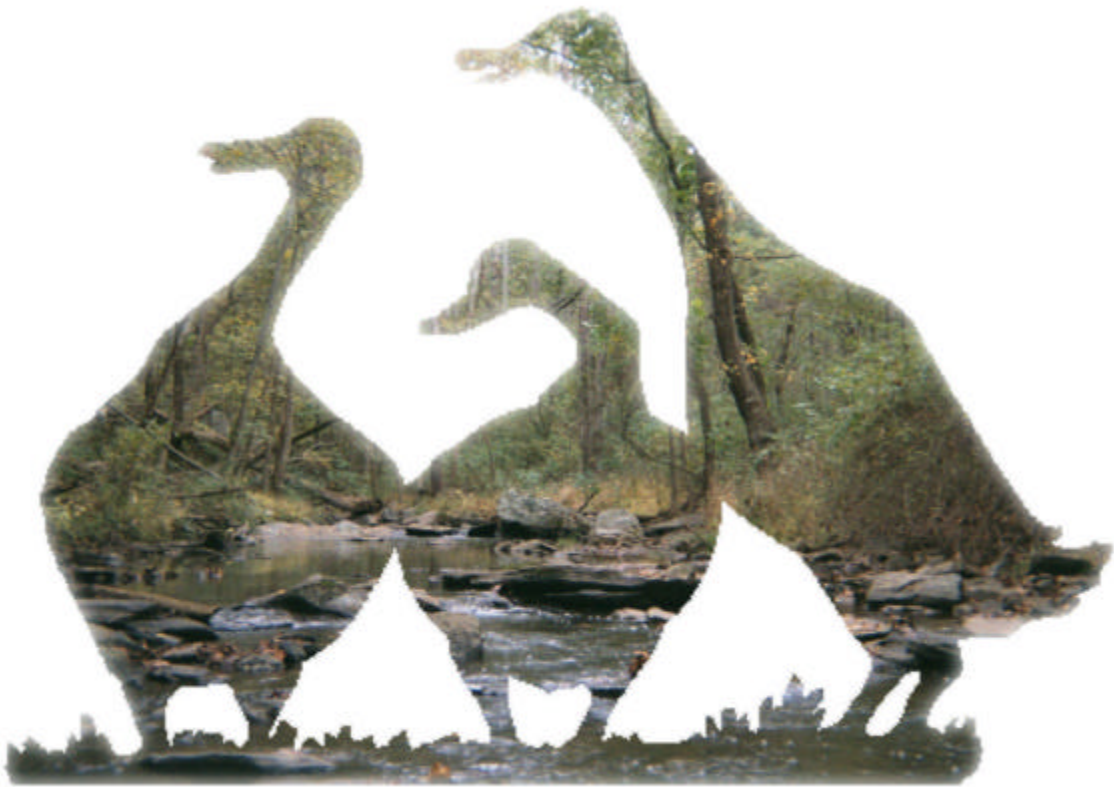


Goose Creek Demonstration Subwatershed Plans

Assessment and Recommendations for Three Subwatersheds within
the Goose Creek in Northern Virginia



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GOOSE CREEK DEMONSTRATION SUBWATERSHED PLANS

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EXECUTIVE SUMMARY

A mix of country hillsides, farms, homes, parks and historic places, Goose Creek is a significant area of natural and historic beauty within the Virginia Piedmont. The Goose Creek Demonstration Subwatershed Plans were designed with two primary goals in mind. The first is to provide baseline information on three specific subwatersheds and recommend priorities and steps for implementing protection and restoration activities within these subwatersheds. The second is to provide a framework for conducting future field studies to complete the remaining 37 subwatersheds for Goose Creek.

The Goose Creek Demonstration Subwatershed Plans are the third part of a three-part study of the Goose Creek Watershed. The Vulnerability Analysis was the first part of this study and consisted of an impervious cover analysis, collection of available stream and land use data, and the subsequent classification of the subwatersheds into High Quality, Rural Impacted, Urban Impacted, and Non-Supporting. The second part of the study consisted of field analyses on three specific subwatersheds—Goose Headwater 105, North Fork 102, and North Fork Upper Direct Drainage. This third and final part of the study includes results from the field data with a review of existing programs that potentially impact the protection and restoration of these same three subwatersheds.

The Goose Creek Demonstration Subwatershed Plans were developed with the rapid watershed planning concept in mind. The rapid watershed approach combines subwatershed scale, impervious cover, and eight tools of watershed protection into a rapid, simple, and inclusive approach. To this end, desktop assessments were focused on readily available mapping and monitoring data and did not incorporate complex modeling efforts. Similarly, the fieldwork conducted as part of the plans included simple stream habitat assessment and a forest conservation assessment. The fieldwork was conducted within one week and helped lead to specific management recommendations. From start to finish, the project represents approximately 15 months of work.

Goose Headwater 105, North Fork 102, and North Fork Upper Direct Drainage represent three different types of subwatersheds within the Goose Creek. They were chosen based on their vulnerability to future land use changes. Goose Headwater 105 is currently classified as High Quality and North Fork 102 and North Fork Upper Direct Drainage are Rural Impacted. While Goose Headwater 105 is expected to remain High Quality, North Fork 102 is expected to remain Rural Impacted and North Fork Upper Direct Drainage is expected to become Urban Impacted. (See Goose Creek Vulnerability Analysis for full explanation of subwatershed types and selection process.)

Field studies verified the findings of the Vulnerability Analysis and allowed for the identification of specific information about opportunities for protection and restoration. In Goose Headwater 105, rolling hills, significant forest, horse and cattle farms, orchards, and a winery can be found within the subwatershed. Subwatershed and stream impacts from the Norfolk Southern Railroad, Route I-66, and agricultural activity, were observed in several areas. North Fork 102 forms the westernmost boundary of Loudoun County and includes the historic Round Hill. Field studies indicated mixed

stream conditions, significant areas of contiguous forest, and the presence of three man-made dams. Features within the North Fork Upper Direct Drainage include a vineyard, two wastewater treatment plants, several specimen trees, stretches of inadequate stream buffers, cattle and horse impacts, and stream erosion.

Three layers of recommendations are included in this document. The first set includes larger-scale watershed-wide recommendations. The second set includes county-wide recommendations developed primarily from the Program Review. The third set includes smaller-scale recommendations targeted specifically to the three individual subwatersheds analyzed in detail as part of this project. In many cases, the watershed and county-wide recommendations directly or indirectly support the subwatershed scale recommendations.

The implementation plan prioritizes both larger-scale and individual recommendations and describes typical unit costs associated with a recommendation. Recommendations are described as follows. The first section highlights two urgent and time sensitive projects. The second section provides a prioritization of overall watershed recommendations. The third section discusses land preservation goals (across subwatersheds). The fourth section prioritizes subwatershed recommendations within each subwatershed, focusing on targeted outreach and individual restoration projects.

Summary of Watershed-wide and Conservation Priority Recommendations			
Project Priority	Location	Description	Expected Costs
URGENT	NF 102	Preservation Round Hill tract.	\$1,200/acre
HIGH	Watershed-wide	Develop an implementation committee.	Low
	Watershed-wide	Revised codes to protect natural areas.	Low
	Watershed-wide	Target natural resources with easements.	Very Low
	Watershed-wide	Establish mountainside initiative.	High
	Watershed-wide	Follow-up monitoring in three subwatersheds.	Low
	Watershed-wide	Coordinate education efforts.	Very Low
	Watershed-wide	Distribute funding information for agriculture.	Very Low
	HW 105-C4	Preserve parcels adjacent to Appalachian Trail.	To be calculated
	HW 105-C4	Preserve parcels near G. Richard Thompson.	To be calculated
	NF 102-C3	Preserve Round Hill zoned R-20.	To be calculated
	NF 102-C2	Preserve Mountain North.	To be calculated
NF 102-C1	Preserve Mountain South.	To be calculated	
MODERATE	Watershed-wide	Improve septic system regulations and illicit discharges.	Moderate
	Watershed-wide	Continue subwatershed planning.	Very High (can be phased)
	HW 105-C5	Preserve areas south of Route 66.	To be calculated
	HW 105-C6	Preserve areas south of Route 66 near the Appalachian Trail.	To be calculated
	HW 106-C6	Preserve other areas south of Route 66.	To be calculated
	Watershed-wide	Preserve large parcels as conservation areas.	To be calculated
*Locations such as HW105-C3 indicate the subwatershed (Goose Headwater 105) followed by the conservation area site identification number (C3).			

Summary of Subwatershed Priority Recommendations			
Project Priority	Description	Project Locations	Expected Costs
URGENT	Sediment cleanup at construction site. Investigate.	HW105-5	To be calculated
HIGH	Agricultural Education	HW105 All, NF102 All	Low
	Encroachment Education	HW105-101	Low
	G. Thompson Wildlife Management Area	HW105-102	Very Low
	Indian Pipe Education Camp	HW105-102	Very Low
	Railroad Management	HW105-105, HW105-201	Very Low
	Defunct Mine Landowner	HW105-201	Low
	Hog Farm	HW105-103	Very Low
	Restoration	HW105-2, HW105-3, HW105-4, HW105-8, HW105-9, HW105-13, HW105-14, NF102-1, NF102-3, NF102-6, NF102-8, NF102-11, NFUpDD-1, NFUpDD-3, NFUpDD-6, NFUpDD-8, NFUpDD-11	To be calculated
	Homeowner Education	NF102 All	Low
	Outreach to Developers	NF102 All	Low
	Conservation Easement Buffers	NF102-101	Low
	Golf Course	NF102-201	Low
	Land Owner Engagement	NF102-102, NF102-104	Very Low
	Special Wetland Outreach	NF102-103	Very Low
	Sleeter Lake	NF102-201, NF102-105	Low
	Homeowner Buffer Education	NFUpDD All	Low
	Agricultural Buffer Education	NFUpDD All	Low
	Better Site Design for Purcellville	NFUpDD All	Low
	Nursery	NFUpDD-101	Very Low
	Manure Storage	NFUpDD-102	Very Low
MODERATE	Vineyard	HW105-102	Low
	In-stream ornamental pond	HW105-101	Very Low
	Debris jam	HW105-101	Very Low
	Restoration	HW105-6, HW105-7, HW105-10, HW105-12	To be calculated
	Adopt-A-Pond	NF102-201	Low
	Loudoun County Golf Course	NFUpDD-101	Low
	Purcellville WWTP Sludge Field	NFUpDD-102	Low
Low	Restoration	HW105-1, HW105-11, NF102-2, NF102-4, NF 102-5, NF102-7, NF102-9, NF 102-10, NFUpDD-2-101, NFUpDD-4 NFUpDD-5, NFUpDD-7, NFUpDD-9, NFUpDD-10	To be calculated
<p>*Project locations such as HW105-4 indicate the subwatershed (Goose Headwater 105) followed by the site identification number (4).</p> <p>**Project locations such as NF102-201 indicate the subwatershed (North Fork 102) followed by the catchment (201).</p>			

HOW TO USE THIS DOCUMENT

This document presents three subwatershed plans including an initial assessment and both general and specific recommendations for implementation. Part I provides background information including descriptions of watershed goals and subwatershed objectives; an introduction to the three subwatersheds and the basic concepts behind the rapid watershed planning approach; and a list of key recommendations. Part II is the plan for Headwater 105. Part III is the plan for North Fork 102, and Part IV is the plan for North Fork Upper Direct Drainage. The final section, Part V, provides an implementation plan including individual and overall recommendations.

To allow watershed managers to focus activities for one specific subwatershed, each subwatershed plan is almost entirely self-contained with the exception of the background information in Part I. Each subwatershed plan is divided into five sections. The first provides an introduction to the subwatershed. The second provides a list of subwatershed objectives; the third section outlines key findings from the subwatershed field assessments; the fourth section makes recommendations based on the assessment; and the fifth section provides more detailed information for each of the catchments within the subwatershed.

Part V, the implementation plan, provides priorities for major plan recommendations at the watershed level and assigns some unit costs associated with these recommendations. Although this part of the document does not provide detail on specific practices, it is the only location in the report that outlines all the individual practices and creates a priority for their implementation.

The appendices include the supporting full-color maps and additional detailed information. Data sheets from the fieldwork, a copy of the program review document, information on streamside restoration practices, and streamside planting guidance are provided.

Terms Used in the Subwatershed Plans

Most of the terminology is fairly transparent within the subwatershed plans and a few terms were used to describe specific restoration practices for consistency. These are as follows:

Streamside Forestation

Several projects included recommendations for streamside forestation, which would include planting trees or shrubs (shrubs only where indicated) at the stream edge. Example guidance on planting is provided in Appendix F of this document.

Livestock Management

This fairly generic term was used to describe a system whose goal is to exclude livestock from the stream bank or stream edge. Specific elements may include an off-stream water source, stream fencing, and improved crossings where appropriate. Each of these elements is specifically enumerated for each project.

Streambank Stabilization

This refers to a group of practices that can help to reduce erosion on stream banks. Note that these are primarily “soft” (i.e., biological) solutions and do not include hard armoring of the stream bank. Appendix E summarized some streambank stabilization techniques.

Grade Control

This practice was recommended in only one site in North Fork 102. Here, the use of a practice to prevent stream incision or “downcutting” was recommended. Grade control options are also presented in Appendix E of this document.

Catchment

In the context of this document, the term catchment refers to a watershed management unit within each of the three subwatersheds. These catchments range in size from 0.5 to 3.9 square miles, with a typical size of between 1.5 and 2.0 square miles. This is a larger drainage area than the typical catchment size of 0 to 0.5 square miles, and is more similar to that of a small subwatershed.

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PART 1. INTRODUCTION

1.1 Background and Purpose

A designated Virginia state scenic river, Goose Creek has a 385 square mile watershed that straddles Loudoun and Fauquier Counties within the northern Piedmont region (see Map 1). The Goose Creek Watershed contains many natural resources as well as numerous urban, suburban and rural communities. This watershed has the notable distinction of having approximately 18% of its watershed area preserved in conservation easements (as of January 2001). Goose Creek serves as a major drinking water source for the City of Fairfax and half of suburban Loudoun County. The unique value of Goose Creek as a natural resource combined with the diversity of land use and water quality concerns within the larger watershed, make it an ideal location to implement and demonstrate watershed planning.

The Goose Creek Demonstration Subwatershed Plans were developed with the rapid watershed planning concept in mind. The rapid watershed approach combines subwatershed scale, impervious cover, and eight tools of watershed protection into a rapid, simple, and inclusive approach. To this end, desktop assessments were focused on readily available mapping and monitoring data and did not incorporate complex modeling efforts. Similarly, the fieldwork conducted as part of the plans included simple stream habitat assessment and a forest conservation assessment. The fieldwork was conducted within one week and helped lead to specific management recommendations. From start to finish, the project represents approximately 15 months of work.

Utilizing data from in-house analyses and field studies, the proposed recommendations were developed from a detailed analysis for three subwatersheds—Goose Headwater 105, North Fork 102, and North Fork Upper Direct Drainage—and an audit of existing programs that have a potential impact on protection and restoration of the Goose Creek. Goose Headwater 105, North Fork 102, and North Fork Upper Direct Drainage were chosen as a result of the Goose Creek Vulnerability Analysis (CWP, 2002) which was produced under separate cover in September 2002 and is available on the Center for Watershed Protection web site at: www.cwp.org/GooseCreek.pdf. This in-office analysis used available data to characterize each of the five to fifteen square mile subwatersheds within the 385 square mile Goose Creek watershed into management categories, and to identify the subwatersheds that are the most vulnerable to current and future threats to water quality.

The Goose Creek Headwater 105, North Fork 102, and North Fork Upper Direct Drainage span the jurisdictional boundaries within the Goose Creek Watershed, including both Loudoun and Fauquier Counties. In addition, they represent the range of watershed conditions and threats, including development pressure, agricultural use impacts, and others. An important feature to note is that although North Fork 102 and North Fork Upper Direct Drainage are discussed separately, they are in fact a part of one contiguous drainage area, and therefore some of the same recommendations appear in both plans.

1.2 Watershed Goals and Subwatershed Objectives

The goal of this Goose Creek Demonstration Subwatershed Plan is twofold. The first is to provide baseline information on three specific subwatersheds and recommend priorities and steps for implementing protection and restoration activities. The second was to provide a framework for conducting future field studies to complete the remaining 37 subwatersheds for Goose Creek.

In addition to the goals of this plan, the planning effort itself focuses on three subwatersheds that cumulatively represent a very small fraction of the Goose Creek Watershed. At the same time, each of the subwatershed plans needs to take into account the driving goal of protecting and enhancing the quality of Goose Creek as a whole. Goals for the Goose Creek Watershed were developed from stakeholder meetings and are as follows:

1. Increase the diversity and abundance of fish and macroinvertebrates
2. Protect critical habitat and natural resources throughout the watershed
3. Maximize the benefits of watershed and citizen groups within the watershed through coordination of their efforts
4. Preserve and enhance the riparian corridor and in-stream habitat of both the Goose Creek mainstem and its tributaries
5. Foster stewardship among all residents of the watershed
6. Sustain the rural and scenic character of the watershed
7. Minimize the impacts of new development on Goose Creek and its tributaries
8. Protect water quality by reducing the inputs of nutrients and bacteria to Goose Creek
9. Continue to better understand and monitor changes throughout the Goose Creek watershed

At the subwatershed scale, more specific, numeric objectives were identified. These objectives are listed in Table 1 along with an identification of the corresponding goals supported from the list above. While all of the objectives identified support the watershed goals identified for Goose Creek, they also help to improve the health and quality of the individual streams that drain to these subwatersheds.

Table 1. Subwatershed Objectives		
Subwatershed	Objectives	Goal(s) Supported
Headwater 105	Achieve forested buffer along 75% of the stream length	1,4,8
	Achieve a "good:" to "excellent" Rapid Bioassessment Protocol (RBP) habitat score at all of the locations analyzed during subwatershed assessments	1
	Preserve existing forest cover in the Headwater 105 subwatershed	2,6
	Preserve the viewshed of the Appalachian Trail	6
	Reduce pollutant loads from areas with a high potential for pollutant contribution	1,8
	Achieve direct involvement and stewardship by watershed residents	5
North Fork 102	Achieve forested buffer along 90% of the stream length assessed during this study	1,4,8
	Achieve a "good:" RBP habitat score at all of the locations analyzed during subwatershed assessments	1
	Improve fish Index of Biotic Integrity (IBI) scores from "Very Poor" to "Fair"	1
	Preserve forest and areas of special value throughout this subwatershed	2,6
	Achieve direct involvement and stewardship by subwatershed residents	5
	Reduce pollutant loads from urban stormwater	7,8
North Fork Upper DD	Achieve 80% forested stream buffer on all stream reaches walked during the assessment of this subwatershed	1,4,8
	Achieve "good" habitat scores all RBP points identified during initial assessments	1
	Reduce the amount of eroded and degraded streams	1
	Reduce the pollutant load from areas with potentially high pollutant concentrations.	8
	Achieve direct involvement and stewardship by subwatershed residents	5
	Minimize the stream degradation typically associated with new development	7

1.3 Introduction to the Three Subwatersheds Included in the Plan

North Fork 102, North Fork Upper Direct Drainage, and Goose Headwater 105 represent a broad range of conditions within the Goose Creek watershed. Each subwatershed was placed into a different management category in the initial vulnerability analysis. Collectively, the subwatersheds include land in both Fauquier and Loudoun Counties, as well as the towns of Round Hill and Purcellville. In addition, each subwatershed contains unique characteristics and natural resources worth preserving and protecting.

Goose Headwater 105

Located in the westernmost portion of the Goose Creek watershed, Goose Headwater 105 is also at the western boundary of Fauquier County. The subwatershed was initially classified as High Quality in the vulnerability analysis and confirmed through field observations. The headwaters are in the foothills of the Blue Ridge Mountains serving as the boundary between Fauquier and Clarke Counties. The watershed is characterized by beautiful rolling hills, with significant forest, particularly at ridge tops. Many of the stream reaches within this subwatershed are extremely high quality (Figure 1).



Figure 1. A high quality stream reach in Goose Headwater 105

The majority of the land in this subwatershed is agricultural or forested. The landscape is also dotted with horse and cattle farms, as well as some orchards and a winery. The Appalachian Trail traverses the subwatershed with large areas of land dedicated for protection. In addition, the G. Richard Thompson Wildlife Management Area comprises a significant portion of the northwestern portion of the subwatershed, preserving a considerable amount of land from future development.

At the same time, some impacts were observed in isolated stream reaches and other sections of the subwatershed. Although little urban development has taken place in this subwatershed over the years, two major transportation routes cross its drainage. The first was a historic railroad built in the 1800s, currently known as the Norfolk Southern Railroad. While the railway adds character and history to the region, stream reaches adjacent to this line show significant impacts. Secondly, Route I-66 was expanded through this region in 1962 and also appears to have some stream impacts as well. Other stream quality impacts are localized and result from agricultural activity such as cattle access.

Management recommendations for this subwatershed focus on preserving this high quality resource through land management techniques, particularly along the ridgelines and near the Appalachian Trail. In addition, localized restoration projects are identified to restore the areas of poor stream quality, particularly along the mainstream adjacent to the rail line.

North Fork 102

North Fork 102 is in the Northwest corner of the Goose Creek Watershed, at the westernmost border of Loudoun County. The subwatershed includes the historic Round Hill, named for a hilltop that is an important conservation area in this study. This subwatershed was placed in the Rural Impacted category in the Vulnerability Analysis. Although it has less than <10% impervious cover, other data suggested impacts from sources such as high septic system and horse densities, and an existing dam acting as a fish barrier. This may result in future placement of this subwatershed into the Rural Impacted category.

Although field crews were permitted access to less than 60% of the total stream miles, the data collected indicates mixed stream conditions, significant areas of contiguous forest, and three dams. The majority (67%) of stream miles have good physical habitat conditions, although isolated stretches of channel erosion and inadequate buffers appear throughout the subwatershed. The area is also characterized by contiguous forest along Round Hill ridgetop and in other areas of the subwatershed, and a marsh area created upstream of a beaver dam (Figure 2). In addition, field data confirmed the presence of three man-made dams that currently bar fish movement.



