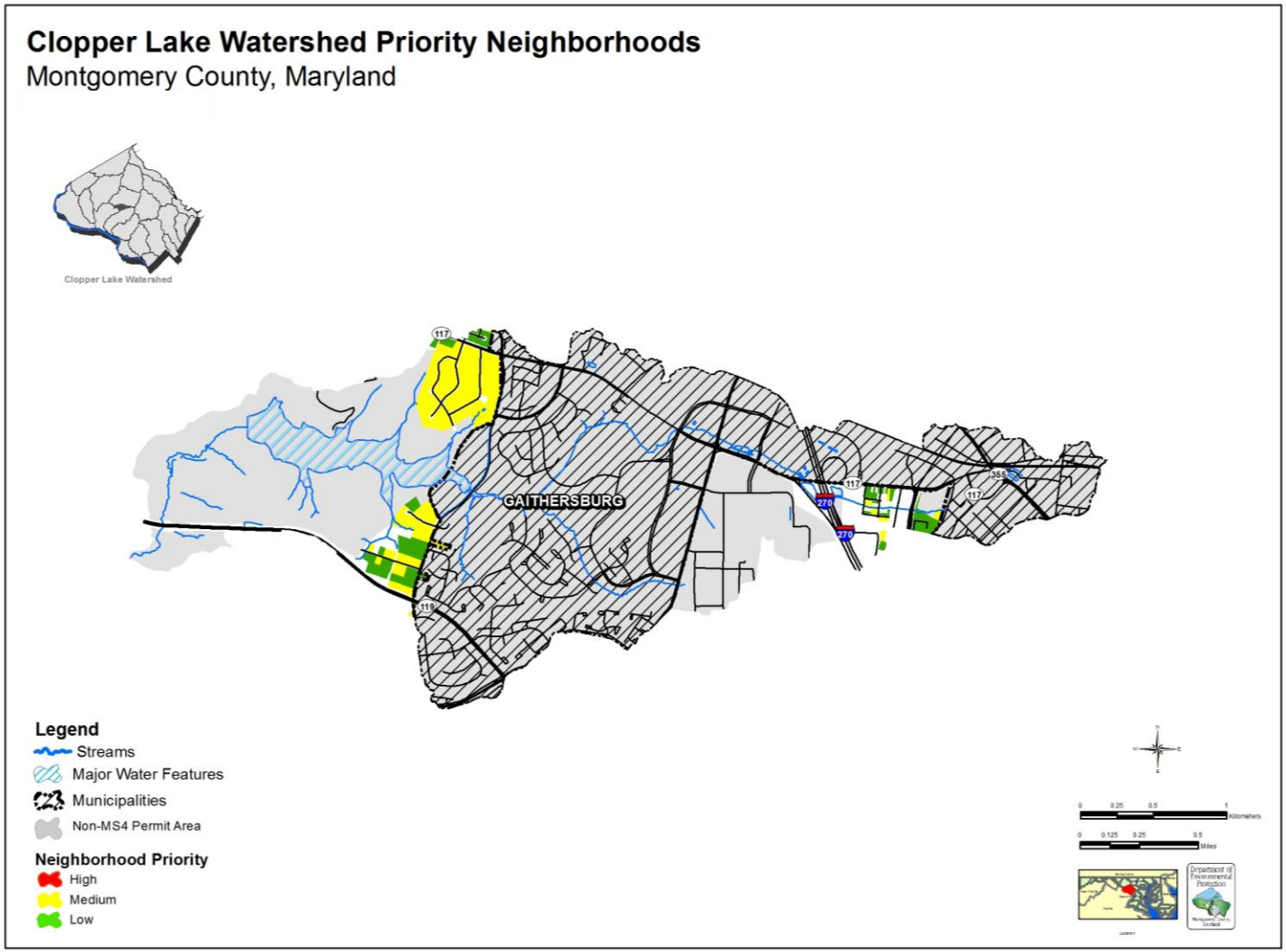



Figure 4: Clopper Lake Priority Neighborhoods

### WTM 4.0 – Habitat Restoration

Other projects on public lands and other practices that are identified in Appendix B of the Guidance Document were explored. For Clopper Lake, the load reduction potential of riparian reforestation projects was modeled. The total amount of unforested 100-ft buffer along streams was computed and then the land use area was converted to forest area in Future Management Practices (see Table B.13 of the Guidance Document, and summary of areas in Table 19 below). One-hundred percent implementation of riparian reforestation across the total area was assumed.