Figure 2. A marsh area created upstream of a beaver dam in North Fork 102

Recommendations in North Fork 102 focus primarily on homeowner and agricultural education to reduce stream access on hobby farms and buffer encroachment by homeowners. Another key focus is the preservation of key forest tracts and other important conservation areas identified during field observations. Although several individual restoration sites (including streamside forestation and streambank stabilization) were identified, they are very few, and taken together represent only a small portion of the improvement and protection of this stream.

North Fork Upper Direct Drainage

North Fork Upper Direct Drainage is the only subwatershed out of the three selected for detailed study, initially identified as having a future threat from growth pressure. While the subwatershed currently has some impacts from rural sources, future development is anticipated to exert the more permanent urban impacts in this subwatershed. Current rural sources include a vineyard and two wastewater treatment plants. In addition, available data suggest poor habitat quality based on macroinvertebrate populations.

Field investigations confirmed this initial assessment. Although the subwatershed did have relatively good habitat conditions (60% of the stations classified “good”), significant problem areas were identified. Greater than 50% of the stream miles walked had inadequate stream buffers, and cattle and horse access and stream erosion were more problematic in this subwatershed than either of the other two. At the same time, some

significant resources were found in the subwatershed, including some very old individual trees (see Figure 3).

Management recommendations in this subwatershed focus on homeowner education, as well as restoration efforts in key problem areas within the subwatershed. This subwatershed is much more impacted by large sources of pollution, and the management plan identifies these potential hotspots.



Figure 3. A specimen tree in North Fork Upper DD

1.4 Rapid Watershed Planning Approach and Philosophy

The rapid watershed approach combines subwatershed scale, impervious cover, and eight tools of watershed protection into a rapid, simple, and inclusive approach. The subwatershed scale, impervious cover, and eight tools approach are explained further below. To make our approach rapid, simple and inclusive, desktop assessments focused on readily available mapping and monitoring data and did not incorporate complex modeling efforts. Similarly, the fieldwork conducted as a part of the plans included simple stream habitat assessments and a forest conservation assessment. The fieldwork was conducted in one week and the plan itself was developed within a 15-month timeframe.

In addition, specific efforts were made to include both government and citizen stakeholders throughout the planning process. The specific opportunities designed to achieve this goal included a training workshop in September 2002, a stakeholder workshop in January 2003, and additional small group feedback for the Program Audit and the draft Watershed Plan. PEC will continue this outreach effort as the plan is finalized and developed.

The Scale of Watershed Planning

Many watershed management units exist to describe watersheds (see Table 2 and Figure 4). The management plans presented in this document focus on subwatershed scale (one to 10 square miles) management units. Subwatersheds are the preferred unit for developing watershed plans, because the small scale allows for easier analysis and implementation (CWP, 1998). Large scale management units such as watersheds, subbasins and basins, are not useful as planning units since the influence of land use and land management on resource quality becomes weak, and is difficult to recommend specific management practices to improve water quality. On the smallest catchment scale, the influence of land use decisions is very strong, but the area is so small that it can be best managed through the normal development review plans and more on detailed site recommendations.

Table 2. Description of the Various Watershed Management Units		
Unit	Typical Area (square miles)	Influence of Impervious Cover
Catchment	0.05 to 0.50	very strong
Subwatershed	1 to 10	strong
Watershed	10 to 100	moderate
Subbasin	100 to 1,000	weak
Basin	1,000 to 10,000	very weak

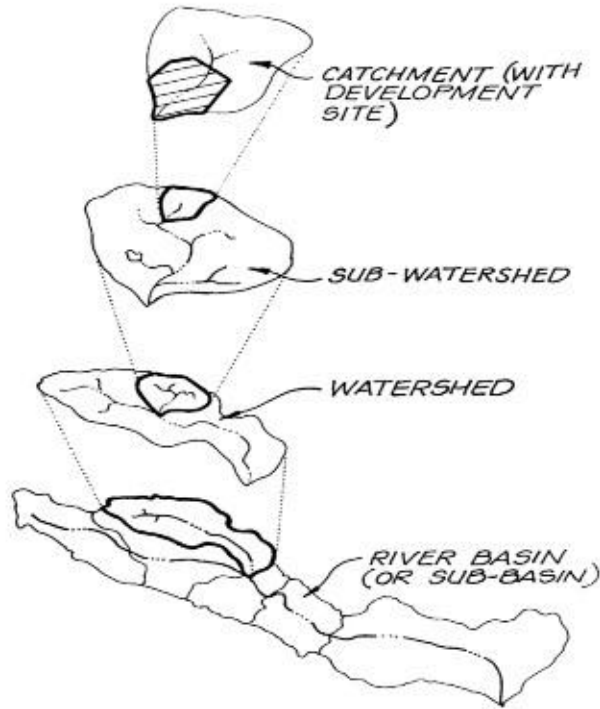


Figure 4. Various Watershed Management Units

The Impervious Cover Model

Throughout this planning effort, impervious cover has been used as a tool to characterize the impacts of urbanization on stream systems. The simple Impervious Cover Model (Figure 5) was used as a basis for this classification. In this model the total amount of pavement rooftop and other impervious surfaces, as a percent of the total drainage area, is used to classify a watershed into a particular management category.

At the same time, it is recognized that non-urban impacts can also play a role in stream health. For example, cattle access to streams or past channelization for agriculture uses can severely impact stream habitat. In fact, in two of the three subwatersheds chosen, urbanization plays a very small role, and these agricultural impacts dominate both the observed and projected future threats to stream health. The management recommendations for these subwatersheds reflect these agricultural impacts.

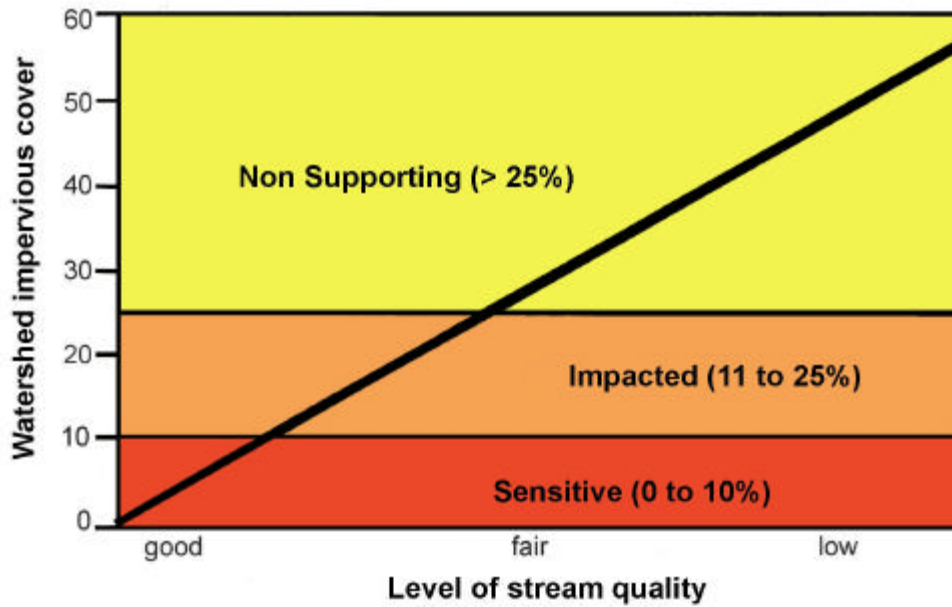


Figure 5. Impervious Cover Model

The Eight Tools of Watershed Protection

The management recommendations contained in this report are arranged according to the “Eight Tools of Watershed Protection” as outlined in the Rapid Watershed Planning Handbook (CWP, 1998), including: Watershed Planning, Land Conservation, Aquatic Buffers, Better Site Design, Erosion and Sediment Control, Stormwater Best Management Practices, Non-Stormwater Discharges, and Watershed Stewardship Programs. Each of these tools is described briefly below:

Tool #1. Watershed Planning

Watershed planning describes a series of tools designed to address both the location and amount of future development within a watershed. Using a combination of zoning, land preservation, and other land use tools, a community can protect its most valuable resources while also meeting the economic and social goals achieved by new development. New development as outlined in Fauquier County’s Zoning Ordinance and Loudoun County’s Comprehensive Plan does not represent a dramatic change in the future within these subwatersheds. Rather than present wholesale changes to overall zoning, these plans focus on minor additions designed to protect the highest quality resources.

Tool #2. Land Conservation

While the first tool emphasizes how much impervious cover is created in a watershed, the second tool concerns itself with land conservation. This tool is heavily emphasized within these subwatershed plans. One major reason for this emphasis is that the Piedmont Environmental Council acts as a conservation organization, and recommendations point to specific action items to best integrate their mission of land preservation with the broader goal of watershed management.

Tool #3. Aquatic Buffers

The aquatic corridor, where land and water meet, deserves special protection in the form of buffers. A buffer can be placed along a stream or shoreline or around a natural wetland. A buffer has many uses and benefits. Its primary use is to physically protect and separate a stream, lake or wetland channel from future disturbance or encroachment. For streams, a network of buffers acts as a right-of-way during floods and sustains the integrity of stream ecosystems and habitats. Technically, a buffer is one type of land conservation area, but its functional importance in watershed protection merits some discussion on how they work and why they are important.

Aquatic buffer restoration and protection is the most critical and widely-applied tool in these subwatershed plans. In individual subwatersheds, specific areas for streamside forestation often accompanied with livestock management systems are recommended to restrict access to the stream. Education initiatives are also recommended within these subwatersheds to target areas with degraded stream buffer but that have no specific restoration projects associated with them. At the larger watershed and county-wide scale, recommendations are made to improve protection of the buffer during the development process and to develop watershed-wide buffer education programs.

Tool #4. Better Site Design

Individual development projects can be designed to reduce the amount of impervious cover they create and increase the natural areas they conserve. Many innovative site planning techniques have been shown to sharply reduce the impact of new development. Designers, however, are often not allowed to use these techniques in many communities because of outdated local zoning, parking or subdivision codes. This document makes broad recommendations regarding Better Site Design with respect to Loudoun and Fauquier Counties' codes and ordinances and also points out how some elements of Better Site Design can help to achieve goals within specific subwatersheds. It also identifies some areas where Better Site Design is key, particularly those areas where conservation areas are located on subdivided plots.

Tool #5. Erosion and Sediment Control

Perhaps the most destructive stage of the development cycle is the relatively short period when vegetation is cleared and a site is graded to create a buildable landscape. The potential impacts to receiving waters are particularly severe at this stage. Trees and topsoil are removed, soils are exposed to erosion, natural topography and drainage patterns are altered, and sensitive areas are often disturbed. A combination of clearing restrictions, erosion prevention and sediment controls, coupled with a diligent plan review and strict construction enforcement are needed to help mitigate these impacts. Recommendations regarding erosion and sediment control (ESC) are derived both from program information in Loudoun and Fauquier Counties. Field observations of inadequate ESC, combined with mass clearing, support these recommendations.

Tool #6. Stormwater Treatment Practices

A watershed manager needs to make careful choices about what stormwater treatment practices (STPs) need to be installed in the subwatershed to compensate for the

hydrological changes caused by new and existing development. The key choice is to determine what are the primary stormwater objectives for a subwatershed that will govern the selection, design and location of STPs at individual development sites. The analysis of STPs focuses primarily on the in-office program review, although a handful of individual existing practices are discussed for some subwatersheds.

Tool #7. Non-Stormwater Discharges

This tool concerns itself with how wastewater and other non-stormwater flows are treated and discharged in a watershed. In some watersheds, non-stormwater discharges can contribute significant pollutant loads to receiving waters. Key program elements consist of inspections of private septic systems, repair or replacement of failing systems, utilizing more advanced on-site septic controls, identifying and eliminating illicit connections from municipal stormwater systems, and spill prevention. Within Goose Creek, a key focus is regulations in place to minimize the impacts of septic systems.

Within the program review, agriculture was also treated as a non-stormwater discharge. Since agriculture comprises a significant fraction of all of the subwatersheds investigated, this source is very important. At the larger watershed level, continued educational efforts and funding for farmers are identified. Within each subwatershed, individual potential projects on agricultural lands are identified.

Tool #8. Watershed Stewardship

Once a subwatershed is developed, communities still need to invest in ongoing watershed stewardship. The goal of watershed stewardship is to increase public understanding and awareness of watersheds, promote better stewardship of private lands, and develop funding to sustain watershed management efforts. Watershed stewardship plays an overriding and essential role in the subwatershed plans presented here. Since the majority of land is privately held, often by individuals with single very large parcels, encouraging watershed stewardship at this level can make a dramatic impact. In addition, the interest and motivation of the various citizens and watershed groups existing within Goose Creek can help provide the “muscle” for fairly aggressive education and public involvement programs.

1.5 Strategies Employed to Develop the Plan

Mapping, stream assessments, conservation area assessments, and an audit of existing programs were the key tools used to develop the subwatershed plans included here. The mapping included land use assessments to relate land cover to observations made in the field, and these data were critical to develop detailed recommendations. Stream assessments included both a Rapid Bioassessment Protocol (RBP) and a Riparian Inventory Tracking (RIT) to characterize stream habitat. Conservation area assessments included contiguous forests high quality streams, Appalachian Trail and conservation area ranking. The program review consisted of a review of the existing codes and ordinances and recommending areas to help further protect and restore Goose Creek. Lastly, stakeholders were asked to provide feedback at significant points throughout the project to add a level of local knowledge and expertise to the final plan. The strategies are detailed below.

Mapping/Land Use Assessments

Mapping and land use assessments are key components of this planning effort. The components of the mapping analysis included: breaking each subwatershed into catchments, identifying upland features, and displaying findings of stream quality. These data were used to portray existing conditions throughout each subwatershed, and the base maps produced as a part of this effort served as the baseline for management maps produced for each catchment.

Catchment breakdown

As a first step within mapping, each subwatershed was divided into “catchments,” although these catchments were actually larger than the catchment size summarized in Table 2. The term was used here to distinguish between the subwatersheds identified in the plan and these smaller (although still technically subwatershed-sized) management units. Each subwatershed was divided in this manner for three reasons. First, this allowed a clear link between in-stream findings and their contributing drainages. Secondly, the “catchments” also allowed for the assessment of the relative threat of development at this scale. Lastly, maps produced at this scale are very readable, allowing greater detail not afforded by subwatershed mapping.

In addition, catchments that coincided with stream reaches studied during field work were included (see below for a discussion). This choice in scale allowed for the field observations, grouped by reach, to be related to upland features in that reach’s contributing drainage. Pinpointing recommendations that resolved in-stream issues related to the stream reach’s immediate drainage area was also made possible.

Upland Features

For each subwatershed, maps portray important upland features, including land use, zoning, and other important points such as vineyards, golf courses, and other individual land uses or properties with a potential impact to stream quality. For most of these features, the foundation of the mapping layers was the original land use and development layers used during the vulnerability analysis. These data were also supplemented with findings from the field, however. For instance, the contiguous forest

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assessment provided a great deal of information about the amount and quality of forest resources within the three subwatersheds. In addition, some key upland features were identified in the field, rather than from original mapping layers. For example, a nursery in North Fork Upper Direct Drainage was identified from field reconnaissance, rather than from existing property maps.

The land use data used for these analyses represents the best available data from Loudoun and Fauquier Counties. Although there is a great deal of confidence in these layers as a whole, some aspects of development are ongoing, and conclusions were drawn from the data available to us. In particular, future growth was estimated using Loudoun County's Subdivision Layer, and conservation recommendations were partially based on this information. These data will of course become outdated over time, and tracking the development process is a key component of future planning in these subwatersheds, and in Goose Creek as a whole.

Findings

Each map displays and helps organize field findings and visually presents stream assessment data. GIS layers of field data were also used to produce summary statistics for each subwatershed and for individual catchments within these subwatersheds. These visual representations and data summaries helped us to quickly summarize the quality of each reach (or catchment area), and to use these findings to develop spatially-based recommendations.

Stream Assessments

In October 2002, field crews performed two types of stream assessments: EPA's Rapid Bioassessment Protocol (RBP) Habitat assessment and the Riparian Inventory Tracking (RIT). Stream habitat was assessed using the RBP habitat assessment sheet every 5000 ft to assess overall habitat conditions. The RIT is a continuous inventory of impacts/problems encountered while walking the stream channel. Descriptions of the assessment are provided below.

Rapid Bioassessment Protocol for Habitat (RBP)

The RBP Habitat Assessment provides a measure of the overall habitat condition of the study reaches based on assessments at discrete intervals. In this case, streams were assessed at 5000 ft intervals. This data complements the results of the RIT form, which inventories potential problems.

The RBP is a semi-quantitative method that asks an investigator to assign a score to various stream habitats or channel parameters by comparing what is seen at points along the stream to a series of descriptions. After each parameter is assessed, a total score is determined. The RBP method determines the degree of impairment by comparing the total assessment scores found at study reaches to those found at the least impaired reference reaches to determine the overall condition and the degree of impairment. These reference streams represent a surrogate for the best attainable condition for the region. More detailed parameter descriptions and a sample field sheet are provided in Appendix

A. The entire RBP method documentation can be viewed and downloaded from EPA's website at www.epa.gov/owow/monitoring/bioassess.htm.

Supplemental information was also collected to characterize watershed features, riparian vegetation type, channel geometry, aquatic vegetation, water quality and substrate components. In addition to this information, relevant field observations are recorded.

Riparian Inventory Tracking (RIT)

The intent of the Riparian Inventory Tracking (RIT) field form is to provide: 1) a rapid means for collecting organized data on the location and extent of significant stream bank and riparian impacts/problems observed during stream walks; 2) a basic description of the problem area and surrounding land use; and 3) an initial mitigation assessment to help prioritize potential restoration projects needing further study. Areas of concern identified either as localized points or continuous reaches, include, but are not limited to: inadequate buffers, severe bank erosion, floodplain/stream encroachment, debris, cattle access or ATV crossing, stormwater outfalls, illicit discharges, and exposed utility line crossings.

Stream reaches between RBP points were inventoried using the RIT data sheets. Latitude and longitude at each problem site were recorded using hand-held GPS receivers. In addition, information was collected as to the type of impact, the extent of channel affected, the severity, and the potential for mitigating the impact. Appendix B provides a sample RIT form, as well as raw data collected by subwatershed.

Conservation Area Assessment

Land conservation is a vital element of any watershed management plan. Protected land can help to keep the amount of impervious cover below degradation thresholds in a subwatershed. It can also serve to protect forestland and important habitat for wildlife and birds, and preserve quality of life for those that live in the community with protected green space and opportunities for recreation. In Goose Creek, conservation planning involved identifying and evaluating contiguous forest tracts (tracts of forest without significant breaks such as roads, power lines or other clearings), identifying high quality streams, and plotting the course of the Appalachian Trail. The result was six conservation areas-- three in North Fork 102 and three in Headwater 105. Of the three components of the conservation area assessment, the contiguous forest was the most critical component followed by high quality streams and the Appalachian Trail.

Contiguous forest has many habitat advantages, including benefits to stream quality and terrestrial animal habitat. Several studies have found that as the amount of forest cover in a watershed increases, stream quality improves correspondingly. For example, three recent studies have found a correlation between forest cover and aquatic insect diversity in New Jersey (Kennen, 1999); Georgia (Meyer and Couch, 2000); and Washington (Booth, 2000). In fact, Booth (2000) found that diversity begins to decline once forest cover is less than 65%. This observation was supported by fieldwork conducted within the three subwatersheds studied as a part of this project. Every RBP

point where stream habitat was classified as “excellent” (five points within Headwater 105) was located within a large contiguous forest tract.

This vital link between contiguous forest and wildlife also extends to birds. As contiguous forest tracts increase in size and roundness, a greater amount of interior forest, forest at least 100 meters from the forest edge (Wilcove, 1985) is created. This interior forest is critical to forest bird species, as it reduces the ability of “edge” species, such as crows and feral cats, to prey on interior forest birds. Similarly, it reduces the ability of opportunistic species such as cow birds to dominate nesting cavities. Consequently, the rate of predation significantly declines as interior forest size increases (Figure 6).

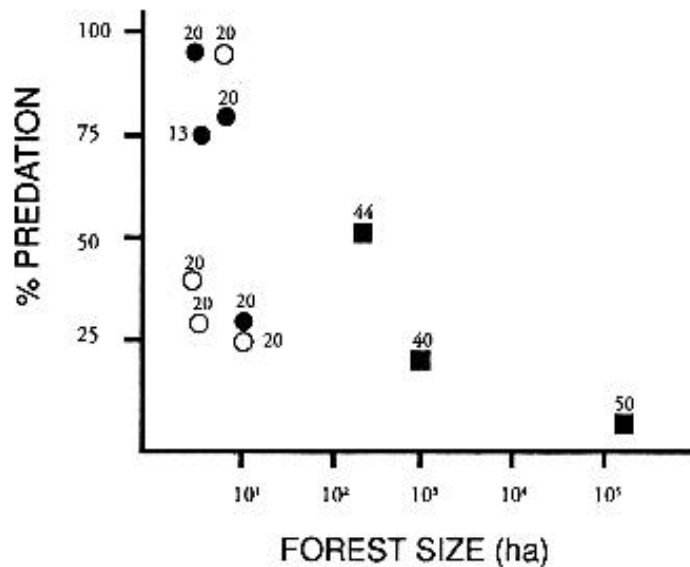


Figure 6. Percent predation as a function of forest size (Source: Wilcove, 1985)

Contiguous Forest Assessment

Contiguous forest identification and assessment involved two steps. In the first step, digital orthophotos of land cover, provided by Loudoun and Fauquier counties, were analyzed to identify potential contiguous tracts of forest. In the second step, candidate sites were evaluated in the field by assessing forest community, structure and canopy. This step involved visits to sites identified as contiguous forest stands to determine if they were affected by roads, clearing or development.

In the third step, if the sites were intact, the forest structure, understory, canopy, dominant tree species, and quality were analyzed. The field sheet used to characterize forest in Goose Creek is included in Appendix C of this document. Some of these features were characterized based on field notes, such as the presence of invasive species, surrounding land use, and species and density of the understory.