Because no stream restoration projects were identified for the County's MS4 permit area for Clopper Lake, the benefits of stream restoration projects were not evaluated. There are a significant number of stream restoration projects in other portions of the Great Seneca subwatershed, however, and further modeling effort could show additional pollutant load reductions from these stream projects.

**Outreach and Stewardship Strategy**
**Future Strategy:**
If further modeling were to indicate additional pollutant load reductions, then additional outreach and stewardship is recommended on stream restoration described in the Practice Sheet entitled Stream Stewards Outreach and Stewardship Campaign.

**Potential Partnerships:**
To support riparian reforestation efforts, it is recommended that the DEP consider working with the City of Gaithersburg and MNCPPC, to encourage buffer installation on private property through volunteer days and County Community Service as described in the Practice Sheet entitled Riparian Reforestation Outreach and

Table 19: Summary of land use categories within the 100-ft buffer area of County streams in Clopper Lake.

| ***MdOP 2002 Land Cover/Land Use*** | ***Watershed*** | ***Total Buffer Area*** | |
|---|---|---|---|
| | ***Acres*** | ***Unforested Area (acres)*** | ***Forested Area (acres)*** |
| **Low Density Residential** | 70 | 2.0 | 2.5 |
| **Medium Density Residential** | 54 | 0.2 | 0.1 |
| **High Density Residential** | 47 | 5.8 | 2.8 |
| **Commercial** | 2 | 0.2 | 0.0 |
| **Industrial** | 0 | 0.0 | 0.0 |
| **Municipal/Institutional- Intensive** | 6 | 0.2 | 0.0 |
| **Total Watershed[1]** | **177.9** | **8.4** | **5.4** |
| **Total Cost[2]** | | **$167,200** | |

[1] Includes additional areas, not shown, including Extensive Municipal/Institutional, rural, and forested areas not targeted for riparian reforestation
[2] Assumes $20k per acre reforestation

**WTM 5.0 – Programmatic Practices**
MS4 programmatic practices identified in Appendix B of the Guidance Document were also examined. For Clopper Lake, this was limited to lawn care and pet waste education, which we have collectively classified as Residential Education.

The potential reduction in load was calculated using the WTM Lawn Care and Pet Waste Education/Future Management Practices, which requires the number of acres of lawn (estimated under Primary Sources) as a percentage of land use type. Default WTM discounts based on residential surveys assume that 80% of lawn areas are fertilized, 65% of those areas are "over fertilized," and 70% of owners would be willing to change their behavior. Default WTM discounts for pet waste include an assumed 40% of households with dogs, 50% of owners who walk their dogs, 60% of owners who currently clean up after their pets, and 60% of owners willing to change their behavior.

**Outreach and Stewardship Strategy Methods of Obtaining Information:** Given that overall Montgomery County has a well educated population and given that there are a great number of residences in this watershed, it is assumed that most of the stakeholders in this watershed have access to a personal computer and thus can be reached through electronic messaging and social media. Further, given that resident surveys have indicated that the majority of Montgomery County residents prefer newspapers as their primary source of information, a vigorous press campaign is recommended in this watershed for effective stakeholder outreach and education.

These default values may be high given the large percentage of apartment complexes in the area. We assume a high fraction (0.8) of the population could be targeted with effective educational messages, which for Clopper Lake targets every household within the watershed at a cost of $15 per household. The potential load reductions from the residential education program are shown in Table 20 25 (Schueler 2005 – USRM #2 Table 47).

Table 20: MS4 Programmatic Practices in Clopper Lake

| ***Strategy*** | ***Units*** | ***Potential Phosphorus Reduction (lbs/yr)*** | ***Unit Cost*** | ***Total Cost*** |
|---|---|---|---|---|
| Lawn Care | 119 lawn acres | 13 | $15 per du | $11,925 |
| Pet Waste | 795 dwellings | 27 | | |

The County should document and collect information from all pet waste removal companies to identify how much pet waste is being collected and disposed of properly. As part of this documentation, there should be incentives provided to residents to use these pet waste removal companies, purchasing/using pet waste bags, and incentives to HOA's to install and maintain pet waste trash receptacles with plastic bags. Incentives should be provided to lawn care companies to reduce the over fertilizing of lawns.