Two forest characteristics were more quantitatively analyzed with specific field tools: dominant tree species using a wedge prism and canopy cover using a concave

densiometer. The wedge prism is a triangular glass prism that a field investigator looks through to identify significant (in size) trees, and to characterize the distribution of tree species. The investigator stands in a single location, and views all of the species in a complete circle around him or her. The trees counted include very large trees at a distance and both large and smaller trees nearer to the investigator. The investigator then records both the species and diameter of these trees.

A concave densiometer, the second quantitative tool, is a piece of reflective metal with 24 squares of uniform size etched into it. The field investigator holds the densiometer parallel to the ground so that it reflects the sky directly above. He or she then records the number of cells that are more than three quarters shaded by leaves. This tool quantifies the density of the forest canopy.

High Quality Streams

High quality, relatively pristine streams are very rare in the landscape and represent areas that diverse species of fish and macroinvertebrates inhabit. The goal of this assessment was to identify the high quality streams in the subwatersheds and prioritize those streams for protection. Stream habitat was evaluated during the field stream assessments using EPA's Rapid Bioassessment Protocols for habitat discussed in section 1.5. Streams that rated excellent using this technique were classified as high quality. All of these streams were located within a single large contiguous forest tract. As a result, these streams were incorporated within this analysis by using their presence as a ranking factor for preservation of the forest tract as a whole.

Appalachian Trail

Parcels adjacent to or in close proximity to the trail add to the protection of the integrity and quality of the trail experience. For this assessment, a GIS layer for the Appalachian Trail obtained from the Appalachian Trail Conference was overlain on the Goose Creek digital orthophoto and property layers to determine parcels of land adjacent to the historic national trail that spans from Georgia to Maine. These parcels were typically part of a larger contiguous forest tract. The data from this analysis were used in two ways. First, abutment against the Appalachian Trail was a ranking factor in favor of preserving a contiguous forest tract. Second, parcels adjacent to the trail are given special attention in the Headwater 105 subwatershed plan (Part II).

Conservation Area Ranking

The six conservation areas identified in this study were ranked using six factors: size, development threat, forest structure, potential to connect with a larger forest tract, presence of high quality streams, and abutment to the Appalachian Trail. (See Appendix C for additional details of the ranking system). A brief overview of the conservation areas is included in Table 3, and discussed in more detail in the subwatershed plans for Headwater 105 (Part II) and North Fork 102 (Part III).

Table 3. Conservation Area Characteristics			
Conservation Area	Subwatershed	Contiguous Forest Size (in Acres)	Conservation Rank
C1: Mountain South	North Fork 102	371	4 of 6
C2: Mountain North	North Fork 102	430	3 of 6
C3: Round Hill	North Fork 102	463	2 of 6
C4: G. Richard Thompson	Headwater 105	2804	1 of 6
C5: South of Route 66	Headwater 105	595	5 of 6
C6: Appalachian Trail South of Route 66	Headwater 105	381 (not contiguous)	6 of 6

Program Review

Identifying the key local programs that can be used to protect the watershed is a key component of watershed protection. As a part of this watershed planning effort, we completed a Program Review for both Loudoun and Fauquier Counties. The eight tools of watershed protection (see section 1.4) served as the structure for both the documentation of programs in place and the summary of future recommendations. While a summary of this review is presented here, a more comprehensive description is presented in Appendix D. Section 1.6 summarizes the watershed and county-wide recommendations derived from the program review.

Four sources of information were used in support of the program review. The first was a detailed program survey completed by staff from both Loudoun and Fauquier counties. The second was a supplementary survey targeted toward watershed and environmental groups active in Goose Creek. Both of these surveys were supplemented with follow-up questions and regular contact with County staff and some environmental organizations. The third source was a collection of 12 key documents including local ordinances, comprehensive plans, subdivision codes, and design guidance, among others. The fourth source was a targeted web search of sites from local, state, federal, and non-profit organizations to confirm and supplement initial information.

Overall, a great deal of commitment was provided by both government and non-government entities in both counties to protect Goose Creek and its water resources in general. Some highlights include the recently revised Comprehensive Plan in Loudoun County, conservation zoning in Fauquier County, and significant outreach, and monitoring efforts by non-government organizations. In addition, the widespread promotion and use of conservation easements both by State (Virginia Outdoors Foundation) and non-government (PEC) entities is impressive.

Nevertheless, several targeted recommendations can help to close remaining gaps in legal documents, program implementation, and public involvement to more completely protect Goose Creek, as well as other water and habitat resources within these two counties. Most of the recommendations were very specific, but some overall themes emerged including increased enforcement, more explicit regulations, and more concerted outreach and volunteer efforts. Overall, both counties lack the staff and in some cases the authority to enforce existing regulations, including erosion and sediment control,

stormwater practice maintenance, and On-Site Disposal System regulations. Several recommendations suggest mechanisms to increase the number of “eyes” throughout the county to thoroughly implement both current and pending regulations.

This is a critical time for Fauquier and Loudoun counties. Many of the conservation efforts within both counties are in development, and in a few isolated cases not yet begun. Consequently, much of the existing language is somewhat broad and often stresses plans to encourage a specific recommendation, such as conservation of critical habitats. As the programs emerge, more specific language or ordinances will be necessary. For example, one recommendation is to more explicitly define how to protect critical habitat areas during development.

A third set of recommendations focuses on public outreach and involvement throughout the two counties. Since so much of the relatively new programs within these counties require actions by the public, many need to be supported by targeted outreach campaigns. In addition, while a number of non-government and volunteer groups are active within the Goose Creek Watershed, there is no central organization that coordinates efforts, such as outreach or public involvement. These groups together represent a powerful force that can unify around particular goals, such as education on a specific topic or protection of an individual subwatershed.

Stakeholder Involvement

Stakeholder involvement as a part of the Goose Creek subwatershed planning effort had three primary objectives: informing the public about the planning effort, training interested citizens on watershed assessment methods, and gathering input to refine our data and plan recommendations. This process was accomplished through a training workshop in October 2002, a stakeholder workshop in January 2003, and two additional feedback meetings for the program review and watershed plan. These workshops drew citizens, non-government organizations, and government representatives throughout Goose Creek. As a follow up, PEC will conduct more targeted stakeholder involvement within the three subwatersheds studied as the plans progress.

The training workshop was conducted in anticipation of October fieldwork. The workshop provided some background regarding the vulnerability analysis that led to the selection of three subwatersheds for more detailed fieldwork and planning. Its primary purpose, however was to provide detailed training regarding field techniques used as a part of the plan. Several attendees actually participated in both the stream and conservation areas assessments.

The stakeholder involvement workshop targeted government representatives and citizens, with the purpose of eliciting comment on draft recommendations and findings. As a result of this workshop, some field information surfaced after the initial field work had been completed. In addition, overall goals for Goose Creek were developed, and advice about particular opportunities and obstacles within the watershed and individual subwatersheds was given.

1.6 Key Recommendations

Three layers of recommendations are included in this document. The first set includes watershed-wide recommendations needed to ease implementation of the three demonstration subwatershed plans, and to improve the quality of Goose Creek as a whole. The second includes county-wide recommendations adopted from the Program Review document, and to be implemented in Loudoun and Fauquier Counties. The third set includes smaller-scale recommendations targeted specifically to the three subwatersheds analyzed in detail as part of this project. In many cases, the watershed and county-wide recommendations directly or indirectly support the subwatershed scale recommendations.

Watershed -Wide Recommendations

Nine watershed-wide recommendations are identified as summarized below, and in Table 4.

1. *Develop an implementation committee to establish responsibility for and begin implementation of the projects and recommendations included in this report.* This document does not directly assign responsibility for implementing its recommendations. One central organization (perhaps Goose Creek Association or Piedmont Environmental Council) should act as a coordinator to ensure that recommendations are carried forward. Some key members of such a committee would include government agencies, nonprofit groups, homeowners, and farmers.
2. *Revise codes to more explicitly protect streams and natural resources from new development.* In the Codes and Ordinances Program Review, several specific recommendations were made and specifically designed to protect resources during the development process. These ranged from improved stormwater management to better stream buffer protection.
3. *Minimize sewage flows to the Goose Creek through improved septic system regulations and inspection, and improved detection and removal of illicit discharges.* Because of Goose Creek's continuing problems with bacteria, improved management of septic systems, along with new programs or monitoring to detect and eliminate illicit discharges was recommended.
4. *Target Natural Resources Preservation when purchasing easements.* In the future, targeting tracts of significant natural land features is needed including contiguous forest tracts as targets for conservation easements. These areas have been identified in the three demonstration subwatershed plans included here.
5. *Establish the "Mountainside Initiative" to preserve land along the Appalachian Trail.* In this initiative, PEC would work with the Appalachian Trail Conference and other trail and conservation associations to preserve the watershed on the eastern slope of the Blue Ridge Mountains. While helping to maintain the integrity of the trail, this would help preserve the headwaters of Goose Creek that contain the highest quality streams and the most significant contiguous forest areas. There are tremendous water

quality, habitat, and quality of life benefits to be gained by the community with such a program.

6. *Continue subwatershed planning throughout Goose Creek.* The three subwatersheds presented here represent a starting point for future planning efforts throughout Goose Creek. Continue to evaluate the remainder of the Goose Creek watershed, using the techniques described in this report.
7. *Conduct further investigations and follow-up monitoring in the three demonstration subwatersheds.* Time and data limitations disallowed two detailed analyses within the three demonstration subwatersheds: an Endangered Species Assessment (ESA) and detailed parcel tracking. Unfortunately, data needed to conduct an ESA within the three demonstration subwatersheds could not be secured. If conducted in the future, this analysis would help managers identify key conservation areas within these drainage areas. While fairly detailed maps of existing parcels exist, key parcels need to be investigated further to confirm their current development status and to identify landholders.

In addition, the use of existing RBP stations as “Sentinel” monitoring stations is recommended. These should be revisited approximately once every five years to evaluate progress within them.

8. *Designate a single group or individual to coordinate education efforts watershed-wide.* This is a single recommendation from the Program Review and bears repeating as an overall watershed recommendation. Goose Creek Association would be a good candidate for harnessing the collective influence of the myriad environmental groups active in the Goose Creek Watershed to focus on specific areas and topics.
9. *Explore and Distribute Information on funding sources for agricultural practices.* While several funding sources are available to support projects on agricultural lands, stakeholders appear unaware of options, and some expressed concern about being restricted from funds due to parcel size or other factors. The Program Review (Appendix D) summarizes some funding sources to support these efforts.

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Table 4. Key Recommendations	
Recommendation	Goals Supported
1. Develop an Implementation Committee to establish responsibility for and begin implementation of the projects and recommendations included in this report	ALL
2. Revise codes to more explicitly protect streams and natural resources from new development	1,2,7
3. Minimize sewage flows to the Goose Creek through improved septic system regulations and inspection, and improved detection and removal of illicit discharges	8
4. Target Natural Resources Preservation when purchasing easements	1, 2,6
5. Establish the "Mountainside Initiative" to preserve land along the Appalachian Trail	2, 6
6. Continue subwatershed planning throughout Goose Creek	ALL
7. Conduct further investigations and follow-up monitoring in the three demonstration subwatersheds	9
8. Designate a single group or individual to coordinate education efforts watershed-wide	3,5
9. Explore and Distribute information on funding sources for agricultural practices	4, 5, 6

County-Wide Recommendations

The Program Review (as discussed in Section 1.5) resulted in over fifty specific recommendations. While each of these is important, this section highlights the highest priority recommendations that should be implemented within the next two years. For a complete list of recommendations, and tips on how to implement them, consult Appendix D, the Program Review document. For detailed prioritization of all recommendations, consult Part 5, the implementation plan.

Loudoun County

The highest priority recommendations for Loudoun County focus strongly on minimizing the impacts of new development, and encouraging stewardship among the citizens of the county (Table 5). Each of these highest priority recommendations is described below.

Table 5. High Priority Recommendations in Loudoun County	
Recommendation	Watershed Goals Supported
Strengthen Overlay District regulations	2,7
Specify open space requirements	2,6,7
Strengthen plant and wildlife habitat language	2,7
Strengthen the Land Conservation Fund and the PDR Program	2,6,7
Develop wetland buffer requirements	2,4,7
Conduct stream buffer education ¹	3,4,5
Protect headwater streams	1,2,4,7
Revise existing stormwater waivers for "adequate channel"	1,4,7
Conduct targeted education campaigns ¹	1,3,5
Conduct stream buffer plantings	1,3,4,5
Create a website to encourage stewardship among citizens ¹	5,8
1: Can be a shared responsibility with Fauquier County, or a watershed organization	

1. *Strengthen overlay district regulations.* Loudoun County incorporates the use of “Overlay Districts” to protect key resources within the county. Specifically, language should be incorporated to better define and protect recharge areas, and also to identify water supply reservoirs as a specific overlay district.
2. *Specify open space requirements.* Currently, many of Loudoun County’s zoning categories require a certain percentage of open space. However, for many of them, there are no minimum requirements for how much of the site must actually contain vegetation or the types of vegetation that are allowed, except through the Conservation Design process that has performance standards for the Rural Transition and Joint Land Management zoning districts. Extend these performance standards to all open space requirements.
3. *Strengthen plant and wildlife habitat language.* The County’s current Plant and Wildlife Habitat Policies identify critical habitat and encourage its preservation. However, these policies could be strengthened by changing current language to make protection of these areas a requirement.
4. *Strengthen the Land Conservation Fund and PDR Program.* Currently, Loudoun County uses the Purchase of Development Rights as a land conservation tool. Three recommendations could strengthen the ability of this program could enhance its ability to protect natural resources. First, the scoring system currently in place to rank potential purchases should be modified to favor environmental and habitat features more strongly. Second, agreements should incorporate specific plans to protect key resources on a property. Finally, conservation plans for properties adjacent to streams should include measures to enhance and preserve the stream buffers.
5. *Develop wetland buffer requirements.* Currently, Loudoun County has no regulations in place to establish natural buffers around wetlands. These rules should be established to protect these critical resources.
6. *Conduct stream buffer education.* To enhance existing stream buffer regulations in place in Loudoun County, the County should develop outreach material regarding both the importance of stream buffers and ways to preserve and enhance them, and distribute this material to streamside residents. For example materials, consult Appendix H of this document.
7. *Protect headwater streams.* Strengthen existing protections of headwater streams by requiring stream buffers on both perennial and intermittent streams with drainages of less than 100 acres.
8. *Revise existing stormwater waivers for “adequate channel.”* Currently, stormwater requirements for stream channel protection can often be waived. Consider eliminating some options for meeting this requirement. In particular, eliminate a waiver for direct discharge to a main channel within a major floodplain, which eliminates channel protection requirements on many projects.

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9. *Conduct targeted education campaigns.* Work together with various watershed and citizens groups, and perhaps with Fauquier County, to work together on specific, targeted educational campaigns. Examples may include stream buffer education or a “scoop the poop” campaign to combat pet waste.

10. *Conduct stream buffer plantings.* The County should work together with volunteer groups to encourage stream buffer plantings in Goose Creek. As a starting point, several potential sites were recommended in the Subwatershed Plans for North Fork 102 and North Fork Upper Direct Drainage contained within this document. The County could offer staffing support, materials, or help secure funding for this effort. One potential funding source is the Chesapeake Bay Restoration Fund.

11. *Create a website to encourage stewardship among citizens.* A website combined with other education efforts can provide information on watershed basics (i.e., what is a watershed), locator watershed maps (i.e., where do you live in the Goose Creek watershed?), promote practices that citizens can do on an everyday basis to become better watershed stewards, and provide information on how to volunteer or become involved. James City County, Virginia has put together such a website: <http://www.protectedwithpride.org/>

Fauquier County

While some of the recommendations are the same for Fauquier County as Loudoun County, the highest priority recommendations in Fauquier County often focus on establishing new regulations or programs. In addition, erosion and sediment control is a more important program to develop in Fauquier County (Table 6).

Table 6. High Priority Recommendations in Fauquier County	
Recommendation	Watershed Goals Supported
Expand PDR program and provisions	2,6,7
Establish stream buffer requirements	4,7
Establish wetland buffer regulations	2,4,7
Conduct stream buffer education ¹	4,5,7
Encourage non-staff Erosion and Sediment Control (ESC) inspections	2,5,7
Improve ESC Enforcement	7
Regulate On-site Disposal Systems (OSDS)	5,8
Conduct Targeted Educational Campaigns ¹	1,3,5
Conduct Stream Buffer Plantings	1,3,4,5
Create a Website to Encourage Stewardship ¹	5,8
1: Can be a shared responsibility with Loudoun County, or a watershed organization	

1. *Expand PDR program and provisions.* This recommendation is very similar to the fourth recommendation for Loudoun County. Fauquier County currently has a PDR program that targets agricultural land only, and ranks land based on agricultural characteristics only. The same three modifications are recommended to this program as were made in Loudoun. First, the scoring system currently in place to rank potential purchases should be modified to favor environmental and habitat features more strongly. Second, agreements should incorporate specific plans to protect key resources on a property. Finally, conservation plans for properties adjacent to streams should include measures to enhance and preserve the stream buffers.
2. *Establish stream buffer requirements.* Currently, Fauquier County has no regulations in place to promote stream buffers. Establish enforceable regulations that would restrict clearing and development within at least 75 feet of the edge of streambanks and encompass associated environmental features, such as steep slopes, floodplains, and wetlands.
3. *Establish wetland buffer regulations.* Like Loudoun County, Fauquier County has no regulations in place to establish natural buffers around wetlands. These rules should be established to protect these critical resources.
4. *Conduct stream buffer education.* Once buffer requirements are established within Fauquier County, information about the importance and preservation of stream buffers should be distributed to citizens. Materials can be developed in concert with Loudoun County, which has similar plant life and climate. See Appendix H for information.
5. *Encourage non-staff erosion and sediment control (ESC) inspections.* Currently, Fauquier County has inadequate staff to inspect construction sites on a frequent basis. Two program tools can help improve ESC inspection. The first is the use of private inspectors, non-county staff who are trained in erosion and sediment control and submit inspection reports to the County. A second is to encourage citizen “watch dogs” to report violations or concerns at construction sites. A key element of this program is to publish newspaper advertisements, or use a web site to encourage citizens to call in ESC complaints, and also educate them on what to look for.
6. *Improve ESC enforcement.* Currently, Fauquier County does not have very strong enforcement capabilities for ESC violations. Upon completion of the enforcement policy review approved by the Virginia General Assembly, stronger enforcement capabilities and penalties should be available to the County. Improve the enforcement and penalties associated with violations of ESC ordinances.
7. *Regulate on-site disposal systems (OSDS).* Fauquier County’s Health Department permits septic tanks, and although they currently have no required maintenance protocol, the County is establishing a maintenance plan. Establish regular maintenance and inspections of all septic tanks in the watershed to ensure that they are properly functioning.

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8. *Conduct targeted educational campaigns.* This recommendation is the same as recommendation 9 for Loudoun County. Work together with various watershed and citizens groups, and perhaps with Loudoun County, to work together on specific, targeted educational campaigns. Examples may include stream buffer education or a “scoop the poop” campaign to combat pet waste.
9. *Conduct stream buffer plantings.* The County should work together with volunteer groups to encourage stream buffer plantings in Goose Creek. As a starting point, several potential sites were recommended in the Subwatershed Plan for Headwater 105 contained within this document. The County could offer staffing support, materials, or help secure funding for this effort. One potential funding source is the Chesapeake Bay Restoration Fund.
10. *Create a website to encourage stewardship.* A website combined with other education efforts can provide information on watershed basics (i.e., what is a watershed), locator watershed maps (i.e., where do you live in the Goose Creek watershed?), promote practices that citizens can do on an everyday basis to become better watershed stewards, and provide information on how to volunteer or become involved. James City County, Virginia has put together such a website: <http://www.protectedwithpride.org/>

Subwatershed Scale Recommendations

Within each of the three demonstration subwatersheds, recommended subwatershed restoration activities are divided into three major categories: Preservation/New Development, Outreach, and Restoration. These recommendations are provided in detail in Parts II through IV of this document. Preservation/New Development recommendations include specific parcels identified for preservation, either via working with developers on subdivided lots, or through easements or PDRs. Outreach recommendations focus on targeted outreach to individual property owners or groups. General, “subwatershed-wide” recommendations, primarily focusing on buffer education, or on large property owners that span more than one catchment are also presented.

Prioritization and Ranking

Because of the wide range of recommendations encompassed within this document, detailed ranking across different types of recommendations are not provided. For example, the relative value of a particular restoration project versus the adoption of an ordinance is not easily rated. Instead, slightly different criteria are used to rank each recommendation. With some slight variation, priority to each recommendation is assigned by answering key questions, including: 1) Does this recommendation support stated watershed goals or subwatershed objectives? 2) Can it be realistically accomplished? 3) Does this recommendation solve a problem that is either severe or widespread? 4) Is this a time-sensitive issue?

A more detailed discussion of the ranking techniques for each category is provided in Part V of this document (Implementation Plan). In general, recommendations are assigned one of the following priorities: Urgent, High, Moderate, or Low. These

classification schemes help determine the phasing for implementing the recommendations made here. For some recommendations, a priority of “ongoing” is assigned for recommendations that are important and represent a continuous, ongoing effort.

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PART 2. GOOSE HEADWATER 105

2.1 Introduction

Goose Headwater 105 (HW-105) is located in the westernmost portion of the Goose Creek Watershed and lies entirely within Fauquier County. The headwaters of this subwatershed originate in the foothills of the Blue Ridge Mountains, which also serve as the boundary between Fauquier and Clarke Counties. This subwatershed has the highest overall stream quality of all the subwatersheds investigated (see Figure 7). The high quality of the streams is due in large part to large tracts of contiguous forest present in the subwatershed. Prominent landmarks in the drainage area include the Appalachian Trail (AT), G. Richard Thompson Wildlife Management Area (Thompson WMA), Norfolk Southern Railroad, and Interstate 66. Map 2 shows the location of the subwatershed in relation to the other two subwatersheds studied.



Figure 7. An example of a high quality stream section in Headwater 105, the subwatershed with the highest quality stream reaches.

The in-office vulnerability analysis classified this subwatershed as “High Quality” and predicts that it will remain in this category in the near term. Favorable factors contributing to this classification are summarized in Table 7 and include a “good” IBI score, high percentage of forested land (75%), and low impervious coverage (6-7%). High percentage of forested streamside (60%) and the presence of only one non-point source hotspot are also taken into consideration in the analysis.