## 3.3 Preliminary Results of Total Phosphorus Load Reduction Analysis for Clopper Lake

The WTM was run iteratively using a series of spreadsheets for each step outlined above. Initially, the WTM was coded with the existing land use and BMP database to calculate the baseline load. As described, the model was calibrated to establish a baseline load consistent with the TMDL. Since the targeted WLA was a 45% reduction from the baseline, the reduction was applied to our WTM computed baseline of 131 lbs/yr TP to establish a target of 71 lbs/year TP load for restoration efforts. From there, the iterative approach was used to track progress as shown in Table 21.

**Table 21**: Preliminary Results of WTM Modeling for Clopper Lake

| ***Implementation Phase*** | ***Total Phosphorus*** *% reduction from baseline* | ***Comments*** | ***Cumulative Cost*** *Million $* |
|---|---|---|---|
| **WTM Baseline Load** | **0%** | **Calibrated to MDE Baseline Load** | - |
| **WTM 2.0** | 0% | **Complete, High Priority, Low Priority and Other Potential Projects** | - |
| **WTM 3.0** | 14% | **ESD Strategies and Other Structural BMPs** | $ 1.30 |
| **WTM 4.0** | 18% | **Habitat Restoration** | $ 1.47 |
| **WTM 5.0** | 48% | **MS4 Programmatic Practices** | $ 1.48 |
| **TMDL WLA** | 45.4% | | |

The restoration strategy is further illustrated in where the implementation phases are shown in order with their resulting TP load in comparison to the WLA. The cost for each implementation phase is also shown. The greatest reduction and most cost efficient strategy is attributed to residential education under MS4 Programmatic Practices, shown in Table 22.

**Outreach and Stewardship Strategy Education Project:**
Stakeholder outreach on the importance of pet waste pick up anywhere a pet may go is recommended. Partnerships for implementation should be fostered between homeowner associations and pet product retailers and service industry. Implementation details are in the Practice Sheet entitled Pet Waste Pickup Education Outreach. Stakeholder outreach on proper lawn care is also recommended in partnership with HOAs, garden retailers, and master gardeners and the City of Gaithersburg. Implementation details are in the Practice Sheet entitled Lawn Stewardship Outreach and Stewardship Campaign.

Table 22: Individual restoration strategy cost effectiveness for TP load reduction in Clopper Lake

| ***Rank*** | ***Restoration Strategy*** | ***TP Reduction*** (lbs/yr) | ***Incremental Cost*** (Million $) | ***Unit Cost*** (lbs/yr/Million $) |
|---|---|---|---|---|
| 1 | MS4 Program/Residential Education | 33 | 0.01 | 6,246 |
| 2 | Underperforming BMP Retrofits | 13 | 0.04 | 341 |
| 3 | Buffer Reforestation | 19 | 0.17 | 112 |
| 4 | Private, Residential ESD Retrofits | 15 | 0.51 | 35 |
| 5 | County Property ESD Retrofits | 7 | 0.75 | 9.9 |