Table 7. Goose Headwater 105 Data (Source: CWP, 2003)	
Area (acres)¹	8,479
Number of Catchments	6
Perennial Stream Miles¹	21.9
Political Jurisdictions	Fauquier County
Conservation Easements¹	0
Current Impervious Cover¹	6%
Future Impervious Cover¹	7%
Stream Classification¹ (Current and Future)	High Quality
Existing Monitoring Data¹	1 Fish IBI point ("good")
Land Use	Mixed use including forest, low intensity agriculture, low density residential

Field findings support the “High Quality” classification made in the vulnerability analysis. Most of the stream reaches within this subwatershed are in high quality condition, due to the presence of good canopy coverage, wide riparian buffers, and minimal channel erosion or incision. Contiguous forest tracts and other forested tracts along the AT and around the Thompson WMA were identified as potential conservation areas, totaling 3,398 acres.

At the same time, field assessments revealed several sites that are in need of restoration efforts or improved landowner stewardship. Inadequate streamside buffer and livestock access contributed to stream degradation in most sites identified to have water quality problems. In addition, severe stream impacts were identified on stream reaches adjacent to the railroad tracks and near Route 66. Several areas of concern warrant further investigation including the private residential in-stream ponds and the defunct mine outfall pipe discharge. Two potential nonpoint sources of pollution include a vineyard and hog farm.

2.2 Assessments

Field assessments conducted in HW-105 include the Rapid Bioassessment Protocol (RBP), the Riparian Inventory Tracking (RIT) and a Conservation Areas Assessment. In addition, stakeholder input on features and concerns for this subwatershed was gathered and is reported in this section. Results of these field assessments, as well as other key features and concerns identified by field staff and stakeholders, are summarized in Table 8 and are described below in more detail. For a more detailed discussion of field methodologies, consult section 1.5 of this document.

Table 8. Field Assessment Data	
Stream Habitat (RBP)	5 "Excellent" 12 "Good" 2 "Fair" 2 "Poor"
Stream Data (RIT)	Approximately 22 miles of stream walked (Only 0.2 miles inaccessible) Inadequate riparian buffer on 8 miles of stream (37% of streams walked) Cattle/Horse Access to about 2.6 miles of stream (12 % total accessible miles) Stream erosion on 0.3 miles (<2% of stream miles walked)
Conservation Areas Assessment	3779 acres of conservation areas (2,803 contiguous forest + 979 acres additional forested tract. Conservation areas account for nearly half the subwatershed (45%) Conservation areas are located in three tracts: 2,803 acres in C4: G. Richard Thompson Management Area 595 acres in C5: South of I-66 381 acres in C6: Appalachian Trail South of I-66
Other Key Features/ Concerns	One construction site causing major sediment deposition Old mine outfall discharging directly to mainstem Indian Pipe Environmental Camp Potential Vineyard non-point pollution management practices In-stream ponds on private property Hog Farm Limited education opportunities exist

Rapid Bioassessment Protocol (RBP)

The RBP provides an in-depth assessment of habitat quality at specific sites along a stream reach, providing a fairly detailed measure of stream habitat quality at those sites. This assessment was conducted in all six catchments within this subwatershed for a total of 21 sites. The results are as follows: five "excellent," 12 "good," two "fair" and two "poor" points (Table 9). Catchment 101 has the highest average habitat quality score, "excellent," while the other five catchments were determined to be in overall "good" condition.

Catchment	RBP Assessments	Average Habitat Score
101	2 "Excellent"	190: "Excellent"
102	1 "Good" 3 "Excellent"	172: "Good"
103	1 "Fair" 2 "Good"	141: "Good"
104	1 "Fair" 2 "Good"	149: "Good"
105	1 "Poor" 3 "Good"	140: "Good"
201	1 "Poor" 4 "Good"	142: "Good"

Riparian Inventory Tracking (RIT)

The RIT is a less detailed assessment than the RBP, but allows investigators to assess the entire length of stream. The RIT focuses on identifying potential restoration opportunities by assessing specific features including, stream habitat, buffers, erosion, contiguous forest and potential impacting land use. Access was only denied on two parcels of land, restricting the assessment of 0.2 miles of the 21.8 miles of perennial stream. Table 10 summarizes RIT results by catchment.

Catchment	Total Perennial Miles	Accessible Stream Miles	Accessible %	Accessible Stream Miles					
				Inadequate Buffer		Erosion		Livestock Access	
				%	Miles	%	Miles	%	Miles
HW105-101	2.6	2.6	100%	12%	0.3	0.0	0.0	0%	0.0
HW105-102	4.8	4.8	100%	31%	1.5	0.0	0.0	19%	0.9
HW105-103	2.4	2.4	100%	27%	0.6	11.4	0.3	11%	0.3
HW105-104	4.3	4.2	98%	20%	0.9	0.0	0.0	2%	0.1
HW105-105	2.1	2.1	100%	56%	1.2	0.0	0.0	0.0%	0.0
HW105-201	5.6	5.5	88%	63%	3.5	1.3	0.1	24%	1.3
Total	21.8	21.6	99%	37%	8.0	2%	0.3	12%	2.6

Inadequate riparian buffers are the most predominant problem in this subwatershed. Approximately 37% of the stream miles walked show some level of inadequate buffer. This problem was primarily associated with livestock stream access, clearing along the railroad track, and major roads. Per stream mile, Catchment 201 stands out as the one with the greatest level of impact in the subwatershed, particularly where the stream runs parallel to the railroad tracks. The results of the RIT point to a strategy that focuses on streamside restoration, using a combination of actual forestation and livestock management techniques.

Conservation Areas Assessment

The conservation areas assessment results identified three conservation areas tracts (Map 3) - C4: G. Richard Thompson Wildlife Management Area (WMA) C5: South of I-66; and C6: Appalachian Trail South of I-66. These tracts cumulatively cover approximately 45% of the total drainage area of HW-105. For more detailed information about the contiguous forest assessment, consult section 1.5.

C4: G. Richard Thompson Wildlife Management Area

This tract is the highest quality conservation area of the six identified in the conservation areas assessment. The large (2,800 acre) size of this tract, combined with the presence of very high quality streams within it contribute to its high ranking. The tract spans Catchments 101, 102 and 201, and includes significant portions the Thompson WMA. One concern within in this conservation area is the evidence of clearing in the Thompson WMA. The openings in the forest may have been created to benefit wildlife, but the unintended consequences are significant populations of invasive plant species and loss of contiguous forest.

C5: South of I-66

This 595-acre tract is located south of I-66 in the southeast corner of the subwatershed. The tract contains good forest canopy, mature trees, and good forest structure, and shows no evidence of recent timber harvesting. The amorphous shape and lack of roundness prevent the creation of interior forest, and the tract therefore receives a relatively low priority compared with other conservation areas.

C6: Appalachian Trail South of I-66

Conservation area C6 contains a portion of the AT and non-contiguous tracts of mature forest. In terms of quality C6 received the lowest rank of all the conservation areas, due primarily to its small (381-acre) size. However, protecting the tract is important because its location enhances the viewshed and aesthetics of the AT.

Stakeholder Input

Stakeholder input on watershed and subwatershed issues was gathered at the January 2003 stakeholder meeting. The focus of the HW-105 breakout group was on sharing environmental concerns and identifying methods to better protect this subwatershed and other high quality subwatersheds. The concerns and recommendations are noted below:

- The beaver population level is too high and is causing excessive damage to the natural stream structure. Some method to reduce beaver numbers is necessary.
- The hog farm off of Rt. 688 (Catchment 103) poses an environmental threat due to manure runoff. The situation has supposedly been reported to authorities but no action has been taken because there is no means of enforcement. Further investigation is needed.
- Development on ridge of Rt. 638 highlights the problem of loopholes in regulations that allow construction on steep slopes. The group was unclear as to whether the development in question was actually in subwatershed HW-105 or in the subwatershed just north of it. The site should be investigated and loopholes need to be closed.

- The trash and degradation along the railroad tracks needs to be cleaned up. It is the general belief that the railroad company is responsible for maintaining a clean and aesthetically pleasing environment along the tracks.
- Virginia Department of Transportation (VDOT) unnecessarily cuts down trees along roadsides, diminishing the rural character of the area. VDOT should be approached to encourage reduction in the clearing width along roadsides.
- Landowners are not usually open to livestock management practices such as livestock management systems because they are perceived to reduce productive land, be less effective than traditional methods, inhibit foxhunting, and are too expensive. In addition, farmers are reluctant to use cost-share programs because they don't know options or financial benefits that they offer. Targeting farmers with specific information about how cost-share programs can be applied to their own farms would increase involvement in these programs.
- Orchards and vineyards are not perceived to be a water quality threat. Stakeholders believe that vineyards already have sufficient nutrient management plans.
- Small property owners are interested in gaining financial assistance with restoration and protection projects on their property. For instance, trees should be offered at a reduced rate for streamside planting.
- Current public education programs and campaigns are not reaching enough stakeholders. Information needs to be brought to the stakeholders in a variety of formats. Suggestions to improve the dissemination of information include more prominent newspaper articles, better publicity of demonstration projects, resident specific flyers, and television ads. Additionally, a coordinated effort of the existing watershed programs and organizations is recommended to raise general awareness across the watershed.

2.3 Objectives

Six objectives were identified within the Headwater 105 subwatershed. These objectives reflect the specific problems identified during subwatershed assessments, and also support the overall watershed goals identified in section 1.2. These objectives, as well as an overview of the recommendations to achieve them, are presented below:

1. Achieve forested buffer along 75% of the stream length.
This objective is achieved through two major mechanisms: streamside forestation projects totaling 3.6 miles of stream, and buffer education focused on agricultural land adjacent to the stream.
2. Achieve a “good” to “excellent” RBP score at all of the locations analyzed during the subwatershed assessments.
The objective is supported by all of the recommendations made throughout this subwatershed, particularly the education and outreach efforts that work to enhance the stream buffer, as well as fourteen individual restoration projects, the majority of which involve reforestation of the stream buffer.
3. Preserve existing forest cover in the Headwater 105 subwatershed.
This objective is primarily achieved through conservation of 26 individual parcels through conservation easement. Two targeted outreach efforts also support the objective, including outreach to the Thompson Wildlife Management Area managers, who manage a significant amount of forest within the subwatershed, and several individual property owners with land adjacent to a significant forest resource.
4. Preserve the viewshed of the Appalachian Trail.
Six specific parcels adjacent to the trail are identified for conservation easement to pursue this goal.
5. Reduce pollutant loads from areas with a high potential for pollutant contribution.
Direct outreach to individual pollutant sources are used to achieve this objective.
6. Achieve direct involvement and stewardship by watershed residents.
This objective is achieved through both broad education and targeted outreach methods throughout the subwatershed.

2.4 Recommendations

Specific recommendations for Headwater 105 focus on three major areas: Conservation, Education, and Restoration. A summary of the recommendations is provided here, with more detailed support information provided in the next section at the catchment scale.

Conservation

Twenty six individual parcels are identified for conservation within this subwatershed, all located within areas identified during the Conservation Areas Assessment. Of these parcels, six are adjacent to the Appalachian Trail, and therefore may be protected as a part of a larger effort to preserve the trail and its viewshed (See section 1.6 for information on the proposed “Mountainside Initiative” to protect these parcels). Protection of these parcels (identified in the “catchment write-ups” section would help achieve the dual subwatershed objectives of preserving existing forest cover (Objective 3) and preserving the viewshed of the Appalachian Trail (Objective 4).

Education

Thirteen specific educational initiatives are identified in this subwatershed (Table 11). These efforts achieve a broad range of subwatershed objectives, and include many targeted outreach efforts targeting individual property owners, and one subwatershed-wide initiative focusing on stream buffer education. While the majority of these educational opportunities are discussed in detail in the supporting “catchment write-ups” (section 2.5), three educational initiatives that cut across catchment boundaries, are discussed here.

Agricultural Buffer Education to Rural Landholders

This should be the most widespread educational campaign in HW 105 and should build on existing NRCS programs. A key focus in Headwater 105 should be stream segments that have inadequate buffer, but do not have an associated restoration project.

Thompson WMA

This property is home to a significant tract of contiguous forest. While the property’s ownership by the state protects it from future development, some patches of clearing were seen during the conservation areas assessment. This practice is often used to encourage certain game species, such as deer, but the practice also disrupts contiguous forest, and therefore inhibits the viability of the more vulnerable interior forest species. This practice should be discussed with wildlife managers at the WMA to learn more about the reasons behind the clearing observed and to discourage this practice, if appropriate.

Norfolk Southern Railroad

Stakeholder input suggested that trash and debris are problems along the railroad tracks, and that the Norfolk Southern Railroad may be responsible for cleanup. Contacting railroad management to discuss the issue further is recommended. Such a meeting would also offer an opportunity to discuss possible forestation projects identified along the track.

Table 11. Education Initiatives in Goose Headwater 105			
Initiative/ Audience	Catchment	Objectives Supported	Description
Agricultural Buffer Education	All	1,2,6	Conduct educational efforts targeting agricultural land holders residing along the stream.
Suburban Landholders near Contiguous Forest Tracts	101	3,6	Landowners should be educated on how to protect and enhance the contiguous forest tracts.
Thompson WMA	101, 102, 201	3,6	Approach wildlife managers to discuss the practice of clearing within the WMA.
Vineyard	102	5,6	Promote pollution prevention techniques at Naked Mountain Vineyard
Indian Pipe Education Camp	102	6	Work directly with Indian Pipe Education Camp to inform, educate and potential partner on watershed protection actions.
In-stream ornamental pond landowners	101	2,6	Landowners should be educated on ways to reduce impact of in-stream ponds
Norfolk Southern Railroad	105, 201	1,2,5	Contact Norfolk Southern Railroad to discuss level of responsibility of railroad to maintain land along the tracks. Also discuss possible restoration opportunities here.
Defunct Mine Landowner	201	5,6	Investigate water quality of outfall discharge and work with landowner to mitigate any identified problems and improve stewardship management practices.
Hog Farm	103	5,6	Investigate the water quality impact of the hog farm and work with landowner to mitigate any identified problems and improve stewardship management practices.
Property Holder near Debris Jam	101	2,6	Investigate the existing impact of existing debris jam

Specific Restoration Opportunities

Fourteen specific restoration opportunities have been identified in HW-105. These opportunities, summarized in Table 12, focus primarily on streamside forestation, although two projects also incorporate in-stream restoration as well. In many cases, the streamside forestation projects are accompanied by livestock management to exclude livestock from the stream. These projects support the subwatershed objective of improving stream habitat. In all but one project (HW 105-5) the projects also support the goal of increasing the amount of forested buffer, and would collectively result in 3.6 miles of forested buffer added to the steam system.

Part 2: Goose Headwater 105

Table 12. Restoration Projects in Goose Headwater 105				
Project ID	Project Components	Length of Stream Impacted (feet)	Objectives supported	Priority
Catchment 101				
HW 105-1	Streamside forestation	359	1,2,6	Low
Catchment 102				
HW105-2	Streamside forestation and livestock management system along Rt. 688	2,027	1,2,6	High
HW105-3	Streamside forestation and livestock management system	2,746		High
Catchment 103				
HW105-4	Streamside forestation and livestock management system	1,763	1,2,6	High
Catchment 104				
HW105-5	Sediment Clean Up	3,562	2	High
Catchment 105				
HW105-6	Streamside forestation / stream rehabilitation	1,921	1,2,6	Moderate
HW105-7	Streamside forestation	588	1,2,6	Moderate
HW105-8	Streamside forestation/ stream restoration near railroad tracks	825	1,2,6	Moderate
Catchment 201				
HW105-9	Streamside forestation and livestock management	1,762	1,2,6	High
HW105-10	Streamside forestation and livestock management	2,388	1,2,6	High
HW105-11	Streamside forestation	328	1,2,6	Low
HW105-12	Streamside forestation and livestock management	644	1,2,6	Moderate
HW105-13	Streambank stabilization, livestock management and streamside forestation	2,481	1,2,6	High
HW105-14	Streamside forestation	1,270	1,2,6	High

2.5 Catchment Write-ups

The following section includes detailed findings and recommendations for each of the six catchments within HW-105. Detailed maps of existing conditions and management recommendations are included for each catchment, where applicable. Recommendations include conservation priorities, targeted outreach, and specific restoration opportunities. Note that, while important throughout the subwatershed, the broader overall outreach initiatives are not detailed in each catchment write-up.

Catchment 101

Catchment 101 is in the western portion of the subwatershed, lying almost entirely north of Interstate 66 and includes agricultural and low density, single-family parcels. The AT runs through the eastern portion of the catchment and is located entirely on state and federal land. Rt. 725 runs through the middle, providing access for the single-family homes that are embedded in the large contiguous forest tract. Overall, recommendations within this subwatershed focus on targeted outreach and preservation of the large conservation area, with one restoration project identified.

Findings

This catchment is largely dominated by a conservation area covers 883 acres and overlays portions of all land uses including 365 acres located in Thompson WMA. Most of the stream reaches are “good” quality, with the only areas of concern noted for inadequate riparian buffer, a debris jam and several in-stream ponds. The two RBP points that are located in the contiguous forest tract are in “excellent” condition. The third point, which is located at the AT stream crossing is in “good” condition. Field notes indicate that this catchment has many unassessed side tributaries, and that there is underground flow in segments. Table 13 reviews the key findings for this catchment.

Table 13. Key Findings in Catchment 101	
Area	1,577 acres
Land Use	Currently a mix of agriculture and forest, with some low density residential Conservation Easements: 0 acres Lower section with horse hobby farms Large Tracts of Federal and State Land
Conservation Areas	883 acres in the G. Richard Thompson WMA (C4) Number 1 priority Conservation Area in Watershed
Streams – RBP	3 RBP Points: 2 “Excellent,” 1 “Good”
Stream Buffer (RIT)	8 miles of inadequate buffer (12% accessible streams)
Stream Erosion (RIT)	None noted
Other Important Features	Includes portions of AT Private landowners with ornamental in-stream ponds Many unassessed side tributaries exist Underground flow in segments

Key Recommendations

Major recommendations for Catchment 101 focus on preserving existing forest resources, homeowner education, and one restoration project.

Recommendations for Conservation

The following recommendation focuses on preserving the large contiguous forest tract in Catchment 101.

Protection in the C4: G. Richard Thompson Wildlife Management

This contiguous forest tract represents 32% of the entire C4 conservation area.

The majority of the remaining portion lies in Catchment 102. Protecting this forest by seeking easement on three parcels located fully or partially within Catchment 101 (see Map 5) is recommended.

Targeted Outreach

Outreach to Forest-Side Residents

Fourteen residences adjacent to conservation areas may require more involved and detailed outreach to prevent forest encroachment. Specific elements would include the importance of contiguous forest and guidance on how the homeowner can protect this resource.

Outreach to Landowner with In-stream Pond

The landowner with ornamental, in-stream ponds should be approached to determine if he/she is willing to implement stewardship management practices to reduce thermal impacts typically associated with in-stream ponds.

Outreach/Investigation of Debris Jam

Field notes indicated a large intentional debris jam causing upstream ponding. The effects of this ponding should be investigated and the landowner should be contacted regarding potential mitigation actions.

Restoration Opportunities

The single restoration opportunity in this catchment focuses on improving streamside forest.



Figure 8. Stream reach in need of streamside reforestation

HW 105-1: Streamside Forestation

This area has a long stretch (109 feet) of moderately severe inadequate streamside vegetation (Figure 8). Restoration activities at this site should include streamside forestation. One agricultural parcel encompasses this area. This is a relatively low priority restoration project, and this goal could alternatively be achieved through educational efforts.

Catchment 102

Catchment 102 falls in the northeastern region of HW-105 and the Thompson WMA encompasses nearly half of the drainage area. The management area is maintained by Virginia Department of Game and Inland Fisheries and contains portions of the AT. With the exception of several clear-cut areas, the Thompson WMA has helped to maintain a very large high quality contiguous forest tract. Key recommendations focus on protecting this contiguous forest tract, outreach, and two streamside forestation projects.

Findings

The two RBP points in the Thompson WMA show the stream reaches to be in “excellent” condition. The third point is being mildly impacted by a stretch of inadequate buffer adjacent to a single-family home, bringing the habitat score down to a “good.” The major water quality concern in this catchment occurs along reaches with cattle access and related inadequate buffers. The two reaches with the greatest severity of inadequate buffer also have unlimited cattle access. The key findings are summarized in Table 14 below.

Table 14. Key Findings in Catchment 102	
Area	2,506 acres
Land Use	1,371 acres of contiguous forest primarily in Thompson WMA Remaining primarily agricultural land use Very few lots with single family units Conservation Easements: 0 acres
Conservation Area	1,371 acres in C4: Thompson Wildlife Area in G. Richard Thompson WMA.
Streams – RBP	4 Points: 3 “Excellent”; 1 “Good”
Stream Buffer (RIT)	All inadequate buffers associated with cattle access to stream. A long stretch minimal buffer erosion was not noted as a problem. 11% steam miles of inadequate buffer
Stream Erosion (RIT)	None noted
Other Important Features	Naked Mountain Vineyard

Key Recommendations

Major recommendations within Catchment 102 focus on preserving existing forest resources, targeted outreach, and two streamside forestation projects.

Recommendations for Conservation

The following recommendation focuses on efforts to protect large contiguous forest tracts Catchment 102.

Protection in the C4: G. Richard Thompson Wildlife Management Area

Nearly half of the 1371 acres of C4 conservation area is located in this subwatershed (see Figure 9). The Thompson WMA already protects most of tract. The remaining portion falls on three parcels of private land, most of which is under agricultural land use.

Targeted Outreach

In addition to the G. Richard Thompson Area, two specific outreach projects are identified in this catchment:

Outreach Naked Mountain Vineyard

Continue existing NRCS efforts to encourage sound management at this vineyard.

Homeowner Outreach

Currently this residential parcel maintains turf to the stream edge. The homeowner should be encouraged to leave a natural grass buffer by not mowing to the bank edge. This effort is one of several that is aimed at improving the lower half of the reach. The agricultural areas downstream are targeted for restoration projects.

Restoration Opportunities

Both of the agricultural restoration opportunities in this catchment address livestock stream access. As the parcels both border Rt. 688 either one would make a good demonstration project. Both project sites have high cattle access and moderate water quality impacts due to inadequate buffer.

HW 105-2: Livestock Management System and Streamside Forestation

This parcel has a total of 435 feet of inadequate buffer and cattle access between the two stream branches that lie on the property. Restoration activities at this site should include buffer forestation, accompanied by livestock management for the cattle. This management should include fencing, an off-stream water source, and improved crossings. The prominent location along the Rt. 688 would make it a good demonstration project site.



Figure 10. Inadequate buffer at site HW 105-3



Figure 9. High quality stream section in conservation area

HW 105-3: Livestock Management System and Streamside Forestation

This highly impacted stream stretch has 433 feet of inadequate buffer and cattle access. Restoration activities at this site should include streamside forestation and livestock management including off-stream water sources, fencing, and improved stream crossing (see Figure 10).

Catchment 103

Catchment 103 is located in the southeastern corner of the subwatershed. It is the smallest catchment and is primarily under agricultural land use, with a few residential parcels along Route 688. Relatively few recommendations were made in this subwatershed, including preservation in the C5 conservation area, one targeted outreach effort, and one restoration project.

Findings

Approximately 445 acres high quality forest is included in the C5: South of I-66 conservation area. Three RBP points were taken; two revealing “good” habitat and the last in only “fair” habitat condition (Table 15). The degraded stream quality is associated with minor levels of cattle access and inadequate buffer along the northern most section of the reach.

Table 15. Key Findings in Catchment 103	
Area	756 acres
Land Use	Currently a mix of agricultural tracts with only several low density residential tracts Conservation Easements: 0 acres Primarily consists of several large agricultural tracts, with a few lots with single family units
Conservation Area	444 acres entirely on agricultural land All in C5: South of I-66 (almost 75% of entire conservation area)
Streams - RBP	3 RBP Points: 2 “Good”; 1 “Fair,” - associated with minimal buffer, cattle access, minimal erosion
Stream Buffer (RIT)	Inadequate buffer on almost 27% of stream miles. Only one stretch with minimal inadequate buffer
Stream Erosion	12% steam miles with low severity of stream bank erosion. Associated with minimal buffer, cattle access, minimal erosion
Other Important Features	Hog farm Rt. 688 passes through drainage area

Key Recommendations

Major recommendations within Catchment 103 focus on preserving existing forest resources, homeowner education, and isolated agricultural restoration activities. Specific recommendations are detailed below.

Recommendations for Conservation

The following recommendation focuses on efforts to protect the tract of contiguous forest in Catchment 103.

Protection in the C5: South of I-66

The 444-acre contiguous forest tract lies entirely on private agricultural land. This portion accounts for almost 75% of entire C5 conservation area. Six key parcels exist within this conservation area.

Targeted Outreach

Only one targeted outreach effort was identified in this catchment.

Hog Farm Targeted Outreach/Investigation

To address stakeholder concerns, the hog farm located along Rt. 688 should be investigated to determine if the farm is posing an environmental threat and if it is violating any regulations. Since this property was not observed by field investigators, detailed recommendations could not be made for this site.

Restoration Opportunities

One agricultural restoration opportunity was identified during the stream assessment in this catchment. This stretch of stream runs parallel to Rt. 688 and has several low-grade impacts including cattle access, inadequate buffer and stream bank erosion.



Figure 11. Inadequate buffer, livestock access and water quality impacts at site HW 105-4

HW 105-4: Livestock Management System and Streamside Forestation

Mild inadequate buffer, cattle access, and stream bank erosion spans 433 feet of this tributary (Figure 11). Although each individual impact may not warrant a restoration project, the combination of all three indicates the location could be causing higher levels of cumulative water quality

damage. Restoration activities at this site should include a combination of livestock

management and streamside forestation. Livestock management would include stream fencing, improved crossings, and an off-stream water source.

Catchment 104

This catchment lies in the southwest corner of the subwatershed and is bisected by Rt. 726. The majority of the catchment is under agricultural land use; only a small portion of the catchment is in residential land use. Here, preservation within the C6 conservation area, one targeted outreach project, and one major restoration project are recommended.

Findings

Just over four miles of stream was observed in this catchment, of which 19% is impacted by inadequate riparian buffer. The impacted portion tightly parallels Rt. 726. The RBP shows two “good” and one “fair” point in this catchment (Table 16). The “fair” point has lowered stream quality due to high embeddedness, heavy levels of sediment deposits, and only marginal quality velocity depth regime.

Table 16. Key Findings in Catchment 104	
Area	874 acres
Land Use	Currently a mix of agricultural tracts with only several low density residential tracts Conservation Easements: 0 Rt. 726 bisects Catchment 104
Conservation Area	C6: Appalachian Trail South of I-66 No contiguous forest but 192 acres of high quality forest worth protecting in conservation area
Streams - RBP	3 RBP Points: 2 "Good" and 1 "Fair"
Stream Buffer (RIT)	Most of the low-grade inadequate buffer along Rt. 726- 19% of stream miles. Restoration options are limited One small stretch of moderately inadequate buffer associated with rail road track and cattle access point
Stream Erosion	None noted
Other Important Features	Construction site with poor ESC Indian Pipe Environmental Camp Orchard with possible clearing

The greatest concern in this subwatershed is the impact of a construction site without effective erosion and sediment control (ESC) measures. At the time of the field survey, ESC practices were failing (Figure 12), and as a result, heavy erosion and deposition in the stream channel occurred (Figure 13).

Key Recommendations

Two preservation efforts, one targeted outreach effort and one restoration project are recommended for Catchment 104.

Recommendations for Conservation

The 192 acres of conservation area C6 overlap two parcel types in this catchment: those along the AT and those not along the AT. Combined they account for approximately 22% of the conservation area. The parcel that runs along the AT extends into Catchment 105. The second parcel type contains high quality forest tracts. Two recommendations are made for the conservation efforts in this catchment, one for each type of parcel.



Figure 12. Failing ESC practices at a construction site in Catchment 104

Protection in the C6: Appalachian Trail South of I-66 - Adjacent to the AT.

The high quality forest along the AT should be protected through the Mountainside Initiative. Facilitation with landowners and the ATC will be necessary to achieve this. The identified parcel extends into Catchment 105.



Figure 13. Heavy erosion and sedimentation in stream near construction site

Protection in the C6: Appalachian Trail South of I-66- Not adjacent to AT.

The high quality forest of this parcel should be protected through easements or other preservation techniques.

Targeted Outreach
Indian Pipe Environmental Camp Outreach

This camp should be contacted about potential joint efforts in that subwatershed. The camp has an environmental focus, and camp employees encountered in the field seemed enthusiastic about watershed protection efforts.

Potential joint ventures could

include educational efforts, streamside forestation projects, or monitoring.

Restoration Opportunities

HW 105-5: Sediment Clean Up Down Stream of Construction Site

Failing ESC practices at a construction site have left large volumes of sediment in the stream. This stretch should be cleaned up to prevent greater down stream impacts. Stream restoration here would be quite expensive and may include “silt sucking” or other techniques designed to remove the sediment from the stream substrate. As a first step, hiring a stream restoration firm to investigate this site is recommended.

Catchment 105

Catchment 105, located in the western most portion of the subwatershed, has the greatest portion of residential development of any catchment within Headwater 105, although agriculture is still a significant component of the drainage area (See Table 17). I-66 and the railroad both run parallel to the stream and severely impact stream quality. Here, the focus is primarily on restoration on the stretch of stream that runs parallel to the railroad tracks.

Key Findings

This subwatershed had relatively poor quality compared to the others within this catchment. Although the upper reaches of the stream had fairly high quality, stream quality severely degrades as the stream runs parallel to the railroad track. Results include highly impacted stream buffer throughout, and the only “poor” RBP point recorded within the subwatershed.

Table 17. Key Findings in Catchment 105	
Area	738 acres
Land Use	Majority of agriculture land; some single-family suburban residences and only single-family residence in urban area in subwatershed. Conservation easements: 0
Conservation Area	152 acres high quality forest, though not contiguous, along AT worth protecting as conservation area
Streams - RBP	4 RBP Points: 1 "poor", 3 "good"
Stream Buffer	Inadequate buffer on 56% of stream miles
Stream Erosion	No erosion was noted
Other Important Features	I-66, Rt. 55 and Railroad pass through subwatershed

Key Recommendations

Major recommendations within catchment 105 focus on three areas of concern: preserving existing forest tracts along AT and agricultural buffer forestation. Note that outreach to the railroad is important in this catchment and is discussed in section 2.4. Specific recommendations are detailed below.

Recommendations for Conservation

The following recommendation focuses on efforts to protect the tract of high quality forest along the AT in Catchment 105.

Protection in C6: Appalachian Trail South of I-66- Adjacent to AT

The 152 acres of high quality forest along the AT should be protected through easements and homeowner education. These tracts can be preserved through techniques identified in the "Mountainside Initiative" (See section 1.6).

Restoration Opportunities

The two restoration opportunities here focus on streamside forestation along portions of the railroad tracks. While these projects have generally severe impacts, they receive a somewhat lower priority than many other restoration projects, because their restoration potential is somewhat hampered due to the proximity to the railroad tracks.

HW 105-6: Streamside Forestation/ Stream Rehabilitation

This stretch of stream has poor buffer for a significant length. To the west, the inadequate buffer on the right bank is largely associated with the railroad (Figure 14), and as the stream flows to the east, virtually no buffers exist on the left bank near Route 55. This is a very poor quality stream reach. Although an investigation of this site for potential streamside forestation is highly recommended, the level of improvement that can be achieved is unclear, particularly on the railroad side. Two possible restoration options are presented here.

Option 1: Streamside Forestation Only

In this option, the restoration would focus solely on streamside forestation, using low shrubs adjacent to the railroad track. One possibility may be to plant low shrubs to provide some filtering adjacent to the track, rather than to target mature forest as an ultimate goal.

Option 2: Total Stream rehabilitation

In this option, a very aggressive approach would include creating a new channel for the stream, allowing it to meander more freely between route 55 and the railroad tracks, and stabilizing and vegetating the banks throughout.

HW 105-7: Streamside Forestation

This stream reach flows toward the railroad tracks, crossing four residential parcels. Here, streamside forestation is recommended and is projected to significantly improve this site.

HW 105-8: Streamside Forestation

This reach is similar to the site at HW 105-6. While the impacts are severe, the proximity of the railroad makes complete restoration unlikely. Again, an investigation of this site is needed but the restoration potential here is uncertain.



Figure 14. Inadequate buffer near railroad tracks

Catchment 201

Catchment 201 runs through the center of the subwatershed and has the second highest concentration of residential land use. This is the only catchment with portions of all three conservation areas (C4, C5, and C6). The catchment spans $\frac{3}{4}$ of the length of railroad tracks that run parallel to the main stem.

Findings

The railroad, along with other impacts, contributes to significant and severe inadequate buffer throughout the catchment. Unlike the other catchments, streambank erosion is also problematic here (see Table 18). Of the five stream habitat assessment points taken during the study, four are in “good” condition and one is in “poor” condition. The point in “poor” condition is just downstream of a stretch with multiple impacting features including severe streambank erosion, livestock access, and moderately severe inadequate buffer.

Table 18. Key Findings in Catchment 201	
Area	2031 acres
Land Use	Many single family home lots in this catchment, mostly along highways and railroad. Remainder is agricultural tracts. Conservation easements: 0
Conservation Area	Largest contiguous forest tract in upper portion of catchment (C4); two small tracts extend from Catchment 104 (C5); with small area of C6.
Streams - RBP	4 RBP Points: 3 "Good" and 1 "Poor," due to areas with high erosion, cattle access and high impact of inadequate buffers
Stream Buffer	63% of accessible miles inadequate buffer. Entire length along rail road and road inadequate buffer a problem.
Stream Erosion	Only erosion problem is located at R105-4 between railroad and highway
Other Important Features	Southern Norfolk Railroad, I-66, and Rt. 55 pass through drainage area. Old mine

Key Recommendations

Major recommendations within Catchment 201 focus on preserving existing forest resources in the C4 and C5 conservation areas, one targeted outreach effort, and six restoration projects.

Recommendations for Conservation

The following recommendations focus on efforts to protect the tract of contiguous forest and other conservation areas in Catchment 201. Portions of all three conservation areas lie in this catchment. A total of 734 acres of this subwatershed is included in the conservation area.

Protection in C4: G. Richard Thompson Wildlife Management Area

The C4 conservation area covers 30% of the catchment. Most of the area to be protected lies on agricultural property of three tracts.

Protection in C5: South of I-66

Two small tracts of contiguous forest lies on agricultural land in this catchment (149 acres) that extends from catchment 103.

Targeted Outreach

In addition to the railroad outreach described in section 2.4, a single targeted outreach opportunity was identified here.

Outreach/Investigation of Old Mine

An investigation into the environmental impact of the outfall pipe discharge should be pursued. At a minimum this should include initial testing of the outfall discharge to assess the potential water quality impacts. On-going volunteer monitoring may be necessary if a problem is apparent. This effort should also include approaching the landowner and providing educational materials on mining discharge regulations and appropriate best management practices.

Restoration Opportunities

There are six restoration projects in this catchment. All require some level of streamside forestation, due to pervasive inadequate buffer.

HW 105-9: Streamside forestation and livestock management

This reach has 537 feet of high-level inadequate buffer and low-level cattle access. Restoration activities at this site should include streamside forestation, off-stream water sources and stream crossing protection.

HW 105-10: Streamside forestation and livestock management

This reach has 726 feet of high-level inadequate buffer and low-level cattle access. Restoration activities at this site should include streamside forestations, off-stream water sources and stream crossing protection. Promoting the utilization of cost-share programs should also be included.

HW 105-11: Streamside Forestation

This site has relatively minor impacts from inadequate buffer. Improvement can be achieved through planting or alternatively, through general educational efforts.



Figure 15. Bank stabilization, streamside plantings and buffer forestation needed here

clearing and grading. A vehicle crossing point is also present, as well as sediment deposition. Here, the project should focus on streamside forestation and be monitored over time to investigate stream recovery.

HW 105-12: Livestock Management System and Streamside Forestation

This area has high levels of stream bank erosion associated with livestock access and a lack of riparian buffer. This site needs bank stabilization, streamside plantings and livestock management system along 261 feet of bank.

HW 105-13: Streambank Stabilization and Streamside Forestation

This stream section has severe impacts associated with erosion and inadequate buffer and some impacts associated with cattle access. Here a combination of livestock management (including an off-stream water source, improved crossing, and fencing), streamside forestation, and streambank stabilization is recommended.

HW 105-14: Streamside Forestation

This 386-foot stretch adjacent to a residential parcel has high levels of inadequate buffer as a result of mass

PART 3. NORTH FORK 102

3.1 Introduction

North Fork 102 is in the northwest corner of the Goose Creek Watershed, at the westernmost border of Loudoun County (see map 16). Its headwaters originate in forest along the Appalachian Trail, and the subwatershed is the drainage to Sleeter Lake, a potential water supply for the citizens of Round Hill. In between, the landscape is dominated by pasture (see Figure 16), with some residential and commercial development in the lower reaches of the watershed. North Fork 102 falls under the jurisdiction of two municipalities: Loudoun County and Round Hill, and a small fraction (8%) of the subwatershed is protected by conservation easement. Table 19 offers a summary of basic North Fork 102 data.

This subwatershed was placed in the “rural impacted” category during the in-office vulnerability analysis (CWP, 2002). Although the review of maps and aerial photographs determined that the watershed had less than 10% impervious cover, other data indicated impacts from other sources including a high number of septic systems, a significant number of horses, an existing dam represented a fish barrier, and very “poor” fish IBI scores above Sleeter Lake (see Table 19).



Figure 16. Agriculture and forested hills dominate much of North Fork 102

Table 19. North Fork 102 Data	
Area (acres)	6,821
Number of Catchments	6
Perennial Stream Miles	18.4
Political Jurisdictions	Loudoun County; Round Hill
Conservation Easements	533 acres (8% of the watershed)
Current Impervious Cover	5%
Future Impervious Cover	9%
Stream Classification (Current and Future)	Rural Impacted
Existing Monitoring Data	1 Fish IBI point (very poor)
Land Use	Mixed use including forest, low intensity agriculture, low density residential, and some townhouse/commercial

Both stream assessments and a conservation areas assessment were conducted in North Fork 102, which was subdivided into six catchments as part of this study (Map 14). Stream assessment data suggest that the majority of the stream miles are in “good” condition for physical habitat. In addition, the subwatershed had significant areas of contiguous forest tracts, both along the Appalachian Trail and within the Round Hill Tract. There are, however, isolated areas of severe channel erosion and significant inadequate buffer throughout the subwatershed. Finally, field data confirmed the presence of fish barriers, with three man-made dams identified in North Fork 102.

3.2 Assessments

Three separate field assessments were conducted in North Fork 102: the Rapid Bioassessment Protocol (RBP), the Riparian Inventory Tracking (RIT) and a Contiguous Forest Assessment. Results of these field assessments are summarized in Table 20 and described below.

Table 20. Field Assessment Data	
Stream Habitat (RBP)	5 "Good" 2 "Fair" 1 "Poor"
Stream Data (RIT)	10.5 miles of stream walked (57% of mapped perennial stream miles) Inadequate Buffer on 51% of stream miles walked Cattle/Horse Access on approximately 23% of stream miles walked Stream erosion on 4% of stream miles walked.
Other Key Features (RIT)	Some small dams Some community ponds with no pond buffer Beautiful wetland upstream of beaver dam Golf course Stream plantings
Contiguous Forest Assessment	1,264 acres (19% of the subwatershed) in three Tracts: 371 acres in C1: Mountain South 430 acres in C2: Mountain North 463 acres in C3: Round Hill

Rapid Bioassessment Protocol (RBP)

The Rapid Bioassessment Protocol is a fairly detailed measure of stream habitat quality, conducted at unique points along the stream. RBP assessments were conducted in four of the six catchments, with a total of eight points collected. While five of the eight points resulted in "good" habitat quality scores, one point in catchment 102 was rated "poor," and two points in catchment 103 were rated "fair" (Table 21). Appendix B of this document includes the RBP field sheets within the Goose Creek Watershed.

Table 21. RBP Summary		
Catchment	RBP Assessments	Average Habitat Score
101	2 "Good"	159: "Good"
102	1 "Poor"	91: "Poor"
103	2 "Fair" 1 "Good"	128: "Fair"
104	No Data	No Data
105	No Data	No Data
201	2 "Good"	151: "Good"

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Riparian Inventory Tracking (RIT)

The RIT is a less detailed but more extensive field method than the RBP. The RIT is a stream walk that focuses on identifying potential education and restoration opportunities. Field crews completed the RIT on only 57% of the mapped perennial stream miles within North Fork 102. A significant amount of stream was inaccessible because field crews did not have permission to enter many of the private properties along the stream.

Key problems identified during the RIT were inadequate stream buffer on approximately half of the stream miles walked throughout the subwatershed (see Table 22 and Figure 17), and cattle and horse access to the stream. Areas of livestock access were concentrated in catchment 101, although severe stream erosion was confined to a few specific locations. Other general observations included multiflora rose and other invasive plants that were pervasive throughout the stream corridor.

Stream Miles				Accessible Stream Miles					
Catchment	Total Perennial	Accessible	Percent Accessible	Inadequate Buffer		Erosion		Livestock Access	
				%	Miles	%	Miles	%	Miles
101	4.6	3	65%	48	1.4	2	0.1	19	0.6
102	1.5	0.6	40%	19	0.1	0	0.0	2	<0.1
103	3.7	2.5	68%	24	0.6	9	0.2	1	<0.1
104	1.9	0	0%	0	0.0	0	0.0	0	0.0
105	0.8	0.5	63%	0	0.0	0	0.0	0	0.0
201	6	4.1	68%	27	1.1	2	0.1	0	0.0
Total	18.5	10.5	57%	30	3.2	4	0.4	8	0.8



Figure 17. Inadequate buffer was common in North Fork 102

Other encouraging observations made during the RIT, included a beautiful wetland upstream of a beaver dam, and a streamside forestation project near a townhouse development in Catchment 103, shown in Figure 18. Fortunately, the wetland is protected by conservation easement. Other observations included poor buffer at the edge of a golf course and along small in-stream ponds in catchment, as well as some small dams not previously known.



Figure 18. Reforestation near a residential area in North Fork 102

Conservation Areas Assessment

The conservation areas forest assessment identified three contiguous forest tracts in this subwatershed (Map 17): C1: Mountain South; C2: Mountain North; and C3: Round Hill. These tracts together comprise approximately 19% of the total drainage area of North Fork 102. For more detail on the methodology used to conduct the assessment, consult section 1.5.

C1: Mountain South

This tract is located in North Fork 102 and is connected to the contiguous Mountain North (C2) tract. The C1 tract is approximately 371 acres and forms a portion of the headwaters of the North Fork subwatershed. Existing development is limited to a few homes with limited clearing. A portion of the forest that borders the Appalachian Trail has been selectively harvested. A strong forest canopy and fairly good oak dominated forest structure exist, with tree ages to be between 50 –100 years within this tract.

C2: Mountain North

This tract is connected to the Mountain South Tract (C1), and contains and borders a portion of the Appalachian Trail. The C2 tract is approximately 430 acres and forms the other portion of the headwaters of the North Fork 102 subwatershed. Development here is also limited to just a few homes most with limited clearing. There is no evidence of recent timber harvesting, and the site contains good forest canopy, mature trees (some >100 year) and good forest structure.

C3: Round Hill

The Round Hill Tract, the namesake of the town of Round Hill, is unique as it is a 463-acre contiguous tract situated away from the mountain ridge where the other two contiguous forest tracts are located. Contiguous forest assessment results revealed mature trees (50-100 years), including tulip poplar, white ash and walnut with good forest structure and canopy cover, even though selective harvesting had taken place in the past 5-10 years. The Round Hill tract is under considerable development pressure as the proposed development, Hamlets at Round Hill, is slated to cover a large portion of the existing contiguous tract.