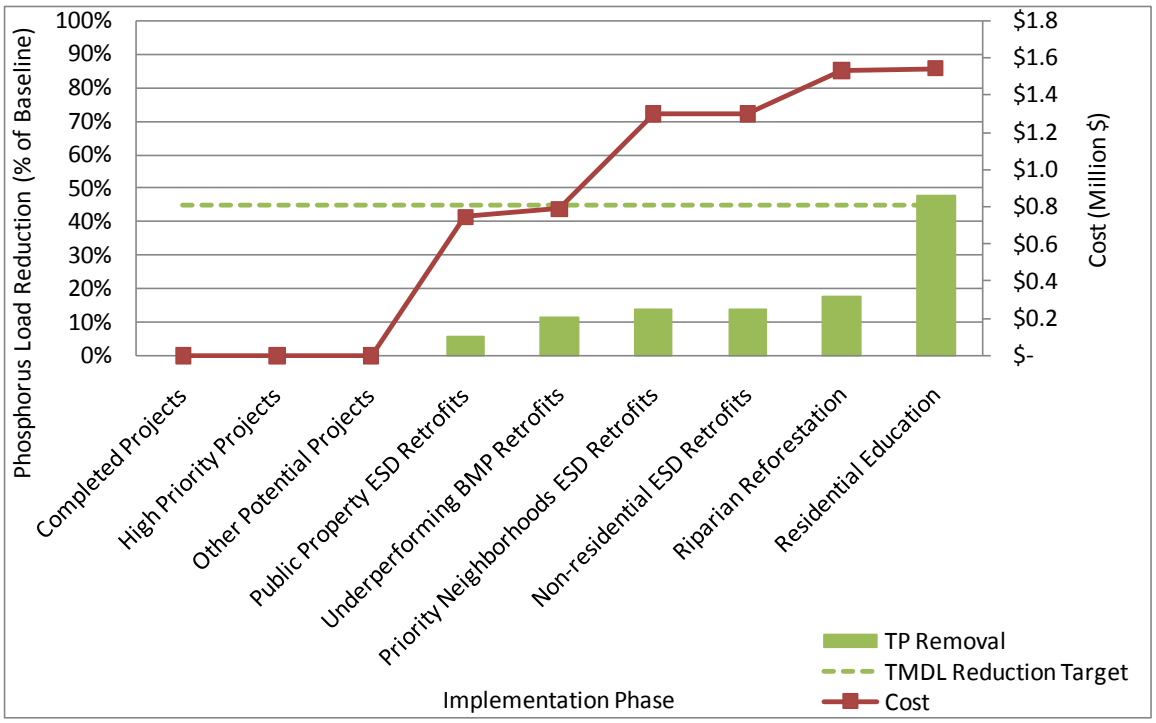



**Figure 5:** TP loading over restoration implementation phase

## 3.4 Trash Reduction and Other Pollutant Load Tracking

Trash and non-TMDL pollutant reductions were also tracked using the WTM. Overall, the TN, TP, TSS, and trash loads in Great Seneca were reduced by 26%, 26%, 29%, and 34%, respectively. For Clopper Lake specifically, TN, TSS, and trash loads were reduced 79%, 17%, and 18%, respectively. Reductions from a baseline condition are provided in Table 23.

Table 23: Preliminary Sediment and Nutrient Results of WTM Modeling for Great Seneca and Clopper Lake

| ***Implementation Phase*** | ***% Reduction from Baseline Load*** | | | | ***Cumulative Cost*** |
|---|---|---|---|---|---|
| | *TN* | *TP* | *TSS* | *Trash* | *Million $* |
| **Great Seneca** *(inclusive of Clopper Lake)* | | | | | |
| **WTM 1.0—Baseline Load** | **0%** | **0%** | **0%** | **0%** | **$0** |
| **WTM 2.0—Completed Projects** | 1% | 1% | 1% | 2% | $0.59 |
| **WTM 2.1—High Priority Projects** | 20% | 20% | 22% | 26% | $18.89 |
| **WTM 2.2—Low Priority and Other Potential Projects** | 26% | 26% | 29% | 34% | $25.69 |
| **Clopper Lake** | | | | | |
| **WTM 1.0—Baseline Load** | **0%** | **0%** | **0%** | **0%** | **$0** |
| **WTM 2.0—Completed, High Priority, Low Priority and Other Potential Projects** | 0 | 0 | 0 | 0 | $0 |
| **WTM 3.1—County Property ESD Retrofits** | 6% | 6% | 6% | 7% | $0.75 |
| **WMT 3.2—Underperforming BMP Retrofits** | 11% | 11% | 12% | 12% | $0.79 |
| **WTM 3.3—Priority Neighborhoods** | 14% | 14% | 15% | 14% | $1.30 |
| **WTM 3.4—Non-residential Retrofits** | 14% | 14% | 15% | 14% | $1.30 |
| **WTM 4.0—Habitat Restoration** | 18% | 18% | 17% | 18% | $1.47 |
| **WTM 5.0—MS4 Programmatic Practices** | 79% | 48% | 17% | 18% | $1.48 |

Figures 6 and 7 illustrate the cumulative cost of implementing completed, current (FY2009-2016), and other potential BMPs to achieve pollutant load and trash reductions in Great Seneca and Clopper Lake, respectively. Since the same core restoration strategies are outlined for reduced pollutant loads, the cost for implementation of trash reduction also remains generally the same. Increased reductions (and costs) could be included if stream restoration projects were also incorporated into the restoration strategy analysis.