Stakeholder Input

Stakeholder input was solicited in a meeting in January 2003, during which a breakout group was formed to discuss specific needs and concerns about North Fork 102. Several recommendations resulted from the discussion, although several of them were on more of a watershed-wide scale. The only major recommendation that pertained solely to North Fork 102 is as follows:

- The group discussed the importance of buffers in this subwatershed. They felt that encouraging the use of buffers at golf courses and community ponds should be made the highest priority.

3.3 Objectives

Six specific subwatershed objectives are identified in this subwatershed, and focus primarily on improving habitat condition, increasing the amount of forest cover, and retaining existing forest cover. Because much of the stream was not accessible during this study, many of the quantifiable objectives refer to the stream miles assessed, rather than to the stream as a whole. These objectives include the following:

1. Achieve forested buffer along 90% of the stream length assessed during this study.
This objective is achieved with two specific initiatives: streamside forestation projects along slightly less than one mile of stream, and educational efforts targeting both rural and suburban watershed residents.
2. Improve habitat quality to “fair” or “good” in all RBP points identified during initial assessments.
All of the recommendations within this subwatershed support this objective, particularly those that incorporate in-stream stabilization, or that result in an improved forest buffer.
3. Improve Fish IBI from “Very Poor” to “Fair.”
All recommendations help to achieve this objective, because all subwatershed factors collectively result in this very poor result.
4. Preserve forest and areas of special value throughout the subwatershed.
A combination of conservation easements and outreach to developers can help to protect some forest and special habitats land from development or degradation, while preserving forest to the extent possible on lands where development is slated to occur.
5. Achieve direct involvement and stewardship by subwatershed residents.
This objective is met largely through direct outreach efforts, and also through opportunities for participation in individual restoration projects.
6. Reduce pollutant loads from urban stormwater
An outreach and restoration project both targeting in-stream stormwater ponds help to meet this objective.

3.4 Recommendations

Within North Fork 102, major recommendations include Conservation, Education, and Restoration. In North Fork 102, education is a major focus, due in large part to the multiple and diverse stakeholders living within the subwatershed.

Conservation

In North Fork 102, conservation recommendations focused on the conservation areas identified during the Contiguous Forest Assessment. Two types of parcels were identified: subdivided lots and large lots. In subdivided parcels, the focus is to work with developers to minimize impacts to forest resources, while the goal in large parcels is to preserve land through conservation easement or other land preservation techniques. Taken together, these parcels represent over 1400 acres of potential conservation easements, in 22 individual agreements. These recommendations contribute toward objective of preserving existing forest within the subwatershed.

Education

The multiple educational initiatives within North Fork 102 are summarized in Table 23. They include three broad educational efforts, as discussed below, as well as six targeted outreach efforts discussed in detail in section 3.4. Within the North Fork 102 subwatershed, educational initiatives targeting both agricultural land holders and homeowners are key to improving water quality. In particular, stream buffer education is important throughout the subwatershed.

Agricultural Buffer Education

Based on field observations in North Fork 102, the key focus of agricultural education and outreach should be stream buffer management. This education is ongoing through the NRCS and can be targeted to stream reaches with inadequate buffer.

Homeowner Buffer Education

Similarly, streamside buffer education should be a focus of homeowner education efforts in North Fork 102. The Program Review in Appendix D provides more detail about specific elements of homeowner streamside buffer education.

Developer Education

Although North Fork 102 is zoned at R20, a significant amount of land within its drainage has been subdivided. This is a critical stage to establish a relationship with developers or holders of subdivided plots in order to promote developments that preserve key resources, such as headwater streams and contiguous forest.

Table 23. Targeted Outreach Initiatives in North Fork 102			
Initiative/ Audience	Catchment	Objectives Met	Description
Agricultural Buffer Education	All	1,2,3,5	Focus on livestock exclusion and limiting clearing
Homeowner Buffer Education	All	1,2,3,5	Focus on limiting clearing and buffer encroachment.
Developer Education	All	1,2,3,4,5	Focus on preserving key natural resources, and contiguous forest in particular.
Stoneleigh Golf Course	201	1,2,3,5	Encourage golf course to practice resource management and enhancement practices.
Land Owner Engagement	102, 104	5	Actively engage large land holders, with a focus on properties where access was not granted for field work.
Adopt-a-Pond	201	3,5,6	Encourage residents near three in-stream ponds to participate in an "adopt-a-pond" program.
Special Wetland Outreach	103	2,3,4,5	Reinforce the value of a high quality wetland on this property that is in conservation easement.
Sleeter Lake	201, 105	4, 5	Encourage protection on the shorelines of Sleeter Lake
Conservation Easement Holders: Stream Buffer Education	101	1,2,3,5	Work with property owners who hold conservation easements to promote streamside forestation.

Restoration

Eleven specific restoration opportunities were identified in North Fork 102 (Table 24). These opportunities could broadly be grouped into four categories: in-stream, streamside, agricultural, and multiple. In-stream practices include stream stabilization or habitat improvement areas; streamside projects include streamside forestation and invasive plant removal; agricultural practices focus specifically on agricultural land holders and include activities such as livestock management. Three projects in this subwatershed fall in multiple categories and include a combination of restoration activities at a single site or stream reach.

Overall, restoration within North Fork 102 is not as important a tool as in the other two subwatersheds discussed in this report. Of the 11 projects identified, only six were assigned high priority. The other five were lower priority because they generally addressed a problem over a very short length of stream or with moderate severity, or provided minimal direct benefit. This result points to the importance of education and land preservation to achieve goals within this subwatershed.

Part 3. North Fork 102

Table 24. Restoration Projects in North Fork 102				
Project ID	Project Components	Length of Stream Impacted (feet)	Objectives Met	Priority
Catchment 101				
NF 102-1	Restoration at a severely degraded site, including grade control, streambank stabilization, livestock management, and streamside forestation.	1009	1,2,3	High
NF 102-2	Streambank stabilization on a small stretch of severe erosion.	227	2,3	Low
NF 102-3	Stream fencing	795	1,2,3,5	High
NF 102-4	Removal of a large stand of bamboo	N/A	1,4	Low
NF 102-5	Possible dam removal	N/A	3,5	Low
Catchment 103				
NF 102-6	Stream stabilization and streamside forestation at a severely degraded stream reach	1170	1,2,3,5	High
Catchment 201				
NF 102-7	Plantings at three in-stream stormwater ponds	879	3,5,6	Low
NF 102-8	Streamside forestation through Route 7 and adjacent to Stoneleigh golf course	1851	1,2,3,5	High
NF 102-9	Stream stabilization downstream of Stoneleigh golf course	230	2,3	Low
NF 102-10	Stream stabilization near a medium density development	165	2,3	Low
NF 102-11	Investigate the potential for a fish ladder at the dam below Sleeter Lake.	N/A	3	High

3.4 Catchment Write-ups

The following section includes detailed findings and recommendations for each of the six catchments within North Fork 102. For each catchment, maps detailing existing conditions and management recommendations are included. Recommendations include conservation priorities, targeted outreach, and specific restoration opportunities. Note that, while important throughout the subwatershed, the broader overall outreach initiatives are not detailed in each catchment write-up.

Catchment 101

Catchment 101 is the most pristine catchment within North Fork 102. It includes three key forest conservation areas: Mountain North, Mountain South, and a portion of the Round Hill Tract, and has very little development in its drainage. Key recommendations within 101 focus on retaining the existing resource through aggressive land management, homeowner education focusing on stream buffer management, and some specific stream restoration projects.

Findings

The initial land use analysis and field assessment identified 101 as a very high quality stream. Some low severity but persistent problems, such as invasive vegetation and inadequate stream buffer, and a few isolated severe problems were identified (see Map 18 and Table 25). Although this catchment is zoned as R20 under Loudoun County's Comprehensive Plan, a significant amount of land within the catchment is within the County's Subdivision Layer, suggesting that it may be developed at a higher density. Of key importance in this catchment, however, is the contiguous forest that represents only slightly less than half of the total catchment area. Key recommendations focus on preserving these contiguous forest blocks. At the same time, several specific restoration opportunities were identified here.

Table 25. Key Findings in Catchment 101	
Area	1,983 acres
Land Use	Mix of agriculture and forest, with some low density residential 218 acres (11%) in conservation easement 589 acres (30%) of subdivided lots Zoning: R-20
Contiguous Forest	900 acres (45% of the catchment) in contiguous forest 371 acres in C1: Mountain South 428 acres in C2: Mountain North 101 acres in C3: Round Hill
Streams – RBP	2 Points - Both “Good” Best two habitat scores in North Fork 102
Stream Buffer (RIT)	Inadequate buffer on 48% of stream miles walked (severe in one area only) Invasives (multiflora rose and bamboo) found in many areas
Stream Erosion (RIT)	Streambank erosion in isolated stream reaches (2% of stream miles walked) Two specific areas of severe erosion: one associated with an outfall and one with a sheep crossing
Other Important Features	Man-made dam Ornamental pond supplied with water diverted from the stream

Key Recommendations

Major recommendations within catchment 101 focus on preserving existing forest resources, homeowner education, and isolated restoration activities (see Map 19). Specific recommendations are detailed below.

Recommendations for Preservation/New Development

The following three recommendations focus on efforts to change the pattern or design of new development to protect key resources in Catchment 101.

Protection in the Round Hill Conservation Tract

A portion of this contiguous forest area is in the eastern portion of catchment 101, which includes two parcels that are entirely contained within this contiguous forest area.

Protection in the Mountainside Tracts (Mountain North and Mountain South) – Outer Reaches

These parcels, although not adjacent to the Appalachian Trail, can help retain the integrity of the Mountainside Tract, adjacent to the Appalachian Trail.

Work with Developers of Subdivided Plots in Conservation Areas

On already subdivided land, work with developers to encourage preservation of forest and stream resources. These plots are in Loudoun County’s subdivision layer but appear to have no development currently. PEC should approach these property owners to ensure that these conservation areas are protected. In particular, encourage construction techniques that minimize clearing of the contiguous forest.

Targeted Outreach

The most important targeted outreach group in this catchment focuses on a few land holders who hold conservation easements.

Conservation Easement Buffer Initiative

This area has a long stretch (1,765 feet) of inadequate, though low severity, buffer. Since this length of stream runs entirely through land in conservation easement, land holders likely have a conservation ethic and could be encouraged to implement streamside plantings, with donations of plant materials by PEC or GCA. This project could be coupled with NF 102-3 to create a connected demonstration reach.

Restoration Opportunities

Five restoration opportunities are present within North Fork 102. These opportunities include stream stabilization, agricultural, and streamside forestation projects, as well as removal of bamboo and a dam.

NF 102-1 Stream Restoration/Sheep Access

This site has multiple problems, including severe streambank erosion, sheep access and very poor buffer in a specific location (Figure 19). The streambank erosion appears to be caused by a “nick point,” a downcut in the stream that moves upstream with time.

Restoration activities at this site should include:

- Grade control at the nick point to prevent further migration and consequent channel degradation.
- Streamside plantings
- Livestock management for sheep, including an improved crossing, fencing along most of the stream, and an alternative water source.

NF 102-2: Stream Stabilization Downstream of Dam

This location has 226 feet of severe streambank erosion (see Figure 20). Streambank stabilization is recommended to reduce the sediment export from this site. The extremely high banks make this a somewhat challenging project, and the first phase of any streambank restoration would be to flatten the angle of the banks. This project would require further investigation to implement.



Figure 19. Candidate for stream restoration; site NF 102-1



Figure 20. Severe channel erosion at site 102-2

NF 102-3: Stream Fencing

This site has poor buffer and some sheep access on the right bank. The hill adjacent to the stream is very steep, however, and it appears that the sheep rarely access the stream. They may, however, graze on the young plants near the streamside, preventing further growth in the stream buffer. The fence to this property encompasses rather than excludes the stream, and moving the fence across the stream and approximately 50 to 100 feet further back is recommended to encourage volunteer vegetation adjacent to the stream.

NF 102-4: Bamboo Removal

This location includes a very large bamboo stand. The restoration would include bamboo removal and ongoing monitoring to prevent regrowth. While this project does not necessarily support a specific subwatershed objective or watershed goal, it is a worthwhile consideration.

NF 102-5: Dam Removal

This dam had no obvious purpose to field investigators and may act as a fish barrier. While no impacts were evident, it likely restricts stream flow, and may possibly act as a fish barrier. Approaching the owner to initiate the possibility of removing this dam is recommended.

Catchment 102

Catchment 102 has mixed land uses. The upper reaches to the west encompass the northeastern portion of the Round Hill Conservation area and are primarily contiguous forest. The stream then flows through a primarily agricultural area, which is in the Round Hill Joint Land Management Area. The southern portion of the catchment is primarily residential and townhouse development. Limited access to the upper reaches of the stream presented a major obstacle to assessing this stream reach completely.

Findings

Assessments within this catchment included a conservation assessment in the eastern portion of the Round Hill Conservation Tract, and stream assessments on the lower portions of the stream. Stream assessments were limited due to stream access issues in the upper stream reaches. The results are summarized in Table 26. The assessment of the lower reaches revealed overall “good” quality stream, with one area of inadequate buffer downstream of Route 719. The high quality Round Hill Tract experiences some development pressure in this catchment due to its proximity to, and in one case inclusion in, the Round Hill Joint Land Management Area (JLMA).

Table 26. Key Findings in Catchment 102	
Area	688 acres
Land Use	Mixture of agriculture, forest, and medium density residential 42 acres (6%) in conservation easement 102 acres (15%) of subdivided lots Zoning: R-20/Round Hill JLMA
Contiguous Forest	218 acres (32% of the catchment) in the Round Hill Tract
Streams - RBP	1 Point – “Poor”
Stream Buffer (RIT)	Inadequate buffer on 19% of stream miles walked Livestock access on 2% of stream miles walked (over a 19’ stretch)
Stream Erosion (RIT)	None found
Other Important Features	Reforestation site near a townhouse development One pipe outfall

Key Recommendations

Major recommendations within catchment 102 focus on preserving existing forest resources in the Round Hill Tract and education and outreach initiatives.

Recommendations for Preservation/New Development

The following three recommendations focus on efforts to change the pattern or design of new development to protect key resources in Catchment 102.

Protection in the Round Hill Conservation Tract

This high priority conservation area includes a significant amount of the land in North Fork 102. While some of these parcels include only a portion of the Round Hill Tract, others are entirely encompassed by it.

Targeted Outreach

A key focus group in this catchment is large land holders

Outreach to Engage Land Owners

This catchment has some key property holders, both due to its development pressure and forest resources. Limited access here suggests some skepticism about the prospects for conservation. Outreach to emphasize incentive-based options may be needed to protect these valuable resources and to achieve conservation goals within the Round Hill Tract.

Restoration Opportunities

No specific restoration opportunities were identified here.

Catchment 103

Catchment 103 is largely in rural residential development, with some higher density development in its lower reaches near Route 7. The catchment has little development pressure, as it is zoned R-20 and has no subdivided land. Although access was somewhat limited, stream assessments revealed some very high quality stream reaches and some problem areas near Route 720. Recommendations focus on broad educational efforts, and one major restoration site.

Findings

Assessments within this catchment included stream assessments on approximately 68% of the stream length. The upper portion, which is dominated by rural land uses, had very little access. The RBP point here was “fair”, and one stretch of stream had somewhat inadequate stream buffer and some livestock access. As the stream flowed through several properties protected by conservation easement, stream quality was improved (with a “good” RBP point) and a very high quality wetland was noted. Downstream of this area, near Route 720, field crews noted a fairly long stretch of stream with severe channel erosion, two outfalls, and severe inadequate buffer. As shown in Table 27, other key features found in this lower reach of stream include two intakes, a debris jam created by an old bridge, and a vehicle crossing.

Table 27. Key Findings in Catchment 103	
Area	1,463 acres
Land Use	Mostly rural residential, with some higher density residential in the lower reaches of the catchment 224 acres (15%) in conservation easement 432 acres (30%) of subdivided lots Zoning: Primarily R-20 with a small pocket of Round Hill JLMA
Contiguous Forest	A very small portion (2 acres) of C2.
Streams - RBP	3 Points - 2 “Fair”; 1 “Good”
Stream Buffer (RIT)	Inadequate buffer on 24% of stream miles walked Livestock access on 1% of stream miles walked
Stream Erosion (RIT)	Severe channel erosion on 9% of stream miles
Other Important Features	Very high quality wetland (See Figure 21) Debris jam 2 stream intakes 3 outfalls 1 vehicle crossing

Key Recommendations

Major recommendations within catchment 103 include specific homeowner and agricultural education efforts, and one restoration site.

Recommendations for Preservation/New Development

No specific recommendations were identified in this catchment.

Targeted Outreach

Targeted outreach in this catchment includes outreach to an individual land owner with a very high quality wetland.

Specific Outreach to Owner of Special Wetland (see Figure 21)

The high quality special wetland identified during the stream walk is a special preservation area. Fortunately, this area is already held in conservation easement. Outreach here would include a single visit or phone call to ensure that the land owner is aware of the importance of the resource and its protection.



Figure 21. Wetlands area in Catchment 103

Restoration Opportunities

One restoration opportunity was identified in Catchment 103, near Route 720.



Figure 22. Buffer encroachment at site NF 102-6.

NF 102-6: Stream Stabilization/ Streamside Forestation

This site is the most degraded portion of the North Fork 102 subwatershed. The stream bank is degraded along the entire 357-foot stretch, no buffer is present, and construction vehicles and debris are adjacent to the stream (see Figure 22). Restoration activities here would include stream stabilization using natural measures (e.g., biologs, fascines, etc.), and streamside plantings. Outreach to the property holder should accompany this project to prevent further encroachment.

Catchment 104

Catchment 104 is almost entirely owned by a single landowner of one very large plot of land. This landowner did not grant access for field work. Recommendations and findings for this subwatershed are based on a single observation made from Route 719.

Findings

No field observations could be made in Catchment 104 due to access issues. The findings presented in Table 28 represent knowledge of land use only.

Table 28. Key Findings in Catchment 104	
Area	770 acres
Land Use	Largely rural, with a small medium density development in the very upper edge of the catchment 5 acres (<1%) in conservation easement 110 acres (14%) in subdivided lots Zoning: Primarily R-20 with a small pocket of Round Hill JLMA
Contiguous Forest	None
Streams - RBP	No Data
Stream Buffer (RIT)	
Stream Erosion (RIT)	
Other Important Features	Dam and associated lake

Key Recommendations

Due to the limited knowledge of this catchment, the only recommendation is outreach directed at a single land holder.

Recommendations for Preservation/New Development

No specific recommendations were identified in this catchment.

Targeted Outreach

The single most important recommendation in this subwatershed is to engage the land holder who owns the majority of the catchment, and the entire stream within it.

Outreach to Engage Land Owner

The large parcel that comprises virtually the entire catchment is proposed for development. We recommend outreach to this developer to help ensure that the parcel is developed in an environmentally sensitive manner.

Restoration Opportunities

No specific restoration opportunities were identified in this catchment.

Catchment 105

Catchment 105 is largely rural/rural residential and currently has minimal development pressure. Field findings suggest a fairly high quality stream, and few specific opportunities were identified (Table 29).

Findings

No RBP point was taken in this catchment, but the RIT suggests no problems related to stream buffer or any in-stream impacts. The only feature of note is a beaver dam in the downstream end of the catchment near Sleeter Lake.

Table 29. Key Findings in Catchment 105	
Land Use	Agriculture and rural residential No conservation easements 106 acres (34%) subdivided Zoning: R-20, with some small areas of Purcellville JLMA
Contiguous Forest	None
Streams - RBP	No Data
Stream Buffer (RIT)	No problems identified
Stream Erosion (RIT)	None noted
Other Important Features	Beaver dam in the downstream end.

Key Recommendations

Only broad educational recommendations are made for this catchment (See section 3.4).

Recommendations for Preservation/New Development

No specific recommendations are made here.

Targeted Outreach

No specific recommendations are made here.

Restoration Opportunities

No restoration opportunities were identified in this catchment.

Catchment 201

The other five catchments within North Fork 102 are tributary to catchment 201, and this catchment includes land considered direct drainage to the second order stream that drains directly to Sleeter Lake. Catchment 201 is also the most highly developed section of the North Fork 102 subwatershed, with Route 7 running through the center of the catchment. Very high density residential and commercial developments abut this major highway. The remainder of the subwatershed is largely dominated by low-density residential and agricultural land, with a portion of the Round Hill contiguous forest tract in the northern reaches of the subwatershed. Other key features include a golf course at the westernmost portion, and Sleeter Lake at the most downstream end of the subwatershed.

Findings

Overall, field findings indicate fairly “good” habitat scores, relatively minor issues associated with stream erosion and inadequate stream buffer, but with some areas warranting restoration (Table 30). A past monitoring station reveals “poor” Fish IBI scores at a station near Route 7 and about one quarter mile upstream of the confluence with Sleeter Lake. Unfortunately, field teams did not have access to the shore of Sleeter Lake, which is a critical feature of the North Fork 102 subwatershed. The intersection of the northern portion of the catchment with the Round Hill contiguous forest tract is also a key area of importance within the catchment. Other in-stream features included a water withdrawal for the Stoneleigh Golf Course and in-stream ponds in the upper reaches of the catchment adjacent to Route 7.

Table 30. Key Findings in Catchment 201	
Area (acres)	1,609
Land Use	Mixed land use, with the highest density along the Route 7 corridor 44 acres (2%) in conservation easement 634 acres (40%) subdivided Zoning: Mixture of Round Hill JLMA and R20
Contiguous Forest	143 acres (9% of the catchment) in the Round Hill Tract
Streams - RBP	2 Points - Both “Good” Note: Fish IBI indicate a “Very Poor” score
Stream Buffer (RIT)	Inadequate buffer on 27% of stream miles Multiflora rose throughout
Stream Erosion (RIT)	Streambank erosion in isolated stream reaches (<2% of stream miles)
Other Important Features	Golf course with water withdrawal In-stream ponds

Key Recommendations

A wide range of recommendations is put forth for this multiple land use catchment, including land conservation within the Round Hill Tract and near Sleeter Lake, educational efforts targeted at particular groups, and three specific restoration projects (see Map27).

Recommendations for Preservation/New Development

Two key preservation areas are the Round Hill Tract of contiguous forest and the land adjacent to Sleeter Lake.