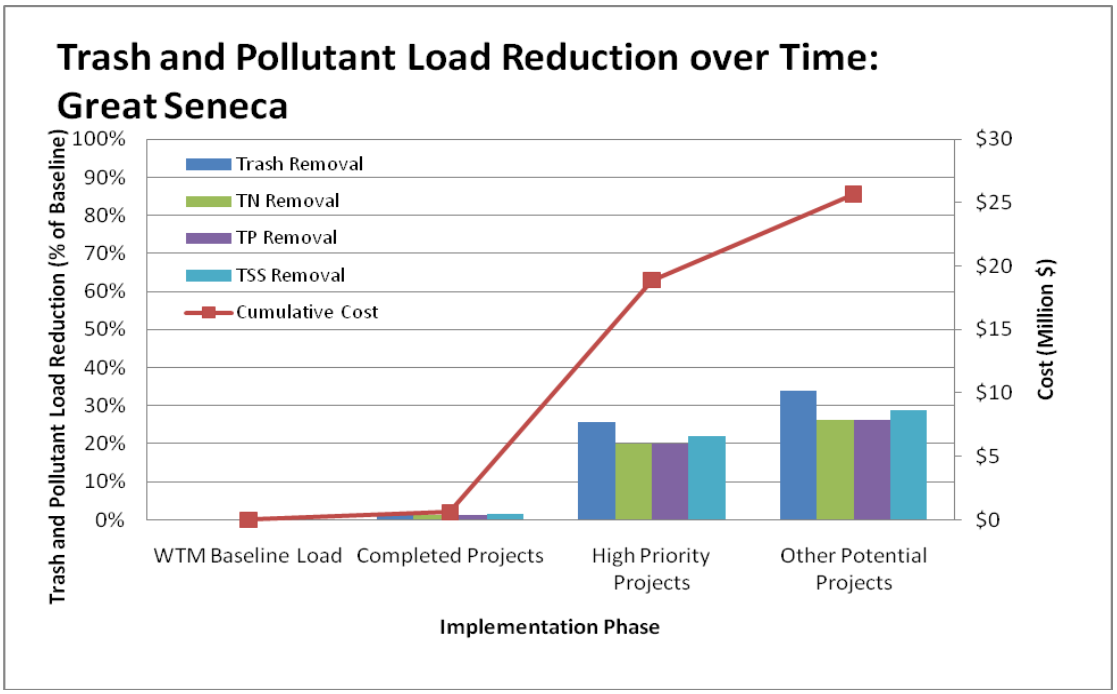



Figure 6: Trash and pollutant load reduction over time and associated costs for Great Seneca modeled using the WTM

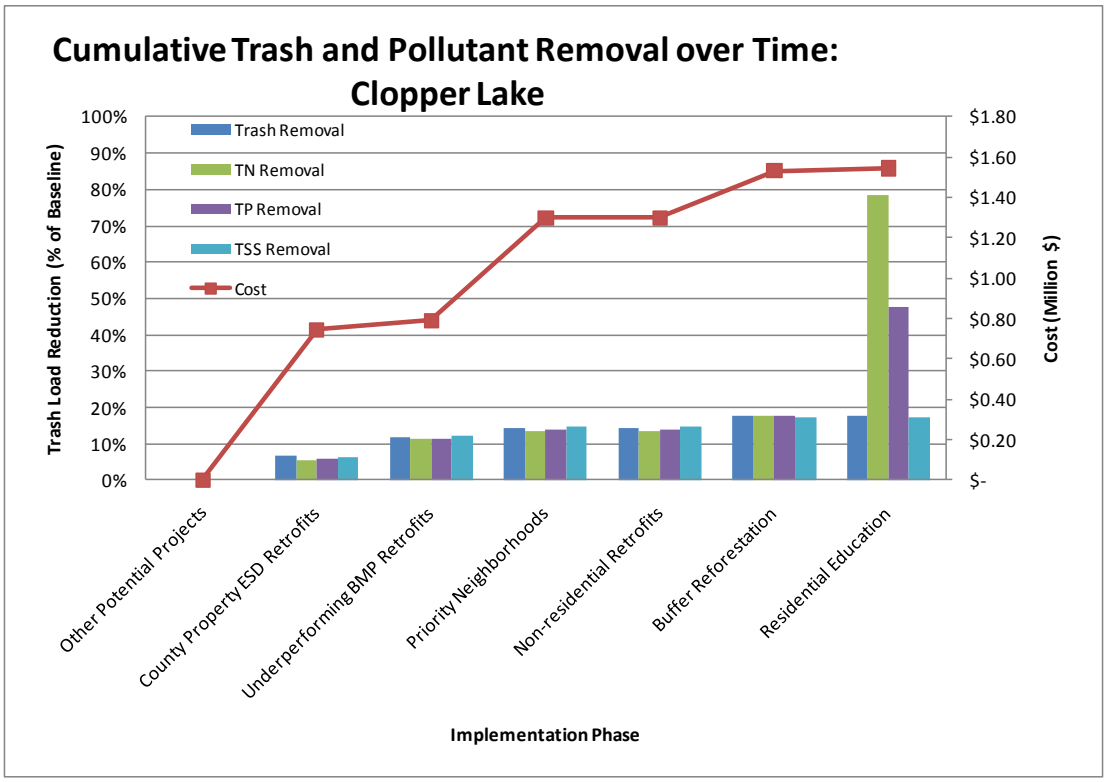



Figure 7: Trash and pollutant load reduction over time and associated costs for Clopper Lake using the WTM

# 4 Action Inventory Implementation Schedule

## 4.1 Summary of Watershed Restoration Strategies Recommended for the Great Seneca subwatershed and Clopper Lake

The implementation schedules summarized in Tables 24 and 25 are action inventory matrices that identify priorities and timeframes for implementation of the above identified watershed restoration strategies as a function of project synergies and expected funding levels countywide. In future permit cycles, the remainder of the other potential projects are targeted.

This watershed implementation plan is unique in that it includes the small Clopper Lake subwatershed which has a phosphorus TMDL. There are limited identified opportunities to pursue in the Clopper Lake subwatershed. During the first permit cycle (through 2015), a priority was placed on full implementation of complete, high and low priority projects within Great Seneca Creek subwatershed (Table 24). A list of the high and low priority projects is provided in Appendix A. Next, 25% implementation of other potential projects was targeted. No opportunities exist for these strategies in Clopper Lake (Table 25). However, full outreach was applied in Clopper Lake in the first permit cycle. In future years, other potential projects are completed in Great Seneca (Table 26). ESD on public and private property and a small amount of riparian reforestation in Clopper Lake is pursued. The Clopper Lake WLA for phosphorus within the MS4 permit area is met by 2025 (Table 27).

**Table 24: Summary of the Implementation Plan Schedule for the Great Seneca Subwatershed, for the 2015 Fiscal Period, with expected level of ESD and pollutant load reductions**

| *Sub-watershed* | *Strategies* | *% Complete in Permit Cycle* | *IC Treated (acres)* | *ESD (% IC)* | *Cost (Million $)* | *ESD (% Cost)* | *% Reduction from baseline* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *TN* | *TP* | *TSS* | *Bacteria* | *Trash* |
| *Great Seneca* | *Completed and High Priority Projects* | 100.0% | 800 | 1% | $19 | 6% | 20.0% | 20.0% | 21.0% | 0.0% | 26.0% |
| | *Low Priority Projects* | 100.0% | 87 | 15% | $7 | 41% | 3.7% | 3.7% | 4.3% | 0.0% | 4.3% |
| | *Other Potential Projects* | 25.0% | 13 | 0% | $0 | 0% | 0.6% | 0.6% | 0.7% | 0.0% | 0.7% |
| | *Public ESD Retrofits* | 0.0% | - | 100% | $0 | 100% | - | - | - | - | - |
| | *Private ESD Retrofits* | 0.0% | - | 100% | $0 | 100% | - | - | - | - | - |
| | *Riparian Reforestation* | 0.0% | - | 0% | $0 | 0% | - | - | - | - | - |
| | *Stream Restoration* | 0.0% | - | 0% | $0 | 0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | *Programmatic Practices* | 100.0% | - | 0% | $0 | 0% | - | - | - | - | - |
| | ***Subtotal*** | ***95.8%*** | ***901*** | ***2.2%*** | ***$26*** | ***15.2%*** | ***24.3%*** | ***24.3%*** | ***26.0%*** | ***0.0%*** | ***31.0%*** |

*IC: Impervious Cover*
*ESD: Environmental Site Design*
*TN: Total Nitrogen*
*TP: Total Phosphorus*
*TSS: Total suspended solids*