Protection in the Round Hill Conservation Tract

This high priority conservation area includes a significant amount of the land in North Fork 102. The parcels identified here are included almost entirely within this conservation area.

Sleeter Lake Shoreline

This is a potential priority area for conservation easement due to the value of the resource, combined with its development pressure.

Targeted Outreach

In this catchment, opportunities include general education, as well as very specific outreach components.

Outreach to Sleeter Lake Residents

Residents adjacent to Sleeter Lake may require more involved and detailed outreach, focusing directly on lake management issues. Specific elements include lakeside buffers, septic system management, lake quality, and lawn care to minimize phosphorus inputs to the lake.

Outreach to Pond Residents

The three in-stream ponds in the western end of this catchment are possible target areas for an “adopt-a-pond” program (See Table 5) with a focus on pond buffering (note link with restoration opportunity NF 102-7).

Outreach to Stoneleigh Golf Club

The Stoneleigh Golf Club located within this catchment borders the stream. The land adjacent to the course has an inadequate stream buffer, a dam used for water diversion from the stream to supply irrigation to the course, and associated downstream channel erosion. At the same time, the course management is proud of its association with the natural beauty of the region, and was recently voted the “prettiest golf course in Northern Virginia” by Golf Digest. Golf course managers here may be receptive to specific management techniques including water conservation, fertilizer management, and buffer planting (See Appendix D for example guidance; note link with restoration opportunity NF 102-8).

Restoration Opportunities

Four specific restoration projects were identified in this catchment, including:

NF 102-7 Plantings at In-Stream Ponds
Buffer plantings at the shore of the three stormwater ponds adjacent to Route 7 (see Figure 23) can act as a demonstration project due to their visibility. This project could be accomplished in conjunction with education and outreach directed specifically at these landowners. Further investigations may lead to the possibility of more aggressive modifications to the practice, including features such as aquatic benches and wetland features.



Figure 23. Possible buffer planting area at site 102-7



Figure 24. Inadequate buffer adjacent to Stoneleigh Golf Course

NF 102-8 Streamside Forestation Through Route 7 and Adjacent to Stoneleigh Golf Course (see Figure 24)

This very long stretch of inadequate buffer can be addressed with streamside forestation. Adjacent to the golf course, this objective needs to be met with sensitivity to the needs of the course managers. While tall trees may interrupt play, shorter shrubs may even enhance the appearance of the course. This project can be conducted in concert with the outreach to the course.

NF 102-9 Stream Stabilization: Stoneleigh

This small area of eroded stream bank downstream of Stoneleigh is a possible restoration opportunity. The project is assigned a low priority because of the very short stretch of stream impacted by the erosion.

NF 102-10 Stream Stabilization

This project would include stream stabilization on 165 feet of stream adjacent to a medium density residential development. This project is also low priority because of difficulty accessing the project, and the small length of stream impacted.

NF 102-11 Fish Ladder

Field staff were unable to investigate this dam, but fish IBI data indicate a sharp decline in fish diversity below versus above Sleeter Lake. While several factors may have contributed to this decline, the dam should be investigated to determine the feasibility of constructing a fish ladder.

PART 4. NORTH FORK UPPER DD

4.1 Introduction

North Fork Upper DD lies within the northern portion of the Goose Creek Watershed and receives drainage from the North Fork 102 headwater (Part 3). This subwatershed's northern and eastern boundaries are defined by the town of Purcellville. The western boundary falls between Sleeter Lake and Franklin Park, and the southern boundary lies just north of Route 622 (Shoemaker School Road). Some of the existing features of the landscape include the town of Purcellville, Loudoun Golf and Country Club (Figure 25), Franklin Park, Overbrook Nursery, Blue Ridge Middle School, Emerick Elementary School, and numerous farms. Some of the larger streams that run through this subwatershed include Jacks Run and North Fork Goose Creek.



Figure 25. Pond at Loudoun Golf and Country Club in Goose Creek watershed

North Fork Upper DD, divided into five catchments for this study (see Map 28), was categorized as “rural impacted” in the vulnerability analysis. Future urban growth is likely to shift North Fork Upper DD into the “urban impacted” category in the future. Some of the rural impacts include its designation as an impaired water, its discharge into an adjacent impaired water, high septic and horse densities, its designation as a nonpoint source pollution area, and the “fair” to “poor” index of biotic integrity (IBI) scores. Table 31 provides a summary of the key features of North Fork Upper DD.

GOOSE CREEK DEMONSTRATION

Table 31. Summary of Data on North Fork Upper DD	
Area (acres) ¹	5,623
Number of Catchments	5
Perennial Stream Miles ¹	16.3
Political Jurisdictions ¹	Loudoun County; Town of Purcellville
Conservation Easements ¹	0
Current Impervious Cover ¹	7%
Future Impervious Cover ¹	11%
Current Stream Classification ¹	Rural Impacted
Future Stream Classification ¹	Urban Impacted
Existing Monitoring Data ¹	2 Fish IBI points – both “fair”
Land Use	Primarily agriculture and rural residential, with pockets of medium and high density residential and commercial land in the northern and eastern portions of the subwatershed.

4.2 Assessments

Two field assessments were conducted in North Fork Upper DD: the Rapid Bioassessment Protocol (RBP) and the Riparian Inventory Tracking (RIT). Note that the Conservation Areas Assessment, which was conducted in North Fork 102 and Headwater 105, was not performed here, as none of the identified conservation features were present. Results of the RBP and RIT are described below and summarized in Table 32. For a more detailed discussion of field methodologies, consult section 1.5 of this document. We also solicited public involvement to develop subwatershed objectives within North Fork Upper DD.

Table 32. Field Assessment Data	
Stream Habitat (RBP)	6 "Good" 2 "Fair" 2 "Poor"
Stream Data (RIT)	13.6 miles of stream walked (84% of mapped perennial stream miles) Inadequate Buffer on 42% of stream miles walked Cattle/Horse Access on about 20% of stream miles walked Stream erosion on 7% of stream miles walked.
Other Key Features (RIT)	Nursery pond Golf course Outfall from town of Purcellville's municipal waste waster sludge field Construction with mass clearing and grading Specimen oak tree Beaver meadow

Rapid Bioassessment Protocol (RBP)

The Rapid Bioassessment Protocol is a fairly detailed measure of stream habitat quality, conducted at unique points along the stream. RBP assessments were conducted in four of the five catchments, with a total of eight points collected. While five points showed "good" habitat quality scores, one point in catchment 102 was rated "poor," and two in catchment 103 were rated "fair" (Table 33). Appendix A of this document includes a sample RBP field sheet and RBP data from within Goose Creek.

Table 33. RBP Summary		
Catchment	RBP Assessments	Average Habitat Score
101	2 "Fair"	127: "Fair"
102	"1 Good" 1 "Poor"	124: "Fair"
103	1 "Poor"	106: "Poor"
104	2 "Good"	169: "Good"
301	2 "Good"	145: "Good"

GOOSE CREEK DEMONSTRATION

Riparian Inventory Tracking (RIT)

The RIT is a less detailed but more extensive field method. While the RBP provides fairly detailed habitat assessments at specific points, the RIT is a stream walk that focuses on identifying potential restoration opportunities. In North Fork Upper DD, a significant amount of the stream had inadequate buffer. Livestock access was an issue in three of the five catchments, and was present on almost half of the stream miles walked in catchment 101 (Figure 26). Streambank erosion was fairly prevalent in this subwatershed, and was particularly pronounced in catchment 103 (see Table 34 for summary RIT data).

Table 34. RIT Summary									
Catchment	Total Perennial Miles	Accessible Miles	% Accessible	Accessible Stream Miles					
				Inadequate Buffer		Erosion		Livestock Access	
				%	Walkable Miles	%	Walkable Miles	%	Walkable Miles
101	3.9	3.5	90	51	1.8	0	0	47	1.8
102	2.4	1.1	44	13	.1	0	0	0	0
103	1.3	1.2	90	10	1.2	21	0.3	29	.4
104	1.7	1.6	94	43	.7	0	0	0	0
301	7.0	6.4	91	47	3.0	15	1.1	19	1.4
Total	16.3	13.8			6.8		1.4		3.6



Figure 26. Stream with cattle access - a major problem within North Fork Upper Direct Drainage

Stakeholder Input

During the January 2003 Stakeholder Involvement meeting, several citizen concerns and key issues were raised that helped guide subwatershed objectives and plan recommendations for North Fork Upper DD. These recommendations focus on education and planning and are summarized below:

- The Town of Purcellville should adopt the planning policies currently in place in Loudoun County regarding communication between the county and/or citizens and the Town Council during the development process.
- Several education and/or publicity initiatives were cited as a high priority, including the following:
 - Landowner education
 - Developer education regarding both structural and non-structural stormwater management practices
 - Volunteer training through Goose Creek Association
 - Publicize volunteer programs
 - Buffer education and publicity

4.3 Objectives

Six key objectives are identified in this subwatershed, focusing primarily on improving the stream buffer, correcting problem areas throughout the subwatershed, and reducing the potential damage associated with new development.

- 1) Achieve 80% forested stream buffer on all stream reaches walked during the assessment of this subwatershed.
This objective is achieved through a combination of agricultural and residential buffer education initiatives, along with ten streamside forestation projects, representing 3.4 miles of streamside restoration.
- 2) Achieve “good” habitat scores at all RBP points identified during initial assessments. All of the subwatershed recommendations support this objective, particularly those that focus on stream restoration or stream buffer improvement.
- 3) Reduce the amount of eroded and degraded streams
This objective is achieved through a combination of individual restoration projects.
- 4) Reduce the pollutant load from areas with potentially high pollutant concentrations. Outreach efforts targeting specific commercial and public land uses help to achieve this goal.
- 5) Achieve direct involvement and stewardship by subwatershed residents.
This objective is met by broad citizen education efforts, along with opportunities to participate in individual restoration projects.
- 6) Minimize the stream degradation typically associated with new development.
A combination of direct outreach and conservation efforts can help to achieve this goal.

4.4 Recommendations

Recommendations for North Fork Upper DD include Conservation, Education, and Restoration. In this subwatershed, in which little significant natural areas remain, and streambank degradation is somewhat significant, the priorities include direct outreach efforts targeted at severe pollutant sources, and a series of restoration projects. While conservation is important in this subwatershed, no specific parcels are identified for conservation easement, and the focus in this arena is on working with developers to reduce the impacts of new development.

Conservation

While the majority of the remaining developable land in this subwatershed is zoned R-20, requiring 20 acre lots, greater than 25% of the subwatershed has already been subdivided. Furthermore, greater than 30% of the subwatershed area is within the Town of Purcellville (TOWN) or within the Purcellville Joint Land Management Area (JLMA). Both of these zoning categories will allow for denser development than the R-20 zone. Finally, many of the remaining land within the subwatershed is in very large parcels for which development at the R-20 zone would represent a significant increase in impervious cover on the existing agricultural land. A three-pronged strategy can help to address these development pressures, as summarized below. In this subwatershed, the primary goal of conservation efforts is to minimize the stream degradation typically associated with new development (objective 6).

Work with Developers of Subdivided Lots

While it is unlikely that developments “in the pipeline” will be stopped, opportunities still exist to work with developers to minimize impacts to the stream system. Better site design opportunities, including clustering lots, preserving natural vegetation, minimizing impervious cover, and retaining buffers should be emphasized here. This recommendation is also critical in North Fork 102, and is discussed in detail in section 1.5 of this document.

Seek Conservation Easements on Large Lots

Although no specific conservation areas are identified within this subwatershed, several very large lots are present. Seeking conservation easements on these large parcels can help to reduce the total amount of development within the subwatershed, and these lots can collectively reduce the impact of development on the stream system.

Work Closely with the Town of Purcellville

Since a significant fraction of the land within North Fork Upper DD is zoned as “TOWN” within Purcellville, the Town of Purcellville is a key partner in protecting this subwatershed. In particular, Purcellville should be encouraged to actively support Better Site Design techniques, state of the art stormwater, and resource protection on all new development.

GOOSE CREEK DEMONSTRATION

Education

Two broad educational initiatives are needed throughout North Fork Upper DD with the primary goal of protecting the stream buffer, along with four specific outreach opportunities are identified in this subwatershed (Table 35). Each of these more targeted outreach opportunities is discussed in section 4.5.

Homeowner Buffer Education

Residential land uses are prevalent within North Fork Upper DD, and an education campaign targeting these land holders is important. The campaign should focus on what stream buffers are, techniques for managing them, and the importance of stream buffers. Example stream buffer education materials are included in Appendix G of this document, and the Program Review (See Appendix D) summarizes some of the specific elements of this outreach.

Agricultural Buffer Education

Currently, the NRCS offices do conduct agricultural education. We recommend focusing heavily on buffers in particular, targeting this education toward properties with somewhat degraded buffer where specific restoration opportunities are not identified.

Table 35. Education Initiatives in North Fork Upper DD			
Initiative	Catchment	Objectives Met	Description
Homeowner buffer education	All	1,2,5,6	Educational effort focusing on limiting buffer clearing and encroachment.
Agricultural buffer education	All	1,2,5	Educational effort focusing on limiting buffer clearing and restricting livestock access to the stream.
Nursery	101	4,5	Investigate the site to determine probable nutrient loading; work with the nursery to limit loading rates
Loudoun County Golf Course	101	4,5	Work with the golf course management to encourage management technique that minimize nutrient loading and preserve the stream buffer
Purcellville WWTP Sludge Field	102	4,5	Investigate to determine nutrient and bacteria loadings from this site
Manure Storage	102	4, 5	Educate the homeowner regarding the impacts of manure storage near the stream side

Specific Restoration Opportunities

Eleven specific restoration opportunities were identified in North Fork Upper DD (Table 36). These opportunities could be broadly grouped into four categories: in-stream, riparian, agricultural, and multiple. In-stream practices include stream stabilization or habitat improvement areas; riparian projects include stream buffer enhancement and removal of invasive species; agricultural practices focus specifically on agricultural land holders and include activities such as cattle exclusion. Three projects in this subwatershed fall in the multiple category and include a combination of restoration activities at a single site or stream reach.

Part 4. North Fork Upper Direct Drainage

Table 36. Restoration Projects in North Fork Upper DD				
Project ID	Description	Length of Stream Impacted (feet)	Objectives Met	Priority
Catchment 101				
NF UpDD-1	Streamside forestation and livestock management	404	1,2,5	High
NF UpDD-2	Streamside forestation along a stretch of stream including the Loudoun Golf and Country Club	3905	1,2,5	Low
NF UpDD-3	Stream daylighting at Loudoun Golf and Country Club	435	2,3	High
NF UpDD-4	Streamside forestation and livestock management	3982	1,2,5	High
Catchment 102				
NF UpDD-5	Streamside forestation, in-stream stormwater retrofit, and streambank stabilization	728	1,2,3,5,6	Moderate
Catchment 103				
NF UpDD-6	Streamside forestation and livestock management	4502	1,2,5	High
NF UpDD-7	Streamside forestation and livestock management	1309	1,2,5	High
Catchment 104				
NF UpDD-8	Streamside forestation	321	1,2,5	Low
Catchment 301				
NF UpDD-9	Streamside forestation and livestock management	1956	1,2,5	Moderate
NF UpDD-10	Streamside forestation and livestock management	2184	1,2,5	High
NF UpDD-11	Streambank stabilization, livestock management, and streamside forestation	2060	1,2,3,5	High (streamside livestock) Low (Stabilization)

4.5 Catchment Write-Ups

The following section includes detailed findings and recommendations for each of the five catchments within North Fork Upper DD. Detailed maps of existing conditions and management recommendations are included for each catchment, where applicable. Recommendations include conservation priorities, targeted outreach, and specific restoration opportunities. Note that, while important throughout the subwatershed, the broader overall outreach initiatives are not detailed in each catchment write-up.

Catchment 101

Catchment 101 consists of the northern portions of the subwatershed (see Map 29). This urbanized catchment includes the northern and western portions of the town of Purcellville, Franklin Park, Loudoun Golf and Country Club, Overbrook nursery, several hobby farms, and Emerick Elementary School. The entire length of Jacks Run falls within this catchment.

A land use analysis for this catchment showed that 57% of the catchment is developable land and nearly 12% is already planned for development. Almost no conservation easements exist in this catchment and contiguous forests are absent. Although this catchment is zoned primarily as R20 under Loudoun County’s Comprehensive Plan, a significant amount of this catchment falls within the County’s Subdivision Layer, suggesting that it may be developed at a higher density. Some of the catchment is designated within the town of Purcellville and as Purcellville Joint Land Management Areas (JLMA).

Findings

Nearly three and a half miles of stream were walked during field studies and some of the key findings are summarized in Table 37. Most of the streams in Catchment 101 have fair quality with mostly medium severity, but persistent problems such as invasive vegetation and inadequate stream buffer, as well as a few isolated severe problems exist. Features of this catchment include a big silver maple tree, and Loudoun Golf and Country Club.

Table 37. Key Findings in Catchment 101	
Area	1,769 acres
Land Use	Mostly residential with some industrial and agricultural 88 acres (.05%) in conservation easement 211 acres (12%) of subdivided lots Zoning: Mostly R-20 with some town and JLMA areas
Streams – RBP	2 Points: Both “Fair”
Stream Buffer (RIT)	Inadequate buffer on 51% of stream miles (severe in one area only) Invasives (multiflora rose) found in many areas
Stream Erosion (RIT)	Streambank erosion on isolated stream reaches One specific area of severe erosion associated with cattle access Impact of livestock seen on 47% of stream miles
Other Important Features	Nursery pond with evidence of over-nutrication Golf course with inadequate buffers throughout

Key Recommendations

Major recommendations within catchment 101 include outreach to a nursery and golf course. Several specific restoration opportunities were identified, including stream restoration activities.

Targeted Outreach

The focus of targeted outreach in this catchment is on two specific properties to mitigate water quality problems.

Outreach to Overbrook Nursery

Streams adjacent to the Overbrook Nursery revealed some water quality issues, including algae growth in the nursery pond, indicating the presence of excessive nutrients. Approaching nursery management with some specific practices to minimize nutrient loading may help mitigate this problem.

Outreach to Loudoun Golf and Country Club

Inadequate buffers and water quality problems relating to excessive nutrients were revealed in streams adjacent to the Loudoun Golf and Country Club. Information about the needs and benefits of buffers, as well as techniques for more environmentally friendly management techniques can be used to approach golf course management in an effort to mitigate these impacts. Some examples include reducing fertilization, adding low ground cover buffers along stream banks, and utilizing integrated pest management practices.

Restoration Opportunities

These areas represent specific stream and riparian restoration activities.



Figure 27. This stream section clearly shows inadequate buffer and livestock access.

NFUpDD-1: Streamside Forestation/ Horse and Burro Access

This section of stream suffers severe impacts from inadequate buffer and horse and burro access (Figure 27). Restoration here would include a livestock management system for the horses and burros, including an alternative water source, an improved crossing, and stream fencing. Once livestock access has been limited, streamside forestation can take place at the stream's edge.

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NFUpDD-2: Streamside Forestation through Loudoun County Golf and Country Club

Although this section of stream was only moderately impacted by inadequate buffer, the extent of the impact (3,905 feet) warrants special attention. Here cooperation with country club management to allow and encourage stream side plantings is recommended. Special considerations may apply here, for example tall trees may interfere with the course, and a low shrub may be a preferable option.

NFUpDD-3: Stream Daylighting/Golf Course

This location in the golf course (see Figure 28) is currently in a culvert. Stream daylighting can help bring this stream back to life and become an educational opportunity. This project is not a very high priority, however, due to the minimal benefit to the subwatershed as a whole.



Figure 28. Stream section in need of daylighting

NFUpDD-4: Stream Restoration/Agricultural Area and Livestock Access

The southern sections of both North Fork Goose Creek and Jacks Run have inadequate stream buffers and livestock access issues. Restoration here can be accomplished through a combination of livestock management and riparian reforestation.

Catchment 102

Catchment 102 occupies the northeastern sections of the subwatershed (Map 31). This urbanized section of the Goose Creek watershed includes the central southern portions of the town of Purcellville, the city of Purcellville's wastewater treatment plant, and Blue Ridge Middle School. Nearly 49% of the catchment is already planned for development, and no conservation easements or contiguous forests exist in this catchment. Zoning is mixed, including Town, PJLM, and R-20 zones.

Findings

While homeowners did not permit access to significant portions of the stream, slightly more than one mile of stream was observed. Table 38 provides a summary of key findings for this catchment. Stream quality ranged from "good" to "poor" with medium severity water quality impacts from inadequate stream buffers. Some areas of concern include outfalls to the stream from the Purcellville wastewater treatment plant sludge field, mass clearing and grading, and rubble and manure piles near streams.

Table 38. Key Findings in Catchment 102	
Area	1,067 acres
Land Use	Mostly residential with some municipal and agricultural. No land is in conservation easement 521 acres (49%) of subdivided lots Zoning: Town, Purcellville JLMA and R-20
Streams – RBP	2 Points - 1 “Good”; 1 “Poor”
Stream Buffer (RIT)	Inadequate buffer on 13% of stream miles
Stream Erosion (RIT)	None
Other Important Features	Outfall from town of Purcellville’s municipal waste water treatment plant Mass clearing and grading

Key Recommendations

Major recommendations within catchment 102 focus on landowner education and property owned by the town of Purcellville. A specific restoration project is recommended for the town of Purcellville below (see Map 32).

Targeted Outreach

The focus of the outreach for this catchment is Purcellville’s wastewater treatment plant (WWTP) and an individual property owner.

Outreach to the Town of Purcellville

The Purcellville WWTP sludge field is a potential point source for pollution. Sampling and monitoring samples can help determine pollutant levels and identify ways to arrest potential, future impacts on the stream. Outreach should also focus on potential stream restoration near this site (See NF UpDD-5).



Figure 29. A manure storage pile adjacent to stream in catchment 102.

Outreach to Individual

Landowner

Water quality problems are a concern at RBP point NFUpDD 102-2, as the landowner stores manure alongside the stream, as seen in Figure 29. As many stream impacts can occur as a result of this practice, the homeowner should be approached and informed of the potential water quality impacts and alternative storage processes of storing manure.

Restoration Opportunities

These areas represent specific stream and riparian restoration activities.