**Table 25: Summary of the Implementation Plan Schedule for the Clopper Lake Subwatershed, for the 2015 Fiscal Period, with expected level of ESD and pollutant load reductions**

| *Sub-watershed* | *Strategies* | *% Complete in Permit Cycle* | *IC Treated (acres)* | *ESD (% IC)* | *Cost (Million $)* | *ESD (% Cost)* | *% Reduction from baseline* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *TN* | *TP* | *TSS* | *Bacteria* | *Trash* |
| *Clopper Lake* | ***Completed and High Priority Projects*** | 100.0% | - | 0% | $0 | 0% | - | - | - | - | - |
| | ***Low Priority Projects*** | 100.0% | - | 0% | $0 | 0% | - | - | - | - | - |
| | ***Other Potential Projects*** | 0.0% | - | 0% | $0 | 0% | - | - | - | - | - |
| | ***Public ESD Retrofits*** | 0.0% | - | 100% | $0 | 100% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | ***Private ESD Retrofits*** | 0.0% | - | 100% | $0 | 100% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | ***Riparian Reforestation*** | 0.0% | - | 0% | $0 | 0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | ***Stream Restoration*** | 0.0% | - | 0% | $0 | 0% | - | - | - | - | - |
| | ***Programmatic Practices*** | 100.0% | - | 0% | $0.01 | 0% | 61.0% | 30.0% | 0.0% | 0.0% | 0.0% |
| | ***Subtotal*** | ***0.0%*** | ***-*** | ***0.0%*** | ***$0.0*** | ***0.0%*** | ***61.0%*** | ***30.0%*** | ***0.0%*** | ***0.0%*** | ***0.0%*** |

*IC: Impervious Cover*
*ESD: Environmental Site Design*
*TN: Total Nitrogen*
*TP: Total Phosphorus*
*TSS: Total suspended solids*

**Table 26: Summary of Implementation Plan schedule for the Great Seneca Subwatershed with expected TMDL compliance endpoints**

| Sub-watershed | Fiscal Year | | 2015 | 2017 | 2020 | 2025 | 2030 | TMDL WLAs |
|---|---|---|---|---|---|---|---|---|
| Great Seneca | Impervious Treated (acres) | | 901 | 921 | 941 | 941 | 941 | *None* |
| | ESD (% Impervious) | | 2% | 2% | 2% | 2% | 2% | |
| | Cost (Million $) | | 26 | 48 | 50 | 51 | 52 | |
| | ESD (% Cost) | | 15% | 8% | 8% | 8% | 8% | |
| | % Reduction from baseline | TN | 24% | 41% | 43% | 44% | 45% | |
| | | TP | 24% | 32% | 34% | 34% | 34% | |
| | | TSS | 26% | 41% | 43% | 44% | 44% | |
| | | Bacteria | 0% | 0% | 0% | 0% | 0% | |
| | | Trash | 31% | 32% | 33% | 33% | 33% | |

*TN: Total Nitrogen*
*TP: Total Phosphorus*
*TSS: Total suspended solids*
*WLA: Waste Load Allocation*

**Table 27: Summary of Implementation Plan schedule for the Clopper Lake Subwatershed with expected TMDL compliance endpoints**

| Subwatershed | Fiscal Year | | 2015 | 2017 | 2020 | 2025 | 2030 | TMDL WLAs |
|---|---|---|---|---|---|---|---|---|
| Clopper Lake | Impervious Treated (acres) | | 0 | 6 | 12 | 22 | 22 | 45.4% |
| | ESD (% Impervious) | | 0% | 86% | 86% | 92% | 92% | |
| | Cost (Million $) | | 0 | 0 | 1 | 2 | 2 | |
| | ESD (% Cost) | | 0% | 72% | 73% | 84% | 84% | |
| | % Reduction from baseline | TN | 61% | 67% | 72% | 79% | 79% | |
| | | TP | 30% | 36% | 41% | 48% | 48% | |
| | | TSS | 0% | 5% | 10% | 17% | 17% | |
| | | Bacteria | 0% | 0% | 0% | 0% | 0% | |
| | | Trash | 0% | 6% | 11% | 18% | 18% | |

*TN: Total Nitrogen*
*TP: Total Phosphorus*
*TSS: Total suspended solids*
*WLA: Waste Load Allocation*

# 5 References

Army Corps of Engineers (USACE). 2009. Great Seneca Creek/Muddy Branch Watershed Ecosystem Restoration Project Montgomery County, MD. Feasibility Scoping Meeting Read Ahead Materials. Baltimore District. Baltimore, MD. February.

Caraco, D. 2009. *New WTM – No Projections.xls*, Personal Email Communication, October 14, 2009.

Caraco, D. 2001. The Watershed Treatment Model: Version 3.0. U.S. Environmental Protection Agency, Region V. Center for Watershed Protection. Ellicott City, MD.

Center for Watershed Protection (CWP) and Chesapeake Stormwater Network (CSN). 2008. *Technical Memorandum: The Runoff Reduction Method*. Ellicott City, MD.

Center for Watershed Protection (CWP). 2007. *National Pollutant Removal Performance Database Version 3.0*. Center for Watershed Protection, Ellicott City, MD.

Chesapeake Bay Program (CBP) Nutrient Subcommittee. 2008. Infiltration and Filtration Practices: Definition and Nutrient and Sediment Reduction Effectiveness Estimates. Center for Watershed Protection, Ellicott City, MD.

Chesapeake Stormwater Network (CSN) and Biohabitats. 2011. *Implementation Plan Guidance Document*. Prepared for Montgomery County Department of Environmental Protection, Rockville, MD.
http://www.montgomerycountymd.gov/dectmpl.asp?url=/Content/dep/water/esdStrategy.asp

Maryland Department of the Environment (MDE). 2010. *Memorandum: 2010 Status of Approved Stormwater Wasteload Allocations for NPDES Regulated Stormwater Entities in Montgomery County*. Baltimore, MD: Maryland Department of the Environment.

MDE. 2009. *Technical Memorandum: 2009 Status of Approved Stormwater Wasteload Allocations for NPDES Regulated Stormwater Entities in Montgomery County*. Baltimore, MD.

MDE. 2002. *Total Maximum Daily Loads for Phosphorus and Sediment for Clopper Lake, Montgomery County, MD*.

Montgomery County Department of Environmental Protection (DEP). 2006. Watts Branch Watershed Restoration Study. A. Morton Thomas and Associates, Inc., Rockville, MD and Biohabitats, Inc. Baltimore, MD.

Schueler, T. 1998. The performance of oil grit separators in removing pollutants at small sites. Technical Note 119. *Watershed Protection Techniques*. 2(4): 539-542. See also Technical Note 120.

# Appendix A – List of High and Low Priority Projects

High and Low Priority Project List - Great Seneca Creek Watershed

| Project Type | Project Name |
|---|---|
| Environmental Site Design (ESD) | Abandoned Vehicle Services |
| | Damascus Park & Ride |
| | Germantown MARC Rail Park& Ride |
| | Kingsview Park & Ride |
| | Laytonsville Elementary School |
| | Plum Gar Neighborhood Recreation Center |
| | Ridgeview Middle School |
| | Upcounty Regional Services Center |
| | Upper County Recreation Center / Pool |
| Stormwater Pond Retrofit | Bridalwood/Fernshire Farms |
| | Cabin Branch No. 2 Regional (Lois Y. Green CP) |
| | Chadswood |
| | Charlene/Harkness Lane |
| | Cinnamon Woods (Homes Association) |
| | Cinnamon Woods (Homes Association) - North Pond |
| | Cinnamon Woods (Homes Association) - South Pond |
| | Clearspring Manor |
| | Cloppers Mill West (Cloppers Mill West CA) |
| | Colony Pond Regional (Old Seneca Woods CA) |
| | DuVall Manor (County View) |
| | East Village (Montgomery Village Foundation) |
| | Flower Hill I Regional |
| | Flower Hill II Regional |
| | Gaithersburg Square/Comp USA |
| | Germantown View (Seneca Forest HOA) |
| | Goshen East |
| | Gunners Lake Village |
| | Hunters Woods (Access Chesley Knoll Drive, Blue Smoke Court) |
| | Kings Bridge (HOA) |
| | Lake Marion (Montgomery Village Foundation) |
| | Lake Walker |
| | Lake Whetstone |
| | M/A Comm DCC (Hughes Network Systems, Inc.) |
| | Meadowvale |
| | Montgomery County Airpark |
| | Montgomery Village Golf Course (Greentree) |
| | Montgomery Village Local Park (Salems Grant) |
| | Montgomery Village/Horizon Run |
| | North Creek Lake |
| | Quail Valley Pond 2 |
| | Quince Orchard Valley (Orchard Valley HOA) |
| | Stewartown Homes |
| | The Plantations |
| | Valley Park (Magruder Branch SVU) |
| | Victory Farms |
| | Watkins Meadow (Great Seneca SVU) |