NFUpDD-5: Stream Restoration/ Municipal Wastewater Treatment Plant

The municipal wastewater treatment plant provides a great opportunity to practice multiple watershed restoration projects and lead by example. The first step is to



Figure 30. Outfall pipe from a sludge field

investigate the feasibility of installing a stormwater wetland to capture untreated stormwater. The proposed retrofit could treat runoff from several stormwater outfalls (see Figure 30) and an existing stormwater detention facility. Cleaning up streamside areas can also help prevent debris from entering the stream.

Catchment 103

Catchment 103 is the smallest catchment in North Fork Upper DD and covers the eastern sections of the subwatershed. This catchment consists primarily of cornfields, cattle fields and rural roadside. An initial land use analysis showed that over 31% of this catchment is subdivided. About 12% of the catchment is under conservation easement. The remaining developable land is zoned R-20.

Findings

Slightly more than one mile of stream was walkable, and all of the stream walked runs alongside the road with little or no buffer along the entire length of stream (Table 39). The fieldwork found the stream quality to be poor, with mostly medium severity, but a few areas of severe inadequate stream buffer, livestock access, and erosion problems were discovered.

The primary management recommendation in this catchment should focus on agricultural landowner education, including emphasis on several areas of farm management. Inadequate buffers, cattle access, and eroded stream crossings are the primary areas of concern (see Map 33).

Table 39. Key Findings in Catchment 103	
Area	444 acres
Land Use	Mostly agricultural, including crops and cattle 53 acres (12%) in conservation easements 140 acres (32%) of subdivided lots Zoning: R-20
Streams – RBP	1 Point – “Poor”
Stream Buffer (RIT)	Inadequate buffer on 100% of stream miles
Stream Erosion (RIT)	Streambank erosion on 21% of stream miles – one severe area Impact of livestock in 29% of stream miles
Other Important Features	None

Key Recommendations

Major recommendations for Catchment 103 include the broad educational opportunities presented in section 4.3, as well as two livestock access and stream restoration projects presented below.

Targeted Outreach

No specific recommendations are made here.

Restoration Opportunities

NFUpDD-6: Stream Restoration/Agricultural Area and Livestock Access

The inadequate buffer, cattle access, and overall moderate watershed erosion make this area a good candidate for restoration (see Figure 31). Specifically, we recommend a livestock management system, combined with streamside forestation. While some erosion exists here, we recommend a passive approach, allowing the stream to repair itself once livestock access is limited, and riparian cover is established.



Figure 31. Livestock management and streamside forestation repair needed in this moderately impacted stream



Figure 32. Potential restoration site with impacts from cattle access, an inadequate buffer and erosion.

NFUpDD-7: Stream Restoration/Agricultural Area and Livestock Access

Inadequate buffer, cattle access, and erosion make this spot another good candidate for restoration (see Figure 32). In this case, livestock management and streamside forestation are recommended for the

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left bank and streambank stabilization for the right bank. The left bank may also need some “spot” erosion control at the point where livestock access the stream.

Catchment 104

Catchment 104 makes up the southwestern portion of the subwatershed. Currently this catchment is lightly developed, although the percentage of developable land makes it a likely candidate for rapid urbanization. Currently, it retains a rural character with a few horse and cattle farms. Nearly 37% has already been subdivided, and no conservation easements exist here. The remaining developable land is zoned R-20.

Findings

Slightly more than one and a half stream miles were observed, and key findings are summarized in Table 40 and shown on Map 35. The stream quality of the two points was “good” with mostly mild cases of inadequate stream buffer, although one severe case has caused water quality impacts. A specimen oak tree and large beaver meadow are two additional features of this catchment.

Table 40. Key Findings in Catchment 104	
Area	748 acres
Land Use	Mostly residential with some municipal and agricultural. Land in conservation easements = 0% 521 acres (37%) subdivided Zoning: R-20
Streams – RBP	2 Points – Both “Good”
Stream Buffer (RIT)	Inadequate buffer on 43% of stream miles
Stream Erosion (RIT)	None
Other Important Features	Specimen oak tree Beaver meadow

Key Recommendations

Major recommendations for this catchment include the broad educational opportunities presented in section 4.3, as well as one streamside restoration opportunity presented here.

Restoration Opportunities

This area represents specific stream and riparian restoration activities.

NFUpDD-8: Stream Restoration/ Riparian Reforestation

Located in the central section of the catchment (see Map 36), this small stretch of stream has severe water quality problems, due to inadequate buffer. This problem can be mitigated with streamside forestation alone.

Catchment 301

Catchment 301 is the largest of this subwatershed and consists of the central sections of the subwatershed (Map 37). The catchment encompasses a minor wastewater treatment plant in the northern section along with a substantial portion of the North Fork Goose Creek tributary. Slightly more than 28% of the catchment has been subdivided, and almost 15% of this is protected in conservation easement. The remaining developable land is zoned R-20.

Findings

More than six miles of stream in this catchment were observed, and key findings are summarized in Table 41. The stream quality was rated “good” at three points with low to medium severity in most stretches of stream. A few spots were reported with high severity, due to livestock access and inadequate stream buffers. Some features of this catchment include the presence of a sycamore tree, large beaver meadow, and areas of floodplain restoration work.

Table 41. Key Findings in Catchment 301	
Area	2,018 acres
Land Use	Mostly agricultural with some residential 302 acres (15%) in conservation easement 571 acres (26%) of subdivided lots Zoning: R-20
Streams – RBP	3 Points - All “Good”
Stream Buffer (RIT)	Inadequate buffer on 47% of stream miles Mostly low severity cases of inadequate stream buffers Two medium and one severe case of inadequate stream buffers
Stream Erosion (RIT)	Stream erosion in 15% of stream miles Mostly low to medium erosion
Other Important Features	Minor wastewater treatment plant abutting Sleeter Lake Beaver dam in upper reaches of streams Specimen sycamore tree

Key Recommendations

Major recommendations for this catchment include the broad educational opportunities presented in section 4.3, as well as three restoration opportunities presented here and shown on Map 38.

Targeted Outreach

No specific recommendations are made here.

Restoration Opportunities

In the lower sections of stream, multiple areas of potential restoration were identified. Water quality impacts at these



Figure 33. Stream with water quality impacts due to inadequate buffer and horse access

locations were medium to severe and included inadequate stream buffers, livestock access, streambank erosion, or a combination of two or more of these problems.

NFUpDD-9: Stream Restoration/Horse Access

This 321-foot stream reach was severely impacted by inadequate buffer, with some evidence of impacts from horse access (Figure 33). Riparian reforestation should be a priority, and livestock management for horses should be investigated as well.

NFUpDD-10: Stream Restoration/Livestock Access

Inadequate buffer and cattle access caused moderate water quality impacts to this stretch of stream. A combination of livestock management for cattle and streamside forestation will repair this stretch of stream.



Figure 34. Another site with inadequate buffer, cattle access and water quality impacts

NFUpDD-11: Stream Restoration/Livestock Access

Inadequate buffer and cattle access have caused severe water quality impacts at this site (see Figure 34). This severely eroded area will require a combination of in-stream stabilization, riparian reforestation, and livestock management for cattle.

PART 5. IMPLEMENTATION PLAN

5.1 Introduction

This part of the Goose Creek Demonstration Subwatershed Plans prioritizes individual and overall recommendations, and assigns typical unit costs associated with individual recommendations. The first section provides a prioritization of overall watershed recommendations. The second section discusses land preservation goals (across subwatersheds). The third section prioritizes subwatershed recommendations within each subwatershed, focusing on education, targeted outreach and individual restoration projects.

Costs associated with recommendations presented here have been categorized as follows:

- Very High: More than \$1 million*
- High: \$100,000 - \$1 million*
- Moderate: \$10,000-\$100,000*
- Low: \$1,000-\$10,000*
- Very Low: Less than \$1,000*

5.2 Watershed-Wide Recommendations

Watershed-Wide recommendations are derived largely from the program review. Here, projects are divided into two categories: High (within two years) and Moderate (Over a five year planning horizon). The major watershed-wide recommendations all support major watershed goals, and all are capable of making a dramatic impact. The two tiers of High and Moderate Priority are primarily operational, in that the High Priority recommendations either act as a foundation for other activities or are more time-sensitive.

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Table 42. Watershed-Wide Prioritization		
Recommendation	Costs	Notes
<i>High Priority (Within Two Years)</i>		
1. Develop an Implementation Committee to establish responsibility for and begin implementation of the projects and recommendations included in this report.	Low: Staff	Should be immediate
2. Revise codes to more explicitly protect streams and natural resources from new development.	Low	(See Tables 44 and 45 for Specifics)
4. Target Natural Resources Preservation when purchasing easements	Very Low	Policy shift, with some specific areas identified in Tables 44 and 45.
5. Establish the "Mountainside Initiative" to preserve land along the Appalachian Trail.	High (Easement Cost of \$1,200/acre)	Supports Recommendation 4.
7. Conduct further investigations and follow-up monitoring in the three demonstration subwatersheds	Low (Staff, Volunteers)	Should precede implementation of each subwatershed plan.
8. Designate a single group or individual to coordinate education efforts watershed-wide	Very Low	Should be immediate.
9. Explore and Distribute Information on Funding Sources for Agricultural Practices	Very Low	Supports implementation of individual restoration projects.
<i>Moderate Priority (Within Five Years)</i>		
3. Minimize sewage flows to the Goose Creek through improved septic system regulations and inspection, and improved detection and removal of illicit discharges.	Moderate (Staff) Low (Code Change)	See Tables 44 and 45 for specifics
6. Continue subwatershed planning throughout the Goose Creek	Very High Total Cost Can be phased	Ongoing, but should be initiated within the next five years.

5.3 County-Wide Recommendations

The program review identified many individual program recommendations. Tables 43 and 44 summarize these recommendations for Loudoun and Fauquier Counties and provide associated costs. Details regarding these recommendations are provided in Appendix D, the Program Review Document. The high priority recommendations are also discussed in Section 1.6 of the introduction of this document. The "watershed protection tool" column can be used as a reference with which to locate the detailed recommendation within Appendix D.

Table 43. Prioritized Recommendations for Loudoun County		
Recommendation	Cost	Watershed Protection Tool #
<i>High Priority (Within Two Years)</i>		
Strengthen Overlay District Regulations	Low	1
Specify Open Space Requirements	Low	2
Strengthen Plant and Wildlife Habitat Language	Low	2
Strengthen Land Conservation Fund and PDR Program	Low	2
Develop Wetland Buffer Requirements	Moderate	3
Conduct Stream Buffer Education	Moderate	3
Protect Headwater Streams	Low	3
Revise Waivers for Adequate Channel	Very Low	6
Conduct Targeted Educational Campaign	Moderate (Shared cost with other groups)	8
Conduct Stream Buffer Plantings	Low Program Development Cost: Unit cost of \$1,200/acre	8
Create Website to Encourage Stewardship	Low (Shared cost with other groups)	8
<i>Moderate Priority (Within Five Years)</i>		
Develop Lawn Care Education Program	Moderate	1
Encourage Use of Required Open Space to Provide Additional Stream Buffer Protection	Very Low	2
Adopt a Tree Preservation Ordinance	Moderate	2
Enhance Stream Buffers	Unit cost of \$1,200/acre	3
Encourage VDOT To Add Flexibility in Street Design	Very Low	4
Encourage Conservation Design Process for Suburban Zoning Districts	Very Low	4
Create Detailed Inspection Schedule	Low	5
Encourage Non-Staff Inspections	Moderate	5
Improve Stormwater Maintenance	Moderate	6
Establish Adopt-a-Pond Program	Moderate	6
Conduct Stormwater Retrofitting Projects	Moderate Setup Costs: Retrofit costs about \$3,000/impervious acre	6
Simplify Existing Water Quality Requirements	Very Low	6
Modify Channel Protection Criteria	Very Low	6
Practice Restrictions	Very Low	6
Develop IDDE Program	Moderate	7
Minimize Impacts of OSDS	Moderate	7
<i>Low Priority (Within Ten Years)</i>		
Expand Use Value Tax Program	Low	1
Conduct Field Inventory of Significant Natural Communities	Moderate	2
Increase Stream Restoration Incentives	Moderate	3
Set Maximum Parking Ratio	Low	4
Limit Clearing	Moderate	5
Conduct Direct Outreach to Golf Courses	Low	7
Conduct Outreach to Vineyards	Low	7
Develop Pollution Prevention Program	Moderate	8

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Table 44. Prioritized Recommendations for Fauquier County		
Recommendation	Cost	Watershed Protection Tool #
<i>High Priority (Within Two Years)</i>		
Expand PDR Program and Provisions	Low	2
Establish Stream Buffer Requirements	Moderate	3
Establish Wetland Buffer Regulations	Moderate	3
Conduct Stream Buffer Education	Moderate	3
Encourage Non-Staff Inspections	Moderate	5
Improve ESC Enforcement	Moderate	5
Regulate OSDS	Moderate	7
Conduct Targeted Educational Campaigns	Moderate (Shared cost with other groups)	8
Conduct Stream Buffer Plantings	Low Program Development Cost: Unit cost of \$1,200/acre	8
Create a Website to Encourage Stewardship	Low (Shared cost with other groups)	8
<i>Moderate Priority (Within Five Years)</i>		
Specify Open Space Requirements	Low	2
Conduct Field Inventory of Significant Natural Communities	Moderate	2
Encourage VDOT to Add Flexibility	Very Low	4
Develop Inspection Program	Moderate	6
Revise Channel Protection Regulations	Low	6
Incorporate “Non-structural” Treatments More Explicitly	Low	6
<i>Low Priority (Within Ten Years)</i>		
Develop Lawn Care Education Program	Moderate	1
Expand Use Value Tax Program	Low	1
Set Maximum Parking Ratios	Low	4
Encourage Right-of-Way Reductions	Low	4
Limit Clearing	Moderate	5
Clarify Manual References	Low	6
Establish Adopt-a-Pond Program	Moderate	6
Conduct Outreach to Vineyards	Low	7
Initiate IDDE Program	Moderate	7
Enhance Pollution Prevention Programs	Moderate	8

5.4 Land Conservation

Land conservation is such a key tool in the Goose Creek watershed, that it appears as both an overall watershed recommendation (the “Mountainside Initiative”) and in specific land preservation recommendations. While securing land in conservation easement is often opportunistic in nature, the quality of particular conservation areas has been prioritized to some extent in this document. Following is a ranking of individual project types, with detail provided in the individual subwatershed plans. In addition, a priority (Urgent, High, or Moderate) is assigned to each parcel type, in order to express the timeframe in which these parcels should be explicitly targeted (see Table 45).

This effort would include direct outreach to these parcel owners. Land on most parcels would be targeted for conservation easement. The one exception is land where development is explicitly slated (e.g., subdivided). Here, a better approach may be for the County or Town Planning Board to work with developers to limit the amount of clearing and encourage forest open space during the site planning process.

The prioritization presented in Table 45 is derived from the ranking of each conservation area (C1 through C6) in the Conservation Areas Assessment (See section 1.5). This overall ranking of each area was based on the quality and size of the tract, and some other factors, including development pressure and being adjacent to the Appalachian Trail.

- 1) C4. G. Richard Thompson
- 2) C3. Round Hill
- 3) C2. Mountain North
- 4) C1. Mountain South
- 5) C5. South of Route 66
- 6) C6. South of Route 66 – AT

The ranking in Table 45 follows a similar pattern, but it also subdivides the conservation areas, giving special attention to the parcels adjacent to the Appalachian Trail (AT), and to parcels with an immediate development threat. The parcels in the Round Hill Tract with a significant development pressure are the highest priority, although this conservation area as a whole was ranked second as a whole. Being adjacent to the Appalachian Trail gives a parcel a somewhat higher priority within the same tract (e.g., within conservation areas C5 and C6).

Table 45. Conservation Prioritization		
Conservation Area and Description	Subwatershed	Priority
Urgent: Target Immediately		
C3. Round Hill Tract: Zoned JLMA or TOWN, or subdivided	NF 102	1
High Priority: Explicitly target within the next two years		
C4. G. Richard Thompson, parcels adjacent to AT*	HW 105	2
C4. G. Richard Thompson, other parcels*	HW 105	3
C3. Round Hill (Zoned R 20)	NF 102	4
C2. Mountain North*	NF 102	5
C1. Mountain South*	NF 102	6
Moderate: Explicitly target within the next five years		
C5. South of Route 66	HW 105	7
C6. South of Route 66 - AT, parcels adjacent to Appalachian Trail*	HW 105	8
C6. South of Route 66 - AT, other parcels*	HW 105	9
Large parcels without conservation areas	All	10
* Possible link with the "Mountainside Initiative"		

5.5 Subwatershed Recommendations

These projects are grouped by subwatershed, and between categories (Tables 46 through 48). Like the overall watershed recommendations, these opportunities are assigned a “high” or “low” (and in some cases moderate) prioritization. Some of the outreach opportunities are also described as “ongoing.” The prioritization of outreach efforts primarily focuses on the ability of an individual outreach effort to effect change within a subwatershed. For the individual restoration projects, more detailed rankings were based on four characteristics: 1) support of a subwatershed objective or watershed goal; 2) extent and severity of the problem addressed; 3) ease of implementation; 4) ability to mitigate the problem.

While the recommendations in sections 5.1 through 5.3 can be implemented across subwatersheds, the recommendations discussed in this section would preferably be implemented on a subwatershed level. For example, an individual group may choose Headwater 105, and choose among that list, rather than choose individual projects between subwatersheds. Thus, the timeframe presented within each subwatershed is the time from plan implementation, rather than from the date this report is published. One exception is the urgent project (HW 105-5) that addresses in-stream sediment.

Table 46. Priority Outreach and Restoration Projects in Goose Headwater 105		
Project	Catchment	Costs ¹
<i>Urgent: Complete Immediately</i>		
Restoration		
HW 105-5	104	E
<i>High: Within Two Years</i>		
Outreach		
Agricultural Education	ALL	Low: Staff
Encroachment education	101	Low: Staff
Thompson WMA	102	Very Low: Staff
Indian Pipe Education Camp	102	Very Low: Staff
Railroad Management	105, 201	Very Low: Staff
Defunct Mine Landowner	201	Low: Staff, Monitoring Sample
Hog Farm	103	Very Low: Staff
Restoration		
HW 105-2	102	A, B, C, D
HW 105-3	102	A, B, C, D
HW 105-4	103	A, B, C, D
HW 105-8	105	A
HW 105-9	301	A, B, C, D
HW 105-13	301	A
HW 105-14	301	A
<i>Moderate: Within Five Years</i>		
Outreach		
Vineyard	102	Low: Staff
In-stream ornamental pond landowners	101	Very Low: Staff
Debris Jam	101	Very Low: Staff, Perhaps Outside Investigators
Restoration		
HW 105-6	105	A; Also M for Option 2
HW 105-7	105	A
HW 105-10	301	A, B, C, D
HW 105-12	301	A, B, C, D
<i>Low: Within Ten Years</i>		
Restoration		
HW 105-1	101	A
HW 105-11	301	A
1: Letters refer to unit costs in Table 50		

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Table 47. Priority Outreach and Restoration Projects in North Fork 102		
Project	Catchment	Costs¹
<i>High: Within Two Years</i>		
Outreach		
Agricultural Education	ALL	Low: Staff
Homeowner Education	ALL	Low: Staff
Outreach to Developers	ALL	Low: Staff
Conservation Easement Holders: Buffer Improvement	101	Low: Staff
Golf Course	201	Low: Staff
Land Owner Engagement	102, 104	Very Low: Staff
Special Wetland Outreach	103	Very Low: Staff
Sleeter Lake	201, 105	Low: Staff
Restoration		
NF 102-1	101	A,B,C,D, F
NF 102-3	101	B
NF 102-6	103	A, G
NF 102-8	201	A
NF 102-11	201	J
<i>Moderate: Within Five Years</i>		
Outreach		
Adopt-a-Pond	201	Low: Staff
<i>Low: Within Ten Years</i>		
Restoration		
NF 102-2	101	G
NF 102-4	101	H
NF 102-5	101	I
NF 102-7	201	A
NF 102-9	201	G
NF 102-10	201	G
1: Letters refer to unit costs in Table 50		

Table 48. Priority Outreach and Restoration Projects in North Fork Upper Direct Drainage		
Project	Catchment	Costs ¹
<i>High: Within Two Years</i>		
Outreach		
Homeowner Buffer Education	ALL	Low: Staff
Agricultural Buffer Education	ALL	Low: Staff
Town of Purcellville (Better Site Design)	ALL	Low: Staff
Nursery	101	Very Low: Staff
MANURE STORAGE	102	Very Low: Staff
Restoration		
NF UpDD-1	101	A, B, C, D
NF UpDD-3	101	K
NF UpDD-6	103	A, B, C, D
NF UpDD-8	104	A
NF UpDD-11	301	A, B, C, D, G
<i>Moderate: Within Five Years</i>		
Outreach		
Loudoun County Golf Course	101	Low: Staff
Purcellville WWTP Sludge Field	102	Low: Staff, Monitoring
<i>Low: Within Ten Years</i>		
Restoration		
NF UpDD-2	101	A
NF UpDD-4	101	A, B, C, D
NF UpDD-5	102	A, G
NF UpDD-7	103	A, B, C, G
NF UpDD-9	301	A, B, C
NF UpDD-10	301	A, B, C, D
1: Letters refer to unit costs in Table 49		

Table 49. Unit Costs for Stream Restoration Projects		
Code	Description	Unit Cost
A	Streamside Forestation	\$1,200/acre
B	Stream Fencing	\$4/ft
C	Off-Stream Water Source	\$2,500
D	Improved Stream Crossing	\$1,400
E	In-Stream Sediment Removal	\$40/cubic yard
F	Grade Control	\$1,000 to \$5,000
G	Streambank Stabilization	\$50/ft
H	Invasives Removal	\$100 - \$400/acre
I	Small Dam Removal	\$1,000 to \$5,000
J	Fish Ladder	Varies (Need on-site investigation)
K	Stream Daylighting	\$200-\$300/lf
L	Stormwater Wetland	\$1,000 to \$5,000/impervious acre draining to the practice
M	Create a New Stream Channel	\$100-\$200/lf

